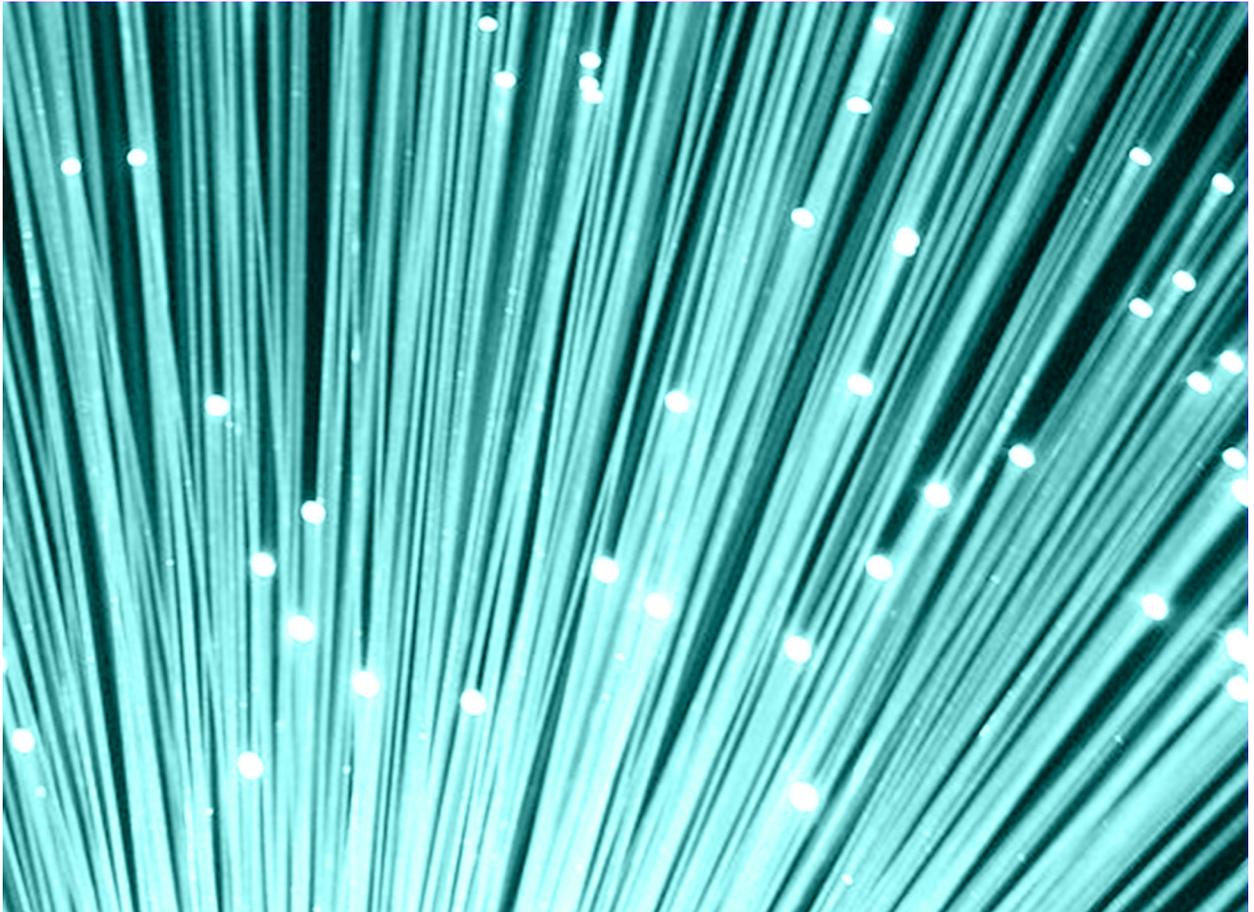


# TECHNOLOGICAL CHANGE 2013-2016

Preliminary investigation of  
the development of radical technologies after the 2013 review



# TECHNOLOGICAL CHANGE 2013–2016

Preliminary investigation:  
Development of radical technologies after the review in 2013

(100 Opportunities For Finland And The World,  
Publication Of The Committee For The Future 11/2014)

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## Foreword

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Dear reader,

This is a preliminary investigation commissioned by the Finnish Parliament's Committee for the Future, concerning the further development of the technology anticipation model 'A Hundred Opportunities for Finland: Radical Technological Solutions'. In this Foreword, I will describe the recommended method of reading this report, whether you are an interested citizen, researcher, entrepreneur looking for new technologies, capital investor, regional developer or representative of media.

In the foreword to the previous publication, I stated that the investigation was unique in Europe, even in the whole world. This was because we were the first to describe a systematic model for rating new technologies. Even though the publication and its English translation received a great deal of attention from the media and many research organizations, no party that addressed the matter objected to my opinion regarding the uniqueness of the study. Thus, it is evidently justified to interpret that my statement is essentially correct.

My unchanged opinion is that our model is one of the best, if not the best, model in the world for technology anticipation; it can predict the speed and probability of the progress of different technology clusters. This observation on the realization of the forecast presented in the previous version of the report is, in fact, the key result of this preliminary investigation. Therefore, a reader in a hurry can skip the first part and go directly to Chapters 1.4 and 1.5. They discuss the above matter and list the technologies that have made the fastest progress in the different baskets, compared with the report of 2013.

Some readers may wonder why Parliament's Committee for the Future is carrying out such extensive investigation into new technologies of the future. The answer to this question is actually obvious. Anticipation of technology is one of the key duties assigned to the Committee for the Future. Systematic anticipation requires appropriate tools. We resolved this question by developing the four-level model for radical technologies. The four-level model is described briefly in section 1.1. The report A Hundred New Opportunities for Finland includes a more extensive description of the model. Readers not familiar with the subject will get a good overview by reading the foreword to the previous report (TUVJ 6/2013) and its first chapter.

The Parliament, public administration and research institutes benefit greatly from knowing which technologies are the most likely to make fast progress. This enables appropriately front-loaded anticipation of legislation, R&D investments and other control effects. If new technology is to be adopted as part of society, norms must be both dissolved and adjusted. In order to be able to carry out this work systematically, we also need a list

of the various control effects, through which each technology is reviewed in the different areas of life. We will continue this work in the actual report and other publications.

The first part of this report discusses the development of the four-level model. Therefore, readers who need information but have little time can skip to Chapter 7. It provides a comprehensive review of the technological development that has taken place after the publication of the previous report. Chapter 7 constitutes the major part of the investigation, and many will find it the most useful chapter to read. The first part of the preliminary investigation discusses how the grouping of the technologies and the structure of the value-producing networks could be improved.

For readers interested in the development of the four-level model as an instrument for regional development, Chapter 3 includes a discussion of this topic. With regard to regional development, it is essential to note that the evaluation of the importance of technologies should take into account the expertise available in the region, as well as networking in relation to the market external to the region. New technology may provide companies or their customers with considerable competitive edge. Thus, for each technology, the companies in the region that would benefit from that particular new technology should be listed. If companies in the region are quick to adopt new technology, the region's competitiveness will also improve.

The Committee for the Future is also interested in finding out how different technologies affect different countries/national economies. The members of the European Union alone represent very different types of countries. Therefore, it can be expected that the fast development of some technologies will have very different impacts on different countries. This is because the weights of the value-producing networks affecting society in other countries are different from those of Finland. In Finland, we did not assign weight coefficients to value-producing networks. However, if we want to conduct an extensive comparison between the EU countries, we will need suitable country-specific weight coefficients for value-producing networks. This question is discussed in more detail in Chapter 4.

In addition, the preliminary report includes a sketch for a database application that could be used for updating the technology list and uniting the currently slightly scattered developer communities. From the perspective of society, it would be very advantageous if research institutes, universities, companies, decision-makers, legislators and authorities had easy access to our material. In addition, researchers, developers of technology and those in need of technology could quickly find each other with the help of the information included in the database. Legislators and authorities could detect control effects related to different value-producing networks, as well as needs to change socio-technical operating models and regulations. Decision-makers could see what opportunities and threats a new technology involves for important areas of life. Additional discussion on this matter can be found in Chapter 5.

Overall, I am very satisfied with the completed preliminary report, and I want to express my warmest thanks to Risto Linturi, the author of the report. I also want to thank Osmo Kuusi, Toni Ahlqvist, Olli Hietanen and Ari Näpänkangas for their participation in the steering group.

'There is no time to lose.'

*Ville Vähämäki*

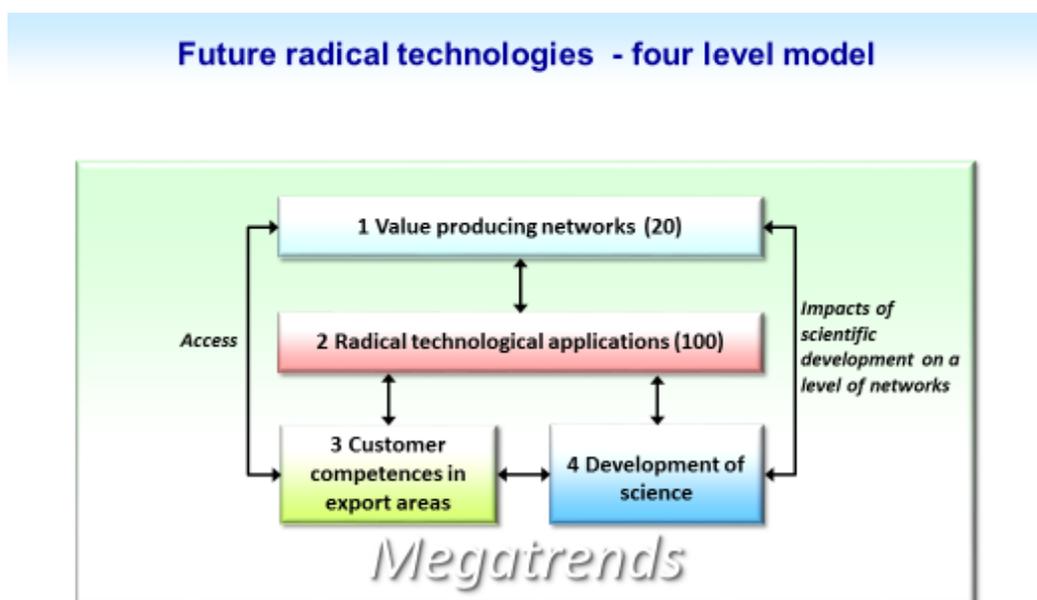
MP

Chairman, Radical Technologies section

# 1 Introduction, summary of observations and recommendations

## 1.1 A Hundred New Opportunities for Finland: Radical Technological Solutions

In autumn 2012, the Committee for the Future started work to develop a method for anticipating the effects of radical technologies on society. As a result of this work, a four-level model of radical technologies, Radical Technology Enquirer, was developed and published in September 2013 in the report A Hundred New Opportunities for Finland: Radical Technological Solutions. This report is referred to in this preliminary investigation using the abbreviation TuVRad9/2013. The publication has been translated and updated and published in 2014 under the name 100 Opportunities for Finland and the World.



The four-level model evaluates the significance of a technological solution from the perspective of twenty different value-producing networks. Value-producing networks aim to cover the added values produced and needed by different actors in society without excessive overlap. Value-producing networks help to detect the potential impact of a technological solution on society as a whole and to detect any needs to change norms.

The four-level model takes into account the technology readiness level and scientific advancements and, through product development investments, the probability of each technology to be launched in the market and become common. The level of Finnish expertise and the existence of export channels are used for evaluating Finland's opportunities for utilising a technology in the export market.

Using hundreds of sources and crowdsourcing, a list of the hundred most promising technological solutions was compiled for the report. These technological solutions were evaluated using the four-level model developed. The potential of each technology was evaluated separately for each value-producing network by a number of experts. The technologies were ranked in effectiveness order on the basis of the level and probability of their social effectiveness. During the preparation of the report, the monitoring of the advancement of the reported technologies was considered as one of the most important benefits of the method.

After the report was published, it attracted extensive and long-lasting media attention, both in electronic and printed media. Newspaper articles about the report were published more than a year after its publication. The report has been widely referred to in expert lectures and regional development seminars, and it has been in extensive internal use in organisations. Many topics highlighted in the report that were relatively unknown at the time of publication have progressed in the government, even resulting in regulatory changes that open new markets.

Within the framework of the innovation system, the report has been used as a catalyst for regional development and the allocation of investments in technology. Two years after publication, the report is still being referred to and used as a source in investigations and development work. Moreover, the Radical Technology Enquirer tool described in the project has also attracted international interest.

## **1.2 Crowdsourcing after the publication of TuVRad9/2013 and acknowledgements**

In March 2013, a Facebook group was established to support the collection of the radical technologies assessed in the report. It was called 'Committee for the Future's radical technologies crowdsourcing'. By 12 February 2016, a total of 1,660 members had joined the group.

At first, the members of the group had the right to comment the moderator's posts only. The TuVRad9/2013 report lists those members of the group that participated in the commenting and posting of technology news with comments that had an effect on the content of the report. After the publication of the report, the group has grown significantly and is still rapidly expanding. This is a result from the interesting posts and comments in the group. The participants have found the discussion very interesting and they feel that they can have an influence on something that they find important.

After the publication of the TuVRad9/2013 report, members of the group have posted more than a thousand important technology news with reference links. Discussions related to hundreds of news have been lively. Commentators have expanded the perspective by offering their own knowledge and links to online references. This preliminary investigation includes the one thousand references mentioned above. The table that is provided as an appendix to the preliminary investigation includes also the name of the person who posted the reference and a link to the related discussion. References included in this preliminary investigation were posted by 132 different

persons. Several hundred people participated in the discussions and commenting. Most of the members of the group are also active followers.

In practice, moderating a large and active group requires daily contribution. Setting up a voluntary group requires producing a lot of interesting content and promoting discussions. Once the group has attracted a few hundred members, it starts to feed itself. In order for the group to produce high-quality content in addition to discussions, a certain degree of determination is required of the moderator. Nearly all members in the group have adopted and accepted the model in which discussion is encouraged but there is strict control related to the working methods and the structure of the four-level model. Olli Hietanen and Risto Linturi have been the moderators of the group.

The following people have provided technology links that were included in the preliminary investigation (people with more than ten links are indicated in bold): Vilho Ahola, Aki Airomaa, **Kari Alanne**, Tapani Alasaarela, Kate Alhola, Timo Ali-Vehmas, Kaisu Annala, Karoliina Auvinen, Nea Barman, Fama Dumbouya, Harri Eela, Jani Ehro, Pia Erkinheimo, Paul Godsmark, Jarmo Hallikas, Antti Halonen, Sulka Haro, Henri Heinonen, Mari Heimala, **Jarmo Heimo**, Esa Heiskanen, Olli Hietanen, Veikko Hintsanen, Aulikki Holma, Jyri Jaakkola, Merja Jauhiainen, Micco Juvonen, **Petja Jäppinen**, Kai Kaasalainen, Marita Kaatrala, Jari Kaivo-oja, Ilkka Kakko, Mikael Kallavuo, Martti Kallinen, Jouni Kari, Tero Kauppinen, Pekka Ketola, Jukka Kilpiö, Antti Kivivalli, Hannu Kokko, Jari Kotola, Juha Krapinoja, Jarmo Kuismanen, Ossi Kuittinen, **Arvo Kukko**, Osmo Kuusi, Leo Kärkkäinen, Krista Lagus, Jarmo Lahti, Pasi Laine, Toke Lahti, Antti Laitinen, Ari Lanamäki, Samuli Laurikainen, **Jouni Laveri**, Mikko Leppänen, **Risto Linturi**, Lasse Lumiaho, **Tatu Lund**, Jarmo Martela, Marko Miinin, Kari Mikkela, Mikko Mononen, Janne Mähönen, Ilmari Määttänen, **Pekka Neva**, Sami Niemelä, Rami Niemi, Ville Nikkanen, Seppo Nikkilä, Ilkka Nojonen, Esko Nuutila, Tarja Ollas, Olli Orkoneva, Juha Paronen, Pekka Pasanen, Teemu Peltonen, Merja Penttilä, Kalle Pihlajasaari, Olli Pitkänen, Ilkka Pirttimaa, Antti-Pekka Puonti, Tero Puranen, Matti Pyhtiälä, Matti Pyykkönen, Ossi Pöllänen, Antti Raike, Tapio Rinne, **Alexi Rossi**, Jussi Ruohonen, Ensio Ruotsalainen, Mikko Saarisalo, Juhani Sademaa, Jarmo Salmela, Karoliina Salminen, Pekka Salokannel, Tuomas Santakallio, Juha Seg, Tuomas Siltala, Eetu Simpanen, Petri Sirviö, Jesse Soininen, Kaj Sotala, Tom Starwalker, Jon Sundell, Jouni Särkijärvi, Heikki Tamminen, Marko Mikael Tenkanen, Laura Tiilikainen, Veijo Tikka, Otto Tiusanen, Karoliina Topelius, Antti Tulonen, Jussi Tunkkari, Jouni Tuomela, Aino Tuominen, Esa Turtiainen, Pasi Vahimaa, **Kari Vahtiala**, Lassi Valkama, Jouni Valkonen, **Harri Vartiainen**, Kirmo Vartiovaara, Kalle Varvikko, **Pekko Vehviläinen**, Juha Viitala, Severi Virolainen, Mikko Vuorela, Ville Vähämäki, Juha Wiskari, Haract Zentec, Anita Özönül.

The author of the preliminary investigation wants to thank all the crowdsourcers for their excellent work, as well as the Committee for the Future for the assignment and Ville Vähämäki, MP, and Olli Hietala, permanent expert in the Committee for the Future, for their great contribution to the structure of the preliminary investigation as members of the project's steering group.

The quality, scope and versatility of the content now collected through crowdsourcing are superior to the source material of the TuVRad9/2013 report. The topic-specific discussions opening through the links included in the reference material include very

professional discourse relating to technologies and their commercialisation. The participants have used various search engines to identify essential developments and preconditions.

Despite undeniable advantages, the material produced through crowdsourcing is not gap-free. A follow-up check of the progress of the hundred technologies included in the TuvRad9/2013 report was conducted relating to this preliminary investigation. It revealed some advancements that had gone unnoticed by the group. These have now been added to the group discussions and this preliminary investigation. An analytic approach has also enabled the identification of subject areas that are progressing in a radical manner but the group members have not been following coverage of them. In addition, there are subject areas that increase in importance along with the growing number of users in a way that becomes news only after the matter has become really important. Many crowdsourcing services, for example, are included in this category.

Thus, crowdsourcing that is based on the follow-up and collection of technology news cannot be used as the only analysis method in this type of work that aims for full coverage. The work must be complemented with analytical means and various expert surveys. However, even combined, these two cannot produce as versatile, open-minded and fresh material as crowdsourcing conducted by such a large voluntary group of citizens.

### **1.3 Objectives of the preliminary investigation**

The reception of the TuvRad9/2013 report has been very positive. Nevertheless, for many reasons, further development of the report and the related instrument, the four-level model, is recommended. The Committee for Future's assignment in 2012 included the idea that, in addition to the evaluation of the importance of technologies, particular attention should be paid to how evaluations change over time. Some of the promising technologies will not progress as anticipated, while others progress very quickly and completely new categories develop. The only means for properly seeing this change is to revise the material of the report and the related evaluation. The preliminary investigation shows that, in many areas, changes are taking place at a very quick pace.

In addition to the revision of the material, there are development needs related to the method itself, so that economic geography is better taken into account. This will facilitate the use of the four-level model for the evaluation of regional opportunities. There is a similar need for the expansion of the systematics if the four-level model is applied in countries in which the economic structure or needs of society are essentially different from the circumstances in Finland. According to the preliminary investigation, the needs related to economic geography can be satisfied with relatively small additions.

The material collected for this preliminary investigation through crowdsourcing is essentially more extensive than the material of the TuVRad9/2013 report. Considering the position that the report has achieved, it can be expected that, in connection with the revision of the report, a considerable amount of additional material will be produced by many interested parties. The management of the material and the preparation and

updating of regional and national versions should be planned carefully. The usability of the report can be considerably improved just by using simple IT applications.

Despite the positive reception of the report, its structuring should be improved. The preliminary investigation pays particular attention to the way of describing the value-producing networks, the grouping of technology baskets and the general effects of the technology domains.

## **1.4 The fastest-progressing baskets in the TuvRad9/2013 Top 25 category**

Nearly all of the hundred technology baskets of the TuvRad9/2013 report have progressed, and there are many that have made substantial progress. Depending on the technology basket, they have progressed through means such as more efficient production methods, better algorithms, more extensive deployment or scientific breakthroughs.

Of the technology baskets included on the Top 25 list of baskets expected to have the greatest impact, eighteen have made significant progress, some of them very rapidly. In this group of technologies with the greatest estimated potential according to the TuVRad9/2013 report, the Top Ten advancers are

- 2.01 Routine and complete DNA sequencing +++++
- 2.02 Biochips or biosensors able to diagnose cheaply and rapidly diseases, physiological states and genetic features of organisms +++++ !
- 2.07 Continuously monitored personal health +++++
- 2.13 Freely organising remote work and organisations that form on the internet +++++
- 2.22 Augmented reality glasses +++++
- 2.32 Real-time 3D modelling of the environment +++++ !
- 2.40 Material radar +++++ !
- 2.45 Self-driving car +++++ !
- 2.56 3D printing of goods +++++
- 2.82 Rapidly cheapening solar energy +++++

DNA sequencing has progressed very quickly at the levels of science, technology and markets. Biochips that detect diseases have been launched in larger markets from the laboratory, and they are progressing quickly. Devices for continuous monitoring of personal health have become more versatile, and new products are continuously launched in the market. The category Freely organising remote work and organisations that form on the internet has evolved from a difficultly identified phenomenon to a hot topic of work-related discussion through global platform companies, such as the Uber taxi service. Augmented reality glasses are on the threshold of a very broad market breakthrough. Real-time 3D modelling of the environment is already reality for high-end vacuum cleaners; new applications and environment-sensing devices are continuously launched in the market. The self-driving car, once an experiment that was unconvincing even to many experts, has become a unanimous target for the car industry. Self-driving cars are already being tested in traffic globally. 3D printing of goods continues its nearly 100% annual market growth, and the equipment technology is developing at an accelerated rate. In many countries, the price of solar energy has reached parity with the grid. Solar energy production is rapidly increasing, and many breakthroughs in research predict that the

strong fluctuation in production that is transforming the electricity market will continue, as well as the decreasing price trend.

After the publication of the TuvRad9/2013 report, the Top25 group of the four-level model developed much more rapidly on average compared with the categories whose potential importance was estimated to be lower. The top category alone included as many quickly progressing technologies as all the other categories put together. This can be considered as a remarkable success in respect of the four-level model. In addition to potential effectiveness, it seems that the model also predicts the development speed. This, in a way, is not a surprise: the model takes into account the quantity of development investments and the technology readiness level, as well as its potential benefit for the different value-producing networks. However, the result is neither obvious nor trivial.

The technologies ranked in the top quarter in the four-level model progressed more quickly during the review period than those ranked in the second quarter. In addition, the difference between the second quarter and the third and fourth quarters was also distinct. Thus, the explaining factor is probably the extent of the potential benefit associated with the top-ranking technologies in independent value-producing networks. Even if progress in a value-producing network was blocked by power structures, there is a number of alternative routes available. On the other hand, investments in development increase along with the promises. From the perspective of the four-level model, the result means that the technology baskets ranking highest in the model are the most likely to make progress. From the perspective of anticipation, this is a very important achievement.

Technology baskets 1–25	rate of progress 3.64
Technology baskets 26–50	rate of progress 3.36
Technology baskets 51–75	rate of progress 3.00
Technology baskets 76–100	rate of progress 2.76

The above figures describe the average rate of progress by category. The categorisation is the same that was used in TuVRad9/2013, influenced by Finnish expertise and export channels. When these influences are eliminated and a global ranking is applied, the difference between the top and bottom quarters increases slightly, while the difference between the second and third quarters becomes slightly narrower.

### **1.5 The fastest-progressing baskets in the TuVRad9/2016 Top 26–100 category**

Many of the technologies placed in the next three categories in the four-level model on the basis of their estimated effectiveness are making rapid progress, even though, on average, the progress seems to correlate strongly with the significance estimated by the four-level model. The fast-progressing technologies with lower overall effectiveness include many that may have quite a dramatic impact on individual value networks.

- 2.04 Drugs based on genetically modified organisms +++++
- 2.06 Longer life time and slower aging processes +++++ !
- 2.10 Repairing and regrowing of human organs, (stem) cell cultivation +++++ !

- 2.14 Human recognition systems ++++ !
- 2.41 Cheap gas sensors ++++ !
- 2.47 Quadcopters +++++
- 2.49 Vactrains ++++ !
- 2.57 3D printing of buildings ++++ !
- 2.80 Ultralight and strong materials +++++ !
- 2.90 Massive storage of energy in high capacity batteries ++++ !

Genetics-based medicines are developed on a continuous basis, and related breakthrough results are frequently reported. Studies to prolong life conducted in mice have led to a number of breakthroughs, and the first tests in humans have started. Cell cultivation, as well as 3D printing and re-growth of organs are already reality for several organs. Human recognition on the basis of an image produced from DNA is a significant breakthrough. Image recognition has also progressed rapidly, and the machine has already surpassed humans in this area. Sensors for hazardous or harmful gases are planned to be included in clothes, for example. Quadcopters are already performing many tasks, and legislation is being adjusted globally. A vactrain test track is being built in California, and the travel speed is estimated at 1,200 km/h. Three years ago, this specific Hyperloop technology had not yet been introduced even as an idea. Experiments in 3D printing of buildings have progressed to include insulated structures that meet the building regulations. Several materials for structures have been developed that are more lightweight than before. As a result of the need created by the use of renewable energy sources, massive storage of energy has become a rapidly growing field, and anticipated new technologies will soon be introduced in the market.

## 1.6 New baskets and fields of technology that are proposed for monitoring

Many of the technology baskets included in TuVRad9/2013 have expanded too much, and this preliminary investigation includes proposals to split them. In some technology baskets, the collected monitoring material has indicated problematic limitations and need for merging. This issue is also addressed here. Some of the technology baskets have been proposed to be removed, either because they are progressing slowly or because the technology is estimated to have already made its main breakthrough in the market. These proposals are included in chapter 7 in connection with the respective technology basket.

On the basis of the material collected by crowdsourcing, the following new categories and specific collections of breakthrough news are proposed for consideration when preparing the new report.

- (new) Urban multilayer cultivation/LED cultivation (2.101)
- (new) Inexpensive small fuel cell (2.102)
- (new) New power sources for vehicles (2.103)
- (new) Radical development of water-borne traffic (2.104)
- (new) CO2 capture (2.105)
- (new) New methods for transferring goods/materials (2.106)
- (new) Robotic manufacturing/service (2.107)
- (new) Ubiquitous environment (IOT) (2.108)
- (new) Off Grid and Micro Grid solutions (2.110)
- (new) MyData (2.111)
- (new) Blockchain and other p2p solutions (2.112)

(new) Verbot – communicative and literary robots (2.113)  
(new) Optics (2.300)  
(new) General AI (2.600)  
(new) Digital art, digital experiences (2.700)  
(new) A collection of medical (2.150), material technology (2.500) and unclassified (2.200) breakthroughs that need to be categorised

Indoor cultivation using LED lighting is rapidly increasing. The optimisation of light, watering and temperature provides an opportunity for efficient cultivation in urban environments. Robotic manufacturing is stepping out of factories and becoming part of trade and services. The development of the IOT is making the environment increasingly smart and interactive. New decentralised electricity production and storage methods will make withdrawal from the grid a sensible option for many. The blockchain mechanism, which the Bitcoin system is built on, provides a decentralised web of trust for increasing types of transactions. Communicative robots that are capable of verbal functions are becoming increasingly common in information networks and also physical situations. The development of digital technology provides new opportunities for art and new interfaces for media. The development of optics for various new applications is rapid, as a result of the progress of material technology and quantum optics. Artificial intelligence is progressing towards more and more important applications. Many breakthroughs are seen in the fields of medicine and material technology. These, and other unclassified breakthroughs, should be categorised in more detail, and the most promising distinct technologies should be included within the hundred technology baskets.

The proposed new categories, including their reference material and news links, are described in chapter 7 in connection with the description of the progress, proposals and reference material related to the technology baskets included in the TuVRad9/2013 report.

## **1.7 Structural improvements to the report**

The initial categorisation of the technologies in the report was made on journalistic grounds. The technology baskets in a category have some similarities, but more related to the structure or idea than the effects. Further improvement of the categorisation can help to highlight the differences in the social effectiveness of different technologies. This philosophy has been applied in the recent Sitra report Technology as an Enabler to Sustainable Well-being, which uses TuVRad9/2013 as its main source of technology. This option for development does not, as such, affect the basic structure of the anticipation method, but it adds depth to the structuring.

Guided by this philosophy, the technology baskets are divided into ten groups in chapter 7. The division is different from that used in the TuVRad9/2013 report. The purpose of the new grouping is to be able to clearly describe the technology push of each category. Therefore, the idea was to group together technologies that have a number of similar general-level effects. In the final report, these group-specific similar effects should be systematically reflected against the dynamics of value-producing networks and general dynamics of economy and society.

Technology groups	
1	Instrumentalisation of everything (measurement and control)
2	Artificial intelligence (AI) and algorithmic reasoning
3	Digitalisation of processing and information stoages
4	Traffic, mobility and logistics
5	Production of goods and services
6	Material technology
7	Biotechnology and pharmacology
8	Energy technology
9	Digital crowdsourcing platforms
10	Globalising technology interfaces

The central part of the anticipation instrument consists of the matrix of twenty value-producing networks used for the evaluation of the hundred technology baskets. The headlining and description technique of the value-producing networks should be improved. For understandable reasons, some readers have found the headings of the value-producing networks in the TuVRad9/2013 report misleading, and the descriptions prepared of them do not adequately facilitate the rating of technologies. Therefore, the rating depends too much on the evaluator's personal ability to understand and remember the potential of each technology when making evaluations. More systematical description of value-producing networks can essentially reduce the dependence on person.

In the description of value-producing networks, particular attention should be paid to the dynamics of the networks. Threats, opportunities and inertial forces should be separated into independent items and structured more clearly. Inertial forces should be systematically addressed, for example, through the concepts of the socio-technical regime described in more detail in chapter 2. This would also provide a clear perspective to the objectives of public administration to promote desirable developments and mitigate threats. The concepts of the socio-technical regime in connection with value-producing networks would provide an excellent instrument for the breaking of norms and the assessment of the need for new norms.

## 1.8 Regional and international application of the four-level model

The four-level model and related material provide many opportunities for regional use. Regional developers in Finland have already expressed great interest in the report, and many events have been arranged around Finland on the basis of the material included in the report. Instead of national competencies and export channels, the application of the four-level model in evaluation could be based on the data of each region. The basic material would remain the same, and regional data could easily be fed into the system at a much more detailed level than national data. The regional model constitutes an excellent platform for forming networks within the region and with other regions, between science,

technological development, regional development, exporters, customer organisations and the regulator. This topic will be discussed in more detail in chapter 3.

TuVRad9/2013 has been translated into English, and it has attracted the interest of the European Commission and other international parties. International use of the four-level model would become easier if the weights of the value-producing networks could be modified. This is necessary if the economic structure or any other structure of society is essentially different from that of a country like Finland. Technically, the modification of the weights is a small job. Weights can be chosen in a number of ways. This topic is addressed in more detail in chapter 4.

### **1.9 Interactive updating of the report with the help of database**

The TuVRad9/2013 report was prepared using a text processing software and an Excel table. Updating of a report compiled in this way requires a lot of manual work. For the purposes of this preliminary investigation, all material of technology news and crowdsourced discussions have been transferred into a database that can be easily viewed from different perspectives. This procedure should be developed further. If the structure of the report was programmed as an application accessible through a browser, it would be easy to produce an up-to-date version of the report anytime. The evaluations of regional needs required by the four-level model would also be easy to update, and a regional or even organisation-specific version of the report would be automatically available.

With a relatively simple application, it would be possible to enter in the database information about experts representing Finnish scientific communities and R&D organisations in the various technology baskets, in addition to entering information about technological breakthroughs. Moreover, it would be possible to enter information about parties in need of technology, as well as information about applications and export channels. This would enable reviewing the technology baskets and related news by value-producing network, branch of science and expert. At the same time, it would become possible to browse the database, proceeding from a team of researchers through technology baskets to potential benefits and winners in the different value-producing networks. These possibilities are described in more detail in chapter 5, and Appendix 1 includes a draft of the required database structure.

### **1.10 Towards a shared discussion platform in the innovation system**

The Finnish innovation system has been called one of the best in the world. The figure below shows a model of one of our good innovation processes. The above database and the application that is based on the four-level model and shared by the actors in the innovation system would provide an excellent tool for facilitating all the anticipation and activation sections in the innovation system process. Preliminary discussions on this considerable advantage have been conducted with the key actors in the innovation system. Hopefully, the parties involved will find that a joint data structure is possible and provides useful added value for all Finnish actors. According to a preliminary survey, the

key parties of the innovation systems are interested in this. The survey conducted on the parties of the innovation system is described in more detail in chapter 6.

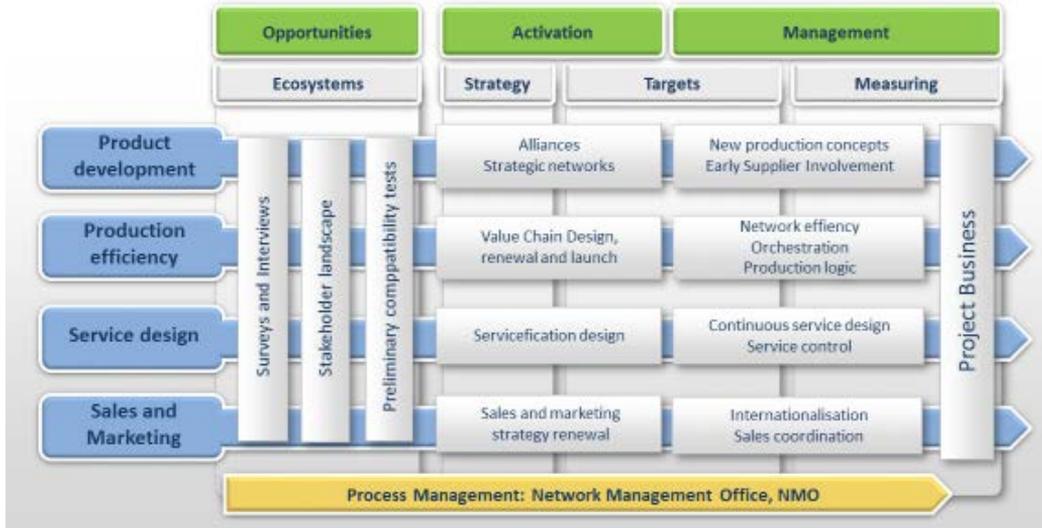


Figure: Anticipation and activation in project business, Juha Ekberg, Gordionpro Oy

## 2 Development needs related to the structure of value-producing networks

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The concept of value-producing networks is one of the key ideas of the TuVRad9/2013 report and the developed four-level model of radical technologies. Because of value-producing networks, the four-level model highlights rising technologies that can change existing structures and, possibly, challenge the regulative environment on a broad front.

The grouping of value-producing networks can be considered as successful and reflective of the priorities of society. However, the headlining in accordance with the most important area of change has led to misunderstandings regarding the role of value-producing networks in the evaluation of technologies. In the description, the dynamics of the networks, the networks' sensitivity to reform and technological development have not been properly distinguished from each other. In the four-level model, value-producing networks have a 'demand pull' role, while a 'technology push' approach is applied to the evaluated technologies. The merit of the four-level model lies in fitting these perspectives together. This thinking can be clarified without losing the interesting character of the text.

It is recommended to split the headings of the value-producing networks in two: the main heading describes the scope of the value network using the demand-pull approach, while the subheading indicates the greatest sensitivity to change. The value networks should still be described briefly but more systematically than in the previous report. The current functional dynamics and scope, as well as the costs and satisfied needs should be clearly specified. The descriptions should still focus on characterising the threats and opportunities associated with technological development in relation to satisfying the needs related to the network and the network's dynamics and sensitivity to change. Thus, threats and opportunities should be described separately. They should be clearly linked to the structures of the current, existing value-producing network and, on the other hand, to the key added values produced by and expected from the network.

Modelling of the structure of the value-producing networks and the added values produced by them could facilitate the evaluation of the significance of the technologies and reduce dependence on the evaluator. However, fully automatic evaluation is not possible. At best, the model would make the evaluator's work easier. Extensive modelling may also involve a challenging amount of work.

It would be useful if descriptions of inertial forces and the current dynamics and sensitivity of the value-producing networks relied on the concept of socio-technical regime, insofar as prevailing structures can be identified in each independent value-producing network. Professor Frank W. Geels has defined the following seven dimensions for socio-technical regimes: technology; user practices and application domains; symbolic meanings of technology; infrastructures; industry structure; regulatory environment; and technical-scientific knowledge. The socio-technical regime must often change thoroughly, particularly prior to radical technological changes, so that the market mechanism can promote the changes.

Increasing structuration  
of activities in local practices

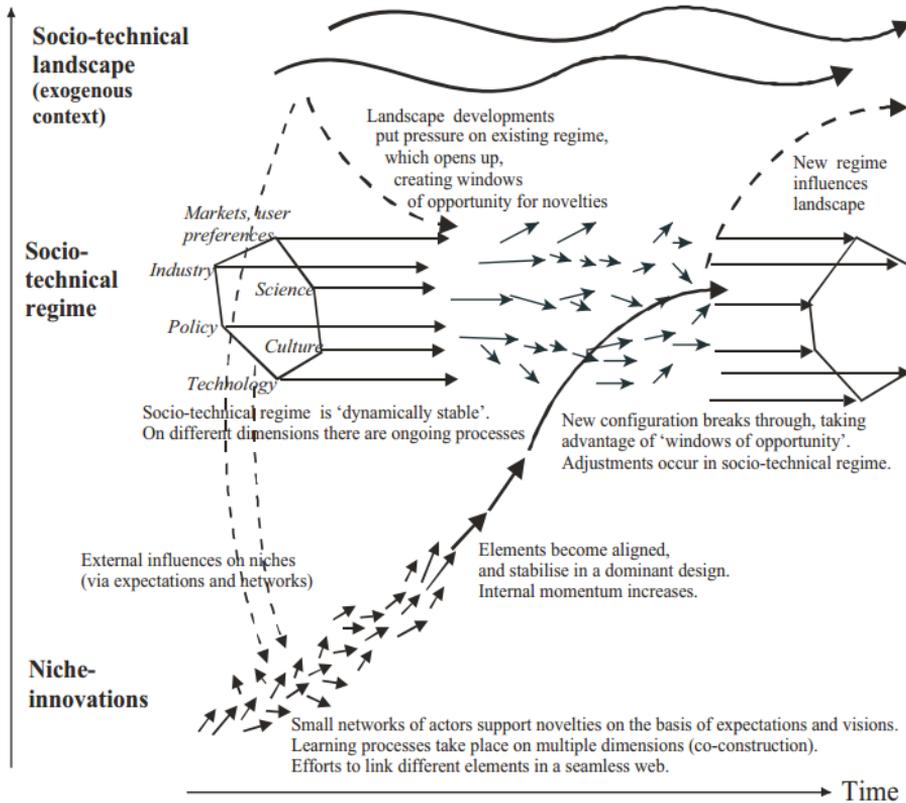


Figure: Effect of socio-technical regime on the breakthrough of innovations

In many areas, particularly in an oligopoly, large companies want to keep the situation unchanged for as long as possible. Economy of scale and customer knowledge often help them to keep smaller newcomers in the market at a distance, even if the latter possess better technology. Despite this, change can be promoted in many ways. Many instruments of attention economy, for example, are in the government’s hands. New technology can be favoured in public procurement. Regulations limiting or blocking its use can be revoked. Regulative obstacles blocking smaller players can be removed, for example, by opening up public procurement with the help of open interfaces. Training in new technology and other related services can be increased. Practices and ecosystem-catalysing platforms and functional roles related to new technology can be developed.

The inclusion of the concepts of the socio-technical regime in the description of value-producing networks would help to evaluate the adoption rate of new technologies and also the administrative measures required to promote desirable technological changes. When reviewed in this way, value-producing networks and the four-level model as a whole would constitute a very efficient tool for analysing the need to break norms and the need for other measures required by the new technologies.

The coverage of the value-producing networks and their sufficient degree of separation should be checked and ensured when preparing their descriptions. Particular attention should be paid to the demand-pull approach, ensuring that the subject area can be sufficiently clearly described as a network that produces specific type of added value. The following new main headings are initially suggested for the value-producing networks; they follow the current classification but have a wider scope:

<b>Value-producing networks</b>	
1	Passenger traffic
2	Freight traffic
3	Manufacturing of goods
4	Trade and services
5	Nutrition
6	Remote control and influence
7	Learning and need for competence
8	Maintenance of health
9	Restoration of the ability to function
10	Improvement of awareness
11	Material technology
12	Functionality of goods
13	Energy production and transfer
14	Availability of raw materials
15	Cultural interaction
16	Safety, security & protection
17	Built environment
18	Self-organisation ability
19	The individual's role and identity
20	Democracy and freedom

### 3 Development needs related to the four-level model from the perspective of regional development

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The four-level model published in the report A Hundred New Opportunities for Finland evaluated the social significance of technologies by focusing on three specific matters. The potential utility value of a technology for a society like Finland can be surveyed using twenty value-producing networks. The readiness level of the technology and scientific investments indicate the technology's probable degree of success. Domestic expertise and networking with the global market indicate the probability at which Finland can benefit from the technology.

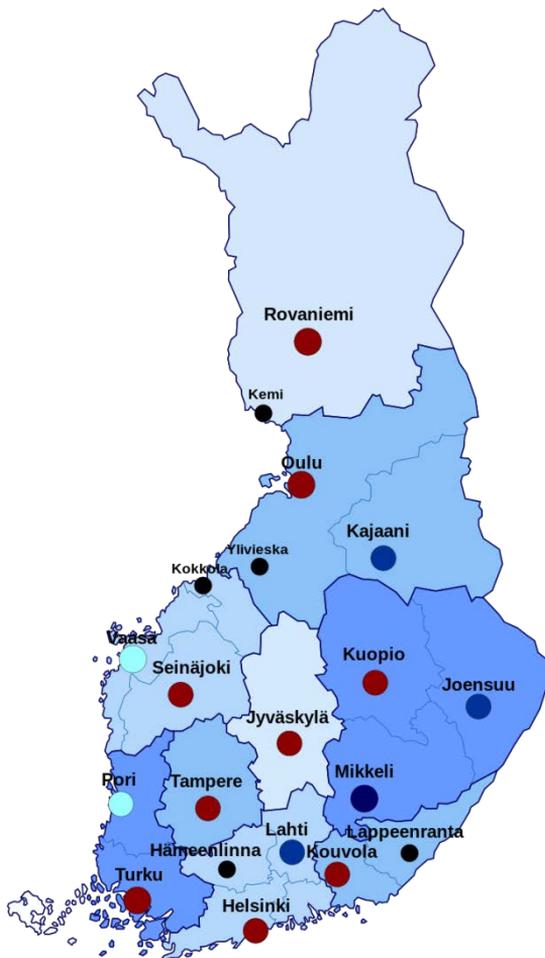


Figure: Centres for Economic Development, Transport and the Environment and regions

From the perspective of regional development, Finland is too large an area to be reviewed. Instead of evaluating Finland as a whole, the evaluation of the importance of technologies should focus on regional expertise and the region's networking with the market external to the region, including the domestic market.

The method should be applied to regional development so that instead of national-level evaluation, those experts in the region are listed whose products or services would gain significant competitive advantage from each technology, as well as those companies whose client base would gain a significant competitive advantage from the technology. The highlighting of these areas demonstrates the region's ability to benefit from each technology, both as a user and a provider of products and services related to the technology.

The observation of regional development needs does not principally require any changes to the common sections of the model. The replacement of Finland's data with regional data basically requires collecting data from the region and substituting them for the national data. There is no need to change the structures of the model.

If the regional development aspect was implemented at a detailed level, listing all the parties that particularly benefit from each technology as a user or provider, the system would also provide a good means for creating networks. In order to accelerate the development of reformation-oriented networks, the required information must be easily accessible for browsing by companies and other organisations in the region, and real-time online updating must be enabled.

The production of a regional report should be appropriately automated. The changing of shared data should not automatically lead to a need to rework the regional versions. Regional information that promotes networking should also be available for interregional and national networking. As regards wide-ranging application of the model, the most fruitful and efficient results can be achieved if the information from the national and regional reports alike are entered into a joint database. Then, according to the selections made, an automatically modified national, regional or even organisation-specifically filtered and prioritised version can be produced.

## 4 Development needs related to the four-level model from the perspective of national differences

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A Hundred New Opportunities for Finland was written from the perspective of a society that is similar to Finland. The 20 value-producing networks of the four-level model have an equal weight in the evaluation of the overall significance of the technology baskets. This solution was chosen for two reasons. When the value-producing networks were being outlined, the largest entities were split into smaller ones. The result was twenty value-producing networks, all of which could be considered as important and extensive entities that affect society. The rating within each value-producing network depended on the overall impact on society through the network in question. This was believed to automatically adjust the weights, so that there was no need for network-specific weighting.

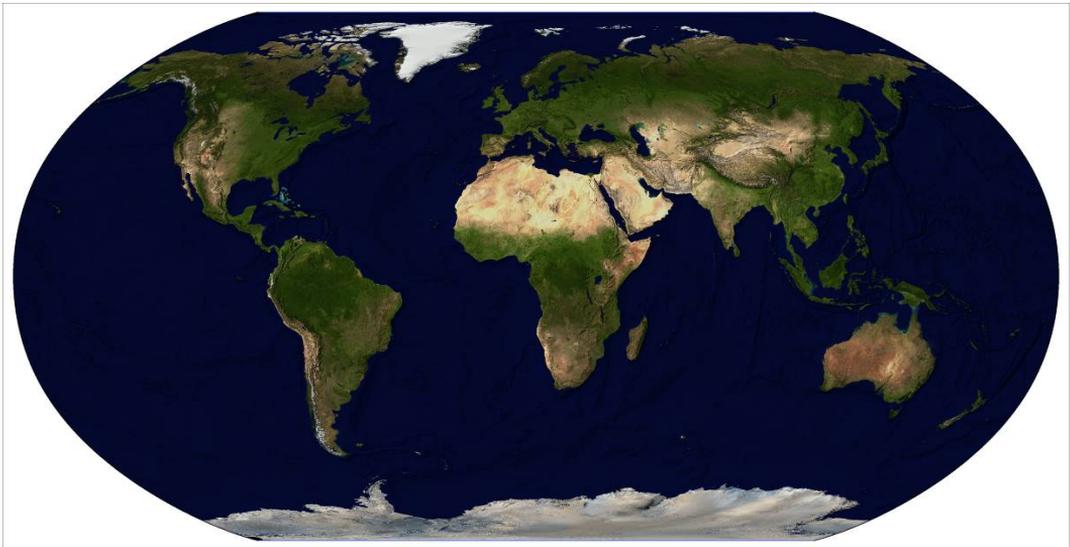


Figure: A global view does not reveal differences in culture and economy

For a country that resembles Finland, such as most of the Western countries, the four-level model and the actual content of the report only require the same modifications that are required for regional models. National competencies and access to international networks must be produced country-specifically. If the structure of the society being reviewed essentially differs from the Finnish structure, the situation is different. For example, if the country in question is very agriculture-dominated, the weights of the value-producing networks should be adjusted. This is very easy to take into account in the model. The score produced by each one of the value-producing networks is multiplied with a weight coefficient, and the resulting values are summed up.

This adjustment is technically simple, but the evaluation of the weights is not quite so straightforward. A panel of experts representing different sectors of society can produce the weights using the Delphi method. Another possible approach is to study the key ratios of national economies to find more schematic and objective methods for determining the weights. This would be suitable for EU-type reviewing, for example, in order to make the prerequisites of countries and their potential benefits comparable with each other.

Key ratios affecting the weight coefficients could be associated with the following matters, for example: level of education; proportion of agriculture; proportion of industry; proportion of military expenditure; proportion of export; proportion of transport; population's age structure; variation in temperature and amount of light according to season; level of raw material resources; national income; differences in income; cultural diversity; form of government.

The next version of the report could test the mutual importance of the value-producing networks in Finland, using the Delphi method. Moreover, a model could be developed for the mutual importance of the value-producing networks, providing justifications for the weights of the networks. This would improve the reliability of the four-level model in national use by increasing its credibility. This would also be a step towards international application of the model.

## 5 Opportunities provided by an information system for dynamic production of a report

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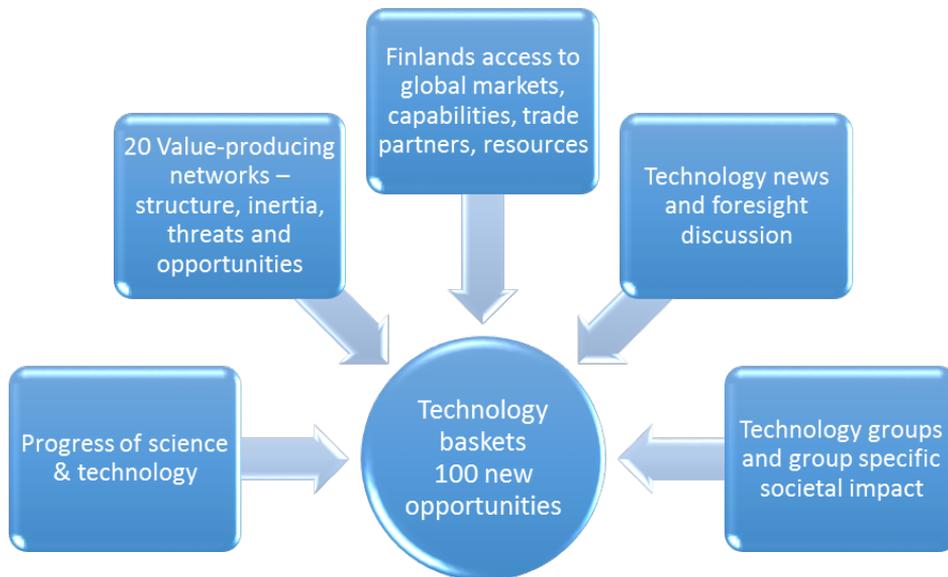


Figure: Technology baskets integrate supply and need into the structures of society

The four-level model of radical technologies links together scientific advancement, technological development, value-producing networks in society, as well as domestic market demand, expertise and export channels. Even though the original purpose of the four-level model was the anticipation of the social effects of technologies, the material needed for assessment and the links required by the four-level model provide extensive opportunities for responding to many other challenges as well.

The material linked to the model can help decision-makers to detect threats and opportunities created by emerging technologies in their important value-producing networks. With the help of the readiness level of technologies and alternative paths of development, it is possible to create a picture of how realistic the effects are and when they will manifest.

Researchers can use the model for identifying the technology baskets that their field of research can affect. In addition, they can assess what types of applications their respective fields of research could contribute to in the different value-producing networks of society. This helps to anticipate the social effectiveness of research. Researchers, developers of technology and those in need of technology could find each other with the help of the information linked to the four-level model.

Legislators and authorities could use the model to detect needs for change in the socio-technical regimes related to the different value-producing networks. The anticipation

material provided by the four-level model facilitates the revoking or amending of regulations, the analysis of the need for education and the analysis of future risks associated with large investments in infrastructure.

In order to ensure that the four-level model responds to these challenges as efficiently as possible, the material should be easily available for processing in the information network. It should be possible to approach the material from different perspectives. It should be possible for actors interested in a particular value-producing network to view only those technology baskets that are related to this network. Similarly, it should be possible to select for viewing only those technology baskets that require expertise in a specific branch of science. It should be possible to easily produce technology basket-specific views into the applications of different value-producing networks, the technology news related to each technology basket and the related discussions, as well as domestic experts, possible parties who need technology and experts in background disciplines.

A broader expert and expert view can easily be linked to an information system built in this way. This can be done, for example, in co-operation with the Academy of Finland, Tekes – the Finnish Funding Agency for Innovation, the Sitra fund, VTT Technical Research Centre of Finland, TEK and Finpro. This would provide each party in the innovation system with a channel that links their field of expertise in a natural way to the other parties’ fields of expertise in the innovation system.

### Preliminary functional description

Only the shared parts of the information system and the parts that are necessary to enable the automatic and real-time update of the report ‘A hundred New Opportunities for Finland’ are described here, as well as the parts that are necessary in order to produce regional and national versions as described above.

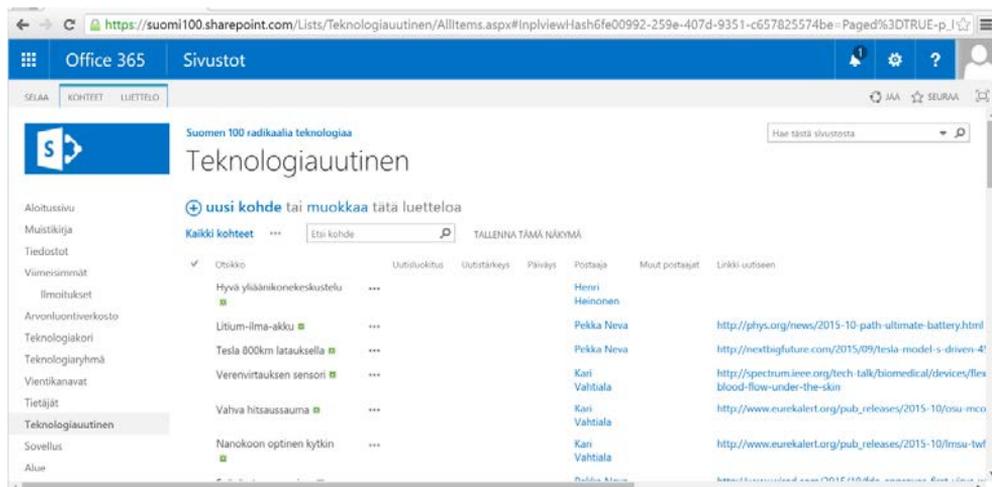


Figure: Draft of the online implementation of the Four-Level Model, Jari Kotola, Sovelto

The system must run on a web browser. The system must provide all users with the opportunity to browse technology news and view the relations between the technology baskets, value-producing networks and export channels using different selection criteria. For authenticated users, the system must allow the addition of technology news; for area administrators, the maintenance of organisational information; for organisations, the maintenance of their own information; and for system administrators, the maintenance and addition of all relations and contents. The system should be implemented in accordance with the principles of open data and with open interfaces. Appendix 1 includes the preliminary description of the data content of the database.

## 6 Views of key stakeholders on development needs

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The following enquiry was sent to six actors in the Finnish innovation system:

ENQUIRY CONCERNING THE FURTHER DEVELOPMENT OF THE REPORT 'A HUNDRED NEW OPPORTUNITIES FOR FINLAND', COMPILED BY THE COMMITTEE FOR THE FUTURE AND RELATED TO ANTICIPATION OF TECHNOLOGICAL BREAKTHROUGHS

Dear recipient,

The Finnish Parliament's Committee for the Future has given me the assignment to survey the needs for further development of the anticipation instrument launched by the Parliament. Crowdsourcing related to the report has identified nearly a thousand post-publication (9/2013) technological breakthroughs of various levels. Therefore, a need has arisen to ensure up-to-date availability of information concerning technological breakthroughs and related domestic competencies to anticipators in the form of a shared database. In addition, there is a need to equip the anticipation instrument with features that support regional development and observe specific national features at European level. A further objective of the revision of the original technology anticipation method and the report is to detect the progress of radical technologies and their impact on society. This is best achieved by revising the work at regular intervals. In connection with this revision, the value-producing networks related to the anticipation methods are described more clearly and the grouping of the technologies is improved, while new observations give rise to the renewal of the list of 100 radical technologies and the re-evaluation of their impact on society.

Therefore, we kindly ask you to answer the following questions on behalf of your organisation or to forward this enquiry to a person who could do it.

Is your organisation interested in providing material that could influence the content of the report?

If this work resulted in the specification, assembly and classification of a database for radical technology-related innovations and related Finnish competence, updated on a continuous basis through crowdsourcing, would your organisation be interested in using it?

Could your organisation consider participating in the funding of the user interface for the above database, together with other actors? The original report was already prepared in a structured format that is suitable for a database. The material will be collected into a database in connection with this preliminary investigation. The objective is to establish a cloud service, in which regional and topic-specific information could be easily found and the effectiveness of reported technologies and their links to experts, regions and value-producing networks could be easily detected using various criteria.

Does your organisation have any preferences on the development of the report and the incorporated anticipation model, relating to the technologies included in the report, the value-producing networks, the regional perspective, the mode of presentation or any other important questions related to the anticipation of radical technologies?

I kindly ask you to send your organisation's answers to these questions by the end of January. Links to the Finnish and English versions of the report:

[https://www.eduskunta.fi/FI/tietoeduskunnasta/julkaisut/Documents/tuvj\\_6+2013.pdf](https://www.eduskunta.fi/FI/tietoeduskunnasta/julkaisut/Documents/tuvj_6+2013.pdf)

[https://www.eduskunta.fi/FI/tietoeduskunnasta/julkaisut/Documents/tuvj\\_11+2014.pdf](https://www.eduskunta.fi/FI/tietoeduskunnasta/julkaisut/Documents/tuvj_11+2014.pdf)

Yours sincerely,

Risto Linturi

The enquiry was sent to the following organisations: The Council of Oulu Region, the Sitra fund, the Academy of Finland, TEKES – the Finnish Funding Agency for Innovation, Academic Engineers and Architects in Finland TEK and VTT Technical Research Centre of Finland. All of them answered the questions in writing. The length and degree of formality varied, and the answers to most of the questions were cautiously positive. The caution was associated with the fact that the questions did not include any actual proposal or action plan.

Without exception, the actors were ready to acknowledge the positive opportunities provided by co-operation. The inclusion of the organisation's own data in a shared data structure was considered as useful, and most of the organisations found that the opportunity to use the data is valuable. Most of the organisations considered the funding of the database development possible, but several actors warned about the dangers of scattered and separate systems. The respondents hoped that this system would be integrated into existing systems or systems currently under development. Except for the question of funding, all the organisations gave either clearly positive or cautiously positive answers to all of the questions. All of them were interested in further discussions. The answers were submitted to the Committee for the Future.

## **7 Technological development after the publication of the report A Hundred New Opportunities for Finland**

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This chapter discusses the general direction of technological development and the associated threats and opportunities for society. The progress of the hundred radical technologies evaluated as important in the previous report is assessed, and important advancements and news about breakthroughs in the technology baskets are pointed out. At the same time, needs to change the outlining of technology baskets are disclosed. Some technology baskets are proposed to be removed and others to be added, on the basis of the new material collected after the publication of the previous report. The proposals are preliminary, and this preliminary investigation does not rate technology baskets in accordance with the four-level model. However, the progress of the baskets is rated on the basis of expert assessment of the collected material, and the ratings are shown in the appendix material. In this chapter, '\*' indicates the placement in one of the four categories of the TuVRad9/2013 report.

The approximately 1,000 post-TuVRad9/2013 technology sources presented in this chapter were collected through crowdsourcing. They are listed, grouped and classified in this preliminary investigation. A complete list is provided as Appendix 2. It includes the heading of the news topic, a reference link to the article discussing the topic and a link to the crowdsourcing discussion on the topic. The discussion may include references to other sources that touch on the subject. This chapter includes the most important preliminary observations and conclusions.

Compared with the attention paid to value-producing networks and individual baskets, the TuVRad9/2013 report paid less attention to the grouping of technologies, which is why the grouping was rather superficial. A new grouping is proposed here to enable group-specific description of the anticipated impact of development from the perspective of society. The purpose of the proposal is to clarify the grouping compared with the previous report. The grouping is based on the report *Technology as an Enabler of Sustainable Well-being in the Modern Society*, written by the author of this preliminary investigation for the Sitra fund. In this report, the 100 radical technologies listed in the Committee for the Future's report, *A Hundred New Opportunities for Finland*, are grouped and the descriptions of the groups are used for the assessment of threats and opportunities in the sustainable well-being model developed by Sitra.

### **General technological development**

The interaction between technology and society is bidirectional. Technological development is influenced by many structures of society, while technological development influences these structures. The development does not automatically lead to a positive result but involves threats as well as opportunities. The socio-technical regime, discussed in more detail in connection with the development needs of the value-producing networks in chapter 2, may allow the materialisation of threats and prevent the utilisation of

opportunities if society does not adapt to the technological development to a satisfactory extent.

A number of different indicators suggest that technological development is accelerating and that technologies are adopted for use increasingly fast. In global competition, this increases the gap between the first and last adopters and increases interference in the economy and society in rapidly and slowly developing areas alike. Pressures on many structures that are outdated from the technological perspective increase, as globalisation blurs borders between countries and increases remote effects.

## **7.1 Instrumentalisation (measurement and adjustment) and telecommunications**

Measurement technology has developed increasingly sensitive sensors that give us information about our environment and ourselves. Households have access to devices that can analyse our genome or the composition of many substances or make a variety of medical findings. Sensors can get the energy they need from their environment and they enable wireless connection. Both wireless communication and communication by wire enable us to connect all the collected data to cloud services.

The number of smart devices is estimated to double over the next five years. Sensors collecting increasingly diverse information are incorporated in these devices and, at the same time, wireless sensors are becoming so small and inexpensive that they can easily be placed in the environment and even in the human body. In addition to sensors, many devices have evolved that activate and control various functions.

As a result of the development, people are getting more and more information about the environment and themselves, and an increasing number of functions can be remotely controlled. Stored and real-time data and controllability enable very advanced automation. With this data, robot-assisted work can be carried out regardless of the physical location of the person controlling the robot. On the other hand, many processes can be automatically monitored at such a detailed level that human monitoring is not necessary.

Technological development after the publication of the TuV9/2013 report and needs for improvement related to reporting:

### **Routine and complete DNA sequencing (2.01) \*\*\*\***

The most affordable human genome sequencer developed so far, Minion, has been launched on the market. It costs approximately EUR 2,000. You can order sequencing of your genome, including explanations, at a price starting from 300 dollars. The prices have fallen rapidly. Minion is inaccurate, but its nanopore technology that is based on graphene holes has been developed further. Simulations have shown that the technology could sequence genomes at an accuracy of 90% without false positives, at a rate of 66 billion base pairs per second. At this speed, the entire human genome could be read 32 times in a second, and on each iteration round the number of errors decreases to one tenth

compared with the previous round. Thus, this technology will probably enable the development of a quick and practically error-free DNA sequencer that is also very affordable. In the future, genome sequencing may be as easy as photographing. In practice, in addition to your own genome, it will be possible to routinely sequence the genomes of other people, animals, food and diseases.

In addition to genome sequencing, writing of DNA sequences has improved. The Crispr-Cas9 method is inexpensive, accurate and easy to use. It has been shared 23 thousand times to researchers. The recently developed Crispr-Cif1 technology is even more accurate and will be extensively distributed to researchers. As a result of the development, gene editing is becoming an accurate and extensive activity. Recommendation: retain and expand to include the editing of genes, in addition to decoding.

<b>Technology links after September 2013</b>	
\$1,000 DNA sequencer Minion in use	<a href="http://www.nature.com/news/pint-sized-dna-sequencer-impresses-first-users-1.17483">http://www.nature.com/news/pint-sized-dna-sequencer-impresses-first-users-1.17483</a>
Fast DNA sequencing	<a href="http://phys.org/news/2015-03-atomic-chicken-wire-key-faster-dna.html">http://phys.org/news/2015-03-atomic-chicken-wire-key-faster-dna.html</a>
USA to analyse DNA from a million Americans	<a href="http://www.reuters.com/article/2015/01/30/us-usa-obama-precisionmedicine-idUSKBN0L313R20150130">http://www.reuters.com/article/2015/01/30/us-usa-obama-precisionmedicine-idUSKBN0L313R20150130</a>
Fast DNA sequencing	<a href="http://spectrum.ieee.org/at-work/start-ups/startups-t2-biosystems">http://spectrum.ieee.org/at-work/start-ups/startups-t2-biosystems</a>
DNA sequencer – test results (USB)	<a href="http://arstechnica.com/science/2014/12/usb-sized-dna-sequencer-is-error-prone-but-still-useful/">http://arstechnica.com/science/2014/12/usb-sized-dna-sequencer-is-error-prone-but-still-useful/</a>
DNA sequencing using graphene	<a href="http://phys.org/news/2014-11-unique-graphene-nanopores-optical-antennas.html">http://phys.org/news/2014-11-unique-graphene-nanopores-optical-antennas.html</a>
Minion USB DNA sequencer comes to market	<a href="http://www.extremetech.com/extreme/190409-minion-usb-stick-gene-sequencer-finally-comes-to-market">http://www.extremetech.com/extreme/190409-minion-usb-stick-gene-sequencer-finally-comes-to-market</a>
Handheld PCR DNA sequencer	<a href="http://gizmodo.com/the-worlds-first-handheld-dna-sequencer-is-a-genetics-l-1626992774">http://gizmodo.com/the-worlds-first-handheld-dna-sequencer-is-a-genetics-l-1626992774</a>
\$1,000 whole genome (Illumina 2015)	<a href="http://www.illumina.com/systems/hiseq-x-sequencing-system.html">http://www.illumina.com/systems/hiseq-x-sequencing-system.html</a>
Genome sequencing for \$300	<a href="http://nextbigfuture.com/2016/01/whole-genome-sequencing-for-330.html">http://nextbigfuture.com/2016/01/whole-genome-sequencing-for-330.html</a>
Simulated DNA sequencing, 66 billion bases/second	<a href="http://phys.org/news/2016-01-nist-simulates-fast-accurate-dna.html">http://phys.org/news/2016-01-nist-simulates-fast-accurate-dna.html</a>
Plan on human GMO embryo at the Karolinska Institutet (Crispr-Cas9)	<a href="https://www.facebook.com/groups/TuVRadikaalit/permalink/891992770918330/">https://www.facebook.com/groups/TuVRadikaalit/permalink/891992770918330/</a>
Genetics of schizophrenia further clarified	<a href="https://www.washingtonpost.com/news/speaking-of-science/wp/2016/01/27/scientists-open-the-black-box-of-schizophrenia-with-dramatic-genetic-finding/">https://www.washingtonpost.com/news/speaking-of-science/wp/2016/01/27/scientists-open-the-black-box-of-schizophrenia-with-dramatic-genetic-finding/</a>
Chemistry Nobel for DNA repair	<a href="http://medicalxpress.com/news/2015-10-chemistry-nobel-dna-foundation-ways.html">http://medicalxpress.com/news/2015-10-chemistry-nobel-dna-foundation-ways.html</a>
Crispr-Cas9 DNA modification	<a href="http://m.phys.org/news/2015-09-scientists-human-genome.html">http://m.phys.org/news/2015-09-scientists-human-genome.html</a>
Gene editing	<a href="http://io9.com/researchers-have-just-found-a-better-way-to-edit-dna-1652828550">http://io9.com/researchers-have-just-found-a-better-way-to-edit-dna-1652828550</a>
Crispr-Cas9 & genome editing & regulation	<a href="https://www.washingtonpost.com/news/speaking-of-science/wp/2015/12/01/historic-summit-on-gene-editing-and-designer-babies-convenes-in-washington/">https://www.washingtonpost.com/news/speaking-of-science/wp/2015/12/01/historic-summit-on-gene-editing-and-designer-babies-convenes-in-washington/</a>

Technology links after September 2013	
Quick DNA information search and combination	<a href="http://spectrum.ieee.org/biomedical/diagnostics/software-helps-gene-editing-tool-crispr-live-up-to-its-hype">http://spectrum.ieee.org/biomedical/diagnostics/software-helps-gene-editing-tool-crispr-live-up-to-its-hype</a>
Quick insertion of DNA into cells	<a href="http://www.eurekalert.org/pub_releases/2016-02/miot-ndm021816.php">http://www.eurekalert.org/pub_releases/2016-02/miot-ndm021816.php</a>
Open-source code synthetic biology	<a href="http://radar.oreilly.com/2015/10/open-source-lessons-for-synthetic-biology.html">http://radar.oreilly.com/2015/10/open-source-lessons-for-synthetic-biology.html</a>
Optimisation of vectors improves the accuracy of CRISPR	<a href="http://futurism.com/new-technique-makes-crispr-gene-editing-easy-point-click/">http://futurism.com/new-technique-makes-crispr-gene-editing-easy-point-click/</a>

## Biochips or biosensors able to diagnose diseases, physiological states and genetic features of organisms cheaply and rapidly (2.02) \*\*\*\*

Biosensors are developing rapidly. In addition to detecting blood flow, new sensors and diagnostic applications have recently been developed for purposes such as the identification of predisposition to cancer; recognition of an extensive range of viruses with one test; detection of cancer from breath; and detection of suicide risk from blood. Bacteria have been modified to recognise cancer, and a drug test has been printed on paper. Extensive virus and protein mapping can be conducted using a handheld device that combines a sensitive sensor and optical analysis. Recommendation: retain or extend the heading to Affordable biochemical sensors

Technology links after September 2013	
Cancer diagnosis from breath	<a href="http://www.rdmag.com/news/2015/09/sniffing-out-cancer">http://www.rdmag.com/news/2015/09/sniffing-out-cancer</a>
Testing a large number of proteins with a handheld device	<a href="http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm">http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm</a>
Accurate graphene biosensor	<a href="http://phys.org/news/2015-06-graphene-biosensors.html">http://phys.org/news/2015-06-graphene-biosensors.html</a>
Antenna on a chip	<a href="http://www.eurekalert.org/pub_releases/2015-04/uoc-nuo040715.php">http://www.eurekalert.org/pub_releases/2015-04/uoc-nuo040715.php</a>
DNA identification software	<a href="http://www.computerworld.com/article/2854003/software-can-now-identify-dna-from-viruses-and-speed-up-diagnoses.html">http://www.computerworld.com/article/2854003/software-can-now-identify-dna-from-viruses-and-speed-up-diagnoses.html</a>
VTT's drug test printed on paper	<a href="http://www.eurekalert.org/pub_releases/2015-04/vtrc-vpa041315.php">http://www.eurekalert.org/pub_releases/2015-04/vtrc-vpa041315.php</a>
Recognition of predisposition to cancer	<a href="http://www.kauppalehti.fi/uutiset/suomalainen-innovaatio-loytaa-nobelin-osoittaman-vian/h9EcFaw6">http://www.kauppalehti.fi/uutiset/suomalainen-innovaatio-loytaa-nobelin-osoittaman-vian/h9EcFaw6</a>
Universal virus test	<a href="http://www.upi.com/Health_News/2015/09/29/New-test-detects-all-the-viruses-that-infect-people-animals/7991443551878/">http://www.upi.com/Health_News/2015/09/29/New-test-detects-all-the-viruses-that-infect-people-animals/7991443551878/</a>
DNA analyser (gene-specific)	<a href="http://www.quantumdx.com/devices.html">http://www.quantumdx.com/devices.html</a>
Blood flow sensor	<a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/flexible-sensors-measure-blood-flow-under-the-skin">http://spectrum.ieee.org/tech-talk/biomedical/devices/flexible-sensors-measure-blood-flow-under-the-skin</a>
Suicide risk blood test	<a href="http://tinyurl.com/suicidal-blood-sample">http://tinyurl.com/suicidal-blood-sample</a>
Self-recharging sensors	<a href="http://www.tivi.fi/kaikki_uutiset/asioiden+internet+kasvaa+it+sestaan+latautuvilla+antureilla/a1038634">http://www.tivi.fi/kaikki_uutiset/asioiden+internet+kasvaa+it+sestaan+latautuvilla+antureilla/a1038634</a>

Technology links after September 2013	
GMO bacterium to find cancer	<a href="http://www.aamulehti.fi/Ulkomaat/1194983145603/artikkeli/elavas-ta+bakteerista+ohjelmoitiin+syovan+etapesakkeita+elimistosta+etsiva+biosensori.html">http://www.aamulehti.fi/Ulkomaat/1194983145603/artikkeli/elavas-ta+bakteerista+ohjelmoitiin+syovan+etapesakkeita+elimistosta+etsiva+biosensori.html</a>
Hand-held biosensor	<a href="http://www.eurekalert.org/pub_releases/2016-02/uon-nrf021816.php">http://www.eurekalert.org/pub_releases/2016-02/uon-nrf021816.php</a>

### Small portable magnetic resonance imaging scanner (2.03) \*

Researchers have succeeded in demonstrating a portable MRI scanner with a cryogen-free, permanent magnet design. The device requires considerable further development. The development does not seem rapid and its significance seems low. Recommendation: incorporate in item 2.40.

Technology links after September 2013	
Portable 2D MRI scanner	<a href="http://onlinelibrary.wiley.com/doi/10.1002/mrm.25147/abstract">http://onlinelibrary.wiley.com/doi/10.1002/mrm.25147/abstract</a>

### Continuously monitored personal health (2.07) \*\*\*\*

Devices for continuous or frequent monitoring of the human physiology are developing and spreading very rapidly. For example, options available for Apple's iPhone include ultrasound, microscope, imaging head for the imaging of the retina or eardrum, ECG, and a number of other measuring devices. Some of these have already been approved by US Food and Drug Administration FDA. While some devices are intended for use by health care professionals only, most of them can be used by consumers for the monitoring of their own health. Apple has developed a system for consumers that easily transfers the results to be viewed by the attending doctor.

Rapid development has been reported in the fields of very low-cost blood count systems and microwave stethoscopy. Glucose sensors have been attached to the skin or a contact lens, and haemoglobin levels can be read from a selfie of the eyelid. A dialysis belt weighing 5 kg and increasingly advanced diagnosis wristbands are among the latest news. New tests, such as a HIV and syphilis test costing 34 dollars, are launched in the market as accessories for mobile phones.

The Tricorder X-Prize contest has progressed to the finals. The deadline has been extended to January 2017. The objective is to develop a portable device that can reliably identify the specified 16 diseases when used by a layperson. It is very likely that by 2020, many diseases and conditions can be reliably diagnosed at home by the patients themselves. Recommendation: retain or split into normal monitoring of physiological metrics and self-diagnosis.

<b>Technology links after September 2013</b>	
Bio processor from Samsung for the monitoring of physiological metrics	<a href="http://motherboard.vice.com/read/with-samsungs-bio-processor-wearable-health-tech-is-about-to-get-weird">http://motherboard.vice.com/read/with-samsungs-bio-processor-wearable-health-tech-is-about-to-get-weird</a>
Tricorder X-Prize finals	<a href="http://tricorder.xprize.org/teams">http://tricorder.xprize.org/teams</a>
Glucose sensor for the skin	<a href="http://news.bioscholar.com/2015/01/engineers-create-temporary-tattoo-painless-sugar-monitoring.html">http://news.bioscholar.com/2015/01/engineers-create-temporary-tattoo-painless-sugar-monitoring.html</a>
Ear infection imaging at home	<a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/diagnosing-ear-infections-with-a-new-smartphone-gadget-">http://spectrum.ieee.org/tech-talk/biomedical/devices/diagnosing-ear-infections-with-a-new-smartphone-gadget-</a>
Blood count (low-cost)	<a href="http://www.eurekalert.org/pub_releases/2015-10/epfd-mcb102215.php">http://www.eurekalert.org/pub_releases/2015-10/epfd-mcb102215.php</a>
Apple Healthkit	<a href="http://www.patentlyapple.com/patently-apple/2014/09/stanford-duke-prepare-major-trials-with-apples-healthkit.html">http://www.patentlyapple.com/patently-apple/2014/09/stanford-duke-prepare-major-trials-with-apples-healthkit.html</a>
Dialysis belt (5 kg)	<a href="http://io9.com/this-medical-device-is-a-major-gamechanger-for-kidney-p-1658564050">http://io9.com/this-medical-device-is-a-major-gamechanger-for-kidney-p-1658564050</a>
Needle-free blood test at pharmacy	<a href="http://www.engadget.com/2014/11/18/walgreens-blood-tests/">http://www.engadget.com/2014/11/18/walgreens-blood-tests/</a>
Quantified self test	<a href="http://www.slideshare.net/PekkoVehvilinen/pekko-vehvilinen-suomen-mitatuin-mies-radio-nova-14122014">http://www.slideshare.net/PekkoVehvilinen/pekko-vehvilinen-suomen-mitatuin-mies-radio-nova-14122014</a>
Subcutaneous chip	<a href="http://www.helsingin uutiset.fi/artikkeli/257297-tekniikka-tulee-ihon-alle-mieheen-asennettiin-siru-helsingissa">http://www.helsingin uutiset.fi/artikkeli/257297-tekniikka-tulee-ihon-alle-mieheen-asennettiin-siru-helsingissa</a>
Contact lens for glucose level measurement	<a href="http://www.engadget.com/2014/01/16/google-smart-contact-lens/">http://www.engadget.com/2014/01/16/google-smart-contact-lens/</a>
\$34 HIV&Syphilis test accessory for smartphone	<a href="http://www.extremetech.com/extreme/198945-34-accessory-detects-hiv-syphilis-and-works-with-any-smartphone">http://www.extremetech.com/extreme/198945-34-accessory-detects-hiv-syphilis-and-works-with-any-smartphone</a>
Devices for self-diagnosis	<a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/5-materials-innovations-that-will-make-new-medical-devices">http://spectrum.ieee.org/tech-talk/biomedical/devices/5-materials-innovations-that-will-make-new-medical-devices</a>
Smart spoon for Parkinson's sufferers	<a href="http://thescienceexplorer.com/brain-and-body/smart-spoon-could-change-lives-parkinson-s-sufferers">http://thescienceexplorer.com/brain-and-body/smart-spoon-could-change-lives-parkinson-s-sufferers</a>
Haemoglobin level from a selfie of the eyelid	<a href="http://www.eyenaemia.com/">http://www.eyenaemia.com/</a>
Diagnosis wristband&API	<a href="http://www.cnet.com/products/samsung-simband/">http://www.cnet.com/products/samsung-simband/</a>
Microwave stethoscopy	<a href="http://spectrum.ieee.org/biomedical/diagnostics/microwave-stethoscope-lets-physicians-peer-into-the-lungs">http://spectrum.ieee.org/biomedical/diagnostics/microwave-stethoscope-lets-physicians-peer-into-the-lungs</a>
Personal diagnosis gadget	<a href="http://www.bloomberg.com/news/videos/2015-04-02/the-star-trek-like-gadget-to-diagnose-your-health">http://www.bloomberg.com/news/videos/2015-04-02/the-star-trek-like-gadget-to-diagnose-your-health</a>
Body implants top 10	<a href="https://wtvox.com/2014/10/top-10-implantable-wearables-soon-body/">https://wtvox.com/2014/10/top-10-implantable-wearables-soon-body/</a>
Dozens of blood tests with a small gadget	<a href="http://spectrum.ieee.org/tech-talk/biomedical/diagnostics/winning-xprize-medical-gadget-could-run-hundreds-of-lab-tests-on-a-single-drop-of-blood">http://spectrum.ieee.org/tech-talk/biomedical/diagnostics/winning-xprize-medical-gadget-could-run-hundreds-of-lab-tests-on-a-single-drop-of-blood</a>
iPhone&Apple Watch digital health review	<a href="http://digiterveys.blogspot.fi/2014/09/apple-watch-ja-iphone-6.html">http://digiterveys.blogspot.fi/2014/09/apple-watch-ja-iphone-6.html</a>
A review of smartphones for personal body measurement	<a href="http://www.eurekalert.org/pub_releases/2016-02/scp-sfs020316.php">http://www.eurekalert.org/pub_releases/2016-02/scp-sfs020316.php</a>
Stethoscope connected to smartphone diagnoses lung conditions	<a href="http://www.eurekalert.org/pub_releases/2016-02/hunes022316.php">http://www.eurekalert.org/pub_releases/2016-02/hunes022316.php</a>

### **Capturing and content searching of personal life (2.16) \*\*\***

In this group, development has progressed mainly in the form of map services and social media services that capture the actions of an individual and provide an archive view to them, combining different matters. The devices referred to in this group that would continuously record sound and image and would include a search function have not substantially advanced or become more common during the review period, with the exception of car dashboard cameras. They can become more common in connection with augmented reality or robotisation. Recommendation: remove.

### **Interfaces reacting on movements (2.21) \*\*\*\***

Until recently, the quality of interfaces reacting on movements has been rather poor. However, promising new methods have been demonstrated during the review period. A ‘micro-radar’ has been integrated to the circuit level that appears to be quick and accurate in demonstrations. The detection of eye movements has also improved. Oculus has introduced handles for its virtual glasses, and Myo has introduced a wristband that recognises motional guidance and various hand movements. The augmented reality glasses of Microsoft and Magic Leap also include a movement and gesture recognition feature. As virtual glasses and augmented reality glasses become more common, gesture and movement recognition will become more important. Recommendation: retain.

<b>Technology links after September 2013</b>	
Gesture user interface – Soli	<a href="https://www.facebook.com/Vocativ/videos/1015231405155761/?fref=nf">https://www.facebook.com/Vocativ/videos/1015231405155761/?fref=nf</a>
Gesture user interface with ultrasound	<a href="http://www.cnet.com/news/elliptic-labs-ultrasonic-gestures-could-revolutionize-smartphone-interaction-next-year/">http://www.cnet.com/news/elliptic-labs-ultrasonic-gestures-could-revolutionize-smartphone-interaction-next-year/</a>
Myo movement control wristband	<a href="https://www.myo.com/">https://www.myo.com/</a>
Microradar user interface	<a href="http://m.youtube.com/watch?v=OQNiZfSsPc0">http://m.youtube.com/watch?v=OQNiZfSsPc0</a>
Eye ‘mouse’	<a href="http://www.theverge.com/2014/11/25/7279849/samsung-eyecan-plus-eye-mouse">http://www.theverge.com/2014/11/25/7279849/samsung-eyecan-plus-eye-mouse</a>

### **Thoughts monitored from brain and action based on them (2.26) \*\***

Development of sensors and more accurate understanding of the structure of the brain enable placing machines directly under the control of the brain. Robot hands have been successfully controlled by thoughts in a number of experiments. Signals measured in the brain have also been tested for controlling smart glasses. The brain has been successfully connected to another brain and thoughts have been transferred. Words have been identified in thoughts. Sensors have been developed that are glued onto the head. In addition, there are remotely read sensors that are placed inside the head and that dissolve in the body at the end of their life cycle and are removed through metabolism. Bio-

compatible graphene implants have also been studied. In addition to these, successful attempts have been made to control the brain from outside of the head using laser beams and other electromagnetic radiation. In this way, it has been possible to relieve symptoms of Parkinson’s disease, improve learning results and even influence thoughts. In the USA, DARPA has launched a project on very accurate two-way linkage of the brain to information systems. Recommendation: retain and include the bidirectional aspect – direct control by thoughts and direct control of thoughts.

Technology links after September 2013	
Direct brain connection	<a href="http://www.iflscience.com/brain/mind-meld-brains-cooperate-without-words">http://www.iflscience.com/brain/mind-meld-brains-cooperate-without-words</a>
Controlling of robot hand with thoughts	<a href="http://www.cnet.com/news/mind-controlled-prosthetic-arm-now-reality/">http://www.cnet.com/news/mind-controlled-prosthetic-arm-now-reality/</a>
Graphene implants in the brain	<a href="http://blog.hospitalclinic.org/en/2014/07/lidibaps-participa-en-el-proyecto-emblematic-graphene-flagship/">http://blog.hospitalclinic.org/en/2014/07/lidibaps-participa-en-el-proyecto-emblematic-graphene-flagship/</a>
Control by the brain	<a href="http://www.wired.com/2014/08/mind-controlled-robot">http://www.wired.com/2014/08/mind-controlled-robot</a>
Flexible, permanent EEG sensor	<a href="http://spectrum.ieee.org/tech-talk/biomedical/bionics/a-braincomputing-interface-that-lasts-for-weeks">http://spectrum.ieee.org/tech-talk/biomedical/bionics/a-braincomputing-interface-that-lasts-for-weeks</a>
Smart glasses controlled by thoughts	<a href="http://techcrunch.com/2014/07/09/forget-ok-glass-mindrdr-is-a-new-google-glass-app-that-you-control-with-your-thoughts/">http://techcrunch.com/2014/07/09/forget-ok-glass-mindrdr-is-a-new-google-glass-app-that-you-control-with-your-thoughts/</a>
Direct control by the brain	<a href="http://defensetech.org/2015/03/02/this-woman-flew-an-f-35-simulator-with-her-mind/">http://defensetech.org/2015/03/02/this-woman-flew-an-f-35-simulator-with-her-mind/</a>
Brain to brain connection	<a href="http://www.iflscience.com/brain/first-brain-brain-interface-could-revolutinize-neuroscience">http://www.iflscience.com/brain/first-brain-brain-interface-could-revolutinize-neuroscience</a>
Brain control by laser	<a href="http://www.livescience.com/49568-thirst-switched-off-brain.html">http://www.livescience.com/49568-thirst-switched-off-brain.html</a>

### Cheap Lidar (2.38) \*\*\*

Laser and spaser systems have evolved fast. They can be used for preparing a 3D model of the environment and for detecting the distance and motion speed of objects. Laser pulses can be created with simple microcircuits, and the pulses can be manipulated with nanomaterials. A laser radar no longer needs fine-mechanical moving parts. The lowest prices of laser radars are now around EUR 200. Lidar systems are an important part of robot traffic. As a result of the price decrease, Lidar systems are already in the market incorporated into high-quality robot vacuum cleaners. Lidar wavebands have become more diverse, and systems that work in difficult weather conditions are being developed. Other distance measurement methods, such as radar and infrared radar, are often used together with Lidar systems. Recommendation: retain and expand to incorporate other sensors used for measuring distance.

Technology links after September 2013	
Low-cost Lidar for braking	<a href="http://spectrum.ieee.org/cars-that-think/transportation/sensors/cheap-lidar-for-automatic-braking">http://spectrum.ieee.org/cars-that-think/transportation/sensors/cheap-lidar-for-automatic-braking</a>
Low-cost Lidar	<a href="http://pulsedlight3d.com/">http://pulsedlight3d.com/</a>
Solid State LIDAR	<a href="http://nextbigfuture.com/2015/11/low-cost-compact-solid-state-lidar.html">http://nextbigfuture.com/2015/11/low-cost-compact-solid-state-lidar.html</a>
Low-cost \$250 'solid state' LIDAR	<a href="http://spectrum.ieee.org/cars-that-think/transportation/sensors/quanergy-solid-state-lidar">http://spectrum.ieee.org/cars-that-think/transportation/sensors/quanergy-solid-state-lidar</a>
Low-cost Lidar	<a href="http://www.dragoninnovation.com/projects/32-lidar-lite-by-pulsedlight">http://www.dragoninnovation.com/projects/32-lidar-lite-by-pulsedlight</a>
OPAL lidar for difficult conditions	<a href="http://www.autonomoustuff.com/uploads/9/6/0/5/9605198/neptec_opal_whitepaper.pdf">http://www.autonomoustuff.com/uploads/9/6/0/5/9605198/neptec_opal_whitepaper.pdf</a>
Lidar vs Radar	<a href="http://spectrum.ieee.org/tech-talk/aerospace/aviation/laser-makes-more-accurate-radar-system">http://spectrum.ieee.org/tech-talk/aerospace/aviation/laser-makes-more-accurate-radar-system</a>
GPS tracking down to the centimeter	<a href="https://www.sciencedaily.com/releases/2016/02/160211111507.htm">https://www.sciencedaily.com/releases/2016/02/160211111507.htm</a>

### Lenseless camera and image construction based on data analysis (2.39) \*\*\*

By measuring the direction of radiation and using structures such as compound eyes, images can be produced without a traditional lens. This requires combining observations with computational means. With similar means, using reflected pulses of pulses that have passed through matter, computational images can be formed of objects around a corner and people or material structures behind walls. All these areas are developing rapidly, mainly at the research level. Recommendation: retain.

Technology links after September 2013	
Computational imaging	<a href="http://www.nature.com/news/optics-super-vision-1.16877">http://www.nature.com/news/optics-super-vision-1.16877</a>
Lenseless imaging	<a href="http://www.osa.org/en-us/about_osa/newsroom/news_releases/2015/pushing_the_limits_of_lensless_imaging/">http://www.osa.org/en-us/about_osa/newsroom/news_releases/2015/pushing_the_limits_of_lensless_imaging/</a>
FlatCam lenseless imaging	<a href="http://arxiv.org/pdf/1509.00116v1.pdf">http://arxiv.org/pdf/1509.00116v1.pdf</a>

### Material radar (2.40) \*\*\*\*

Using a spectrometre, it is possible to deduce the composition of a radiating or radiation-reflecting material. The least expensive material radar is SCIO, which will be launched in the market at a price of 250 dollars. The launching of SCIO has been delayed, but, according to media, one thousand development versions have been distributed and a functioning device has been demonstrated to media. In these demonstrations, the device has even been able to distinguish between an original medicine and its generic version. VTT has been developing similar circuit technology in Finland. In the infrared range, molecular identification is based on the 'fingerprint' of reflected radiation. A number of

other wave ranges are being studied. At terahertz frequencies, identification is more accurate. Now it is even possible to form an image of molecular structure. At longer distances, material radar applications are studied in Finland for military use. For example, camouflage materials stand out from the surrounding terrain. By measuring Wi-Fi frequency reflections, moving people and other objects can be followed through walls. It is even possible to measure the heart rate. Moreover, material radars can be used for examining blood and other tissue samples, replacing a number of chemical analyses with optical methods. Many tests can be performed on passing people without them noticing anything. This is a very rapidly developing domain. Recommendation: retain.

<b>Technology links after September 2013</b>	
Nanospectroscopy	<a href="http://www.nature.com/nnano/journal/vaop/ncurrent/full/nnano.2015.168.html">http://www.nature.com/nnano/journal/vaop/ncurrent/full/nnano.2015.168.html</a>
Hyperspectral camera	<a href="http://www.tiede.fi/artikkeli/uutiset/hyperspektrikamera_voi_kutistua_kannykkakokoon">http://www.tiede.fi/artikkeli/uutiset/hyperspektrikamera_voi_kutistua_kannykkakokoon</a>
SCIO material radar	<a href="http://edition.cnn.com/2014/05/02/tech/innovation/molecular-sensor-fits-in-your-hand/">http://edition.cnn.com/2014/05/02/tech/innovation/molecular-sensor-fits-in-your-hand/</a>
Material radar in Finland	<a href="http://www.tekniikkatalous.fi/innovaatiot/2015-01-09/Terrorismin-torjuntaan-lis%C3%A4%C3%A4-v%C3%A4lineit%C3%A4---Jyv%C3%A4skyl%C3%A4n-yliopisto-kaupallisti-uuden-rikostutkimenetelm%C3%A4n-3258169.html">http://www.tekniikkatalous.fi/innovaatiot/2015-01-09/Terrorismin-torjuntaan-lis%C3%A4%C3%A4-v%C3%A4lineit%C3%A4---Jyv%C3%A4skyl%C3%A4n-yliopisto-kaupallisti-uuden-rikostutkimenetelm%C3%A4n-3258169.html</a>
'Quick' NanoMRI	<a href="http://spectrum.ieee.org/nanoclast/biomedical/imaging/new-technique-brings-nanomri-a-step-closer-to-commercial-applications">http://spectrum.ieee.org/nanoclast/biomedical/imaging/new-technique-brings-nanomri-a-step-closer-to-commercial-applications</a>
Monitoring of humans (vital signs) through walls	<a href="http://newsoffice.mit.edu/2014/could-wireless-replace-wearables">http://newsoffice.mit.edu/2014/could-wireless-replace-wearables</a>
Near-real-time nanoscale 3D video	<a href="http://www.eurekalert.org/pub_releases/2015-12/miot-mcn121415.php">http://www.eurekalert.org/pub_releases/2015-12/miot-mcn121415.php</a>
Optical laboratory	<a href="http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm">http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm</a>
Nanoscale metamaterial lens	<a href="http://www.buffalo.edu/news/releases/2015/05/039.html">http://www.buffalo.edu/news/releases/2015/05/039.html</a>
Food scanner	<a href="https://www.indiegogo.com/projects/tellspec-what-s-in-your-food">https://www.indiegogo.com/projects/tellspec-what-s-in-your-food</a>
Nanometer-level imaging	<a href="http://www.eurekalert.org/pub_releases/2015-09/aiop-msi092515.php">http://www.eurekalert.org/pub_releases/2015-09/aiop-msi092515.php</a>
Comprehensive set of blood tests optically	<a href="http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm">http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm</a>

### Cheap gas sensors (2.41) \*\*\*

Gas detection has advanced moderately well. In research studies, mould spores are detected; wearable gas sensors are designed to warn about conditions dangerous to the health; the prices of gas chromatographs are coming down to an affordable level. Experiments are being made on digitalising and printing smells. An increasing number of conclusions can be made on the basis of smells. Recommendation: retain or incorporate in expanded item 2.02.

Technology links after September 2013	
Gas measurement	<a href="http://www.tekniikkatalous.fi/innovaatiot/huumeongelmaan-keksittiin-suomalainen-ratkaisu-kayttoon-2019-3481908">http://www.tekniikkatalous.fi/innovaatiot/huumeongelmaan-keksittiin-suomalainen-ratkaisu-kayttoon-2019-3481908</a>
Gas sensors in clothes	<a href="http://www.smithsonianmag.com/innovation/thin-sensors-on-our-skin-in-our-clothes-may-warn-us-environmental-hazards-180956127">http://www.smithsonianmag.com/innovation/thin-sensors-on-our-skin-in-our-clothes-may-warn-us-environmental-hazards-180956127</a>
Smell digitalisation and printing	<a href="http://themindunleashed.org/2014/06/first-scent-message-transmitted-across-the-atlantic-via-the-internet.html">http://themindunleashed.org/2014/06/first-scent-message-transmitted-across-the-atlantic-via-the-internet.html</a>
Small gas chromatograph	<a href="http://www.eurekalert.org/pub_releases/2015-04/vt-ntp041315.php">http://www.eurekalert.org/pub_releases/2015-04/vt-ntp041315.php</a>
Recognition of mold spores	<a href="http://www.tekniikkatalous.fi/innovaatiot/tama+tulee+tarpeeseen+suomessa+kehitettiin+uusi+menetelma+homevaurioiden+tuennistamiseen/a1062992">http://www.tekniikkatalous.fi/innovaatiot/tama+tulee+tarpeeseen+suomessa+kehitettiin+uusi+menetelma+homevaurioiden+tuennistamiseen/a1062992</a>
Scents digitalised and reproduced	<a href="http://themindunleashed.org/2014/06/first-scent-message-transmitted-across-the-atlantic-via-the-internet.html">http://themindunleashed.org/2014/06/first-scent-message-transmitted-across-the-atlantic-via-the-internet.html</a>
Artificial nose smells cancer	<a href="http://utain.uta.fi/uutiset/keinonen%C3%A4-haistaa-sy%C3%B6n%C3%A4n-virtsasta">http://utain.uta.fi/uutiset/keinonen%C3%A4-haistaa-sy%C3%B6n%C3%A4n-virtsasta</a>
Accurate NO <sub>2</sub> detection with graphene oxid	<a href="http://pubs.rsc.org/en/Content/ArticleLanding/2014/NR/c4nr00332b">http://pubs.rsc.org/en/Content/ArticleLanding/2014/NR/c4nr00332b</a>

### Very sensitive camera sensors based on nanocarbons (2.42) \*\*

Nanocarbon-based optics have progressed, but no substantial breakthrough in camera cells at light wavelengths can be seen in near future. Recommendation: remove.

Technology links after September 2013	
Image cells in quick development	<a href="http://www.eetimes.com/document.asp?doc_id=1325655">http://www.eetimes.com/document.asp?doc_id=1325655</a>

### Printed cheap biosensors (2.43) \*\*\*\*

Sensors and electronics have been printed on paper using inkjet technology. Many graphene-based sensors are also becoming very affordable. Recommendation: incorporate in expanded item 2.02.

Technology links after September 2013	
Inkjet-printed flexible electronics	<a href="http://www.eurekalert.org/pub_releases/2015-04/pu-ilm040815.php">http://www.eurekalert.org/pub_releases/2015-04/pu-ilm040815.php</a>
Roll-to-roll electronics evolve	<a href="http://spectrum.ieee.org/tech-talk/semiconductors/materials/roll-to-roll-electronics-manufacturing-rolls-on">http://spectrum.ieee.org/tech-talk/semiconductors/materials/roll-to-roll-electronics-manufacturing-rolls-on</a>
Graphene biosensor	<a href="http://www.upenn.edu/pennnews/current/2015-01-15/latest-news/new-graphene-based-biosensor-triple-threat">http://www.upenn.edu/pennnews/current/2015-01-15/latest-news/new-graphene-based-biosensor-triple-threat</a>
Microcircuit on nanocellulose paper	<a href="http://spectrum.ieee.org/tech-talk/consumer-electronics/portable-devices/green-microchips-created-on-cellulose-nanofibril-paper">http://spectrum.ieee.org/tech-talk/consumer-electronics/portable-devices/green-microchips-created-on-cellulose-nanofibril-paper</a>

### Graphene-based terahertz devices (2.44) \*\*\*

Terahertz waves can now be manipulated and analysed. Research data has increased rapidly, and practical applications are expanding. There are already stores specialising in terahertz-based devices. The THz-waveband enables relatively accurate radar images regardless of snow or rain. Nano-level laser can be tuned to terahertz-range wavelengths. In spectroscopy, terahertz-range analysis is considerably more detailed compared with the infrared range. With terahertz waves, the speed of wireless communication can be increased by many orders of magnitude compared with the Wi-Fi range. Recommendation: expand the heading to manipulation of terahertz waves.

Technology links after September 2013	
THz equipment store opened	<a href="http://www.prweb.com/releases/terahertz/032014/prweb11686016.htm">http://www.prweb.com/releases/terahertz/032014/prweb11686016.htm</a>
THz-amplifier	<a href="http://spectrum.ieee.org/tech-talk/telecom/wireless/darpa-builds-first-terahertz-amplifier">http://spectrum.ieee.org/tech-talk/telecom/wireless/darpa-builds-first-terahertz-amplifier</a>
THz-IR with graphene plasmonics	<a href="http://pubs.acs.org/doi/abs/10.1021/nn406627u">http://pubs.acs.org/doi/abs/10.1021/nn406627u</a>
THz laser with graphene in a magnetic field	<a href="http://phys.org/news/2014-11-magnetic-fields-lasers-elicite-graphene.html">http://phys.org/news/2014-11-magnetic-fields-lasers-elicite-graphene.html</a>
THz imaging	<a href="http://www.eurekalert.org/pub_releases/2015-08/ef-icf080615.php">http://www.eurekalert.org/pub_releases/2015-08/ef-icf080615.php</a>
Capture of terahertz rays with graphene	<a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/graphene-offers-a-better-way-to-capture-trays">http://spectrum.ieee.org/tech-talk/biomedical/devices/graphene-offers-a-better-way-to-capture-trays</a>
THz store	<a href="http://www.prweb.com/releases/terahertz/032014/prweb11686016.htm">http://www.prweb.com/releases/terahertz/032014/prweb11686016.htm</a>
THz in spectroscopy	<a href="http://www.photonics.com/Article.aspx?AID=56212">http://www.photonics.com/Article.aspx?AID=56212</a>
Tunable nanolaser & THz	<a href="http://www.nature.com/ncomms/2015/150420/ncomms7939/full/ncomms7939.html">http://www.nature.com/ncomms/2015/150420/ncomms7939/full/ncomms7939.html</a>

### Nanoradio (2.95) \*

There are no observations of development in this field, but some energy issues related to sensors fitted inside blood vessels and cells has been resolved. According to research data, the minimum size of radio transmitters with a signal that can be heard through the human body is now 1mmx1mmx10mm. Recommendation: incorporate in item 2.05.

Technology links after September 2013	
Injectable-size interbody radio transmitter	<a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/injectable-radios-to-broadcast-from-inside-the-body">http://spectrum.ieee.org/tech-talk/biomedical/devices/injectable-radios-to-broadcast-from-inside-the-body</a>

### LED-"radio" (2.96) \*

LED technology suitable for wireless interroom communication is called LiFi connection. The theoretical speed is 10,000 times the speed of a WiFi connection. Researchers have achieved a speed of 224 Gbps. The suitability of the LiFi connection for identification has also been studied. The annual growth of the LiFi market is expected at nearly 100%, reaching six billion dollars by 2018. The first LiFi product, Li-1st, was introduced in 2014. Recommendation: retain, change the name to LiFi networks.

Technology links after September 2013	
LIFI 100Gbit/s	<a href="http://spectrum.ieee.org/tech-talk/semiconductors/optoelectronics/laser-lifi-could-blast-100-gigabits-per-second">http://spectrum.ieee.org/tech-talk/semiconductors/optoelectronics/laser-lifi-could-blast-100-gigabits-per-second</a>
LIFI achieves 224-Gbps data transmission speed	<a href="http://www.electronics-eetimes.com/en/li-fi-achieves-224-gbps-data-transmission-speeds-with-room-scale-coverage.html?cmp_id=7&amp;news_id=222923915">http://www.electronics-eetimes.com/en/li-fi-achieves-224-gbps-data-transmission-speeds-with-room-scale-coverage.html?cmp_id=7&amp;news_id=222923915</a>
LiFi identification, etc.	<a href="http://spectrum.ieee.org/tech-talk/telecom/wireless/fujitsu-forges-lifilike-qr-code">http://spectrum.ieee.org/tech-talk/telecom/wireless/fujitsu-forges-lifilike-qr-code</a>
Photonics modem (NASA)	<a href="http://www.kurzweilai.net/nasa-engineers-to-build-first-integrated-photonics-modem">http://www.kurzweilai.net/nasa-engineers-to-build-first-integrated-photonics-modem</a>

### Wireless transmission 2.5 terabytes per second (vortex beam) (2.97) \*\*\*

Optical Vortex is a demonstrated phenomenon. This phenomenon is used for purposes such as identifying planets in foreign solar systems. However, use of the phenomenon for improving the speed of telecommunications has proved challenging, due to its difficult controllability. Therefore, applications cannot be expected in near future. Recommendation: remove.

Technology links after September 2013	
Vortex beam and quantum entanglement	<a href="http://spectrum.ieee.org/telecom/security/two-steps-closer-to-a-quantum-internet">http://spectrum.ieee.org/telecom/security/two-steps-closer-to-a-quantum-internet</a>
Doubling of speed on the radio path	<a href="http://www.technologyreview.com/news/532616/simple-circuit-could-double-cell-phone-data-speeds/">http://www.technologyreview.com/news/532616/simple-circuit-could-double-cell-phone-data-speeds/</a>
Transmission speed 1 Tb/s	<a href="http://www.scienceworldreport.com/articles/14261/20140425/using-light-and-microresonators-for-ultra-fast-data-transmission.htm">http://www.scienceworldreport.com/articles/14261/20140425/using-light-and-microresonators-for-ultra-fast-data-transmission.htm</a>

## Multi-channel communication and software-based controlling of information networks (2.98) \*\*

So far, multi-channel communication has not become more common. Controlling of information networks has progressed quickly and is already mainly software-based. Recommendation: remove.

## (new) Optics (2.300)

Optics is a very rapidly developing area. This is a general code related to the topic, including a collection of recent examples without a particular theme: Transparent (clear) aluminum developed, considerably harder than glass; femtosecond lasers have evolved quickly in different wavebands and in nanoscale (spaser); nanoscale optical switches, optical diodes and transistors have been developed. White-blue quantum dot leds have been produced; a paper-thin lamp has been printed out; millimetre-size microwave laser has been developed; miniaturised particle accelerator has been developed; black material with 0.035% reflectivity has been produced; artificial daylight has become realistic; photonic link for silicon-based processor has been produced; SPAD camera can see around the corner; WLAN signal to be visualised; optically active thin sheet to be produced using perovskite. Recommendation: analyse the group in more detail and identify trends with important effects to form a new group or several groups.

Technology links after September 2013	
White laser with QDs	<a href="http://spectrum.ieee.org/tech-talk/semiconductors/devices/the-first-white-laser">http://spectrum.ieee.org/tech-talk/semiconductors/devices/the-first-white-laser</a>
Photonic link with processor	<a href="http://www.eurekalert.org/pub_releases/2015-12/uoc--edf121815.php">http://www.eurekalert.org/pub_releases/2015-12/uoc--edf121815.php</a>
Femtosecond lasers for network analysis	<a href="http://spectrum.ieee.org/tech-talk/at-work/test-and-measurement/femtosecond-lasers-drive-a-new-generation-of-network-vector-analyzers">http://spectrum.ieee.org/tech-talk/at-work/test-and-measurement/femtosecond-lasers-drive-a-new-generation-of-network-vector-analyzers</a>
Small and fast optical modulator	<a href="http://www.eurekalert.org/pub_releases/2015-07/ez-sfc072715.php">http://www.eurekalert.org/pub_releases/2015-07/ez-sfc072715.php</a>
Nanoscale optical switch	<a href="http://www.eurekalert.org/pub_releases/2015-10/lmsu-tw102715.php">http://www.eurekalert.org/pub_releases/2015-10/lmsu-tw102715.php</a>
Black material 0.035% Vantablack	<a href="http://www.independent.co.uk/news/science/blackest-is-the-new-black-scientists-have-developed-a-material-so-dark-that-you-cant-see-it-9602504.html">http://www.independent.co.uk/news/science/blackest-is-the-new-black-scientists-have-developed-a-material-so-dark-that-you-cant-see-it-9602504.html</a>

<b>Technology links after September 2013</b>	
Perovskite transistor	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/for-first-time-researchers-fabricate-a-transistor-out-of-perovskite">http://spectrum.ieee.org/nanoclast/semiconductors/materials/for-first-time-researchers-fabricate-a-transistor-out-of-perovskite</a>
Perovskite thin sheet	<a href="http://www.eurekalert.org/pub_releases/2015-09/dbnl-adt092515.php">http://www.eurekalert.org/pub_releases/2015-09/dbnl-adt092515.php</a>
SPAD camera that sees around the corner	<a href="http://spectrum.ieee.org/tech-talk/semiconductors/optoelectronics/camera-that-tracks-hidden-moving-objects-could-aid-rescue-missions-and-avoid-vehicle-collisions">http://spectrum.ieee.org/tech-talk/semiconductors/optoelectronics/camera-that-tracks-hidden-moving-objects-could-aid-rescue-missions-and-avoid-vehicle-collisions</a>
Visualisation of WLAN signal	<a href="http://www.theverge.com/2015/11/28/9811910/augmented-reality-app-lets-you-see-wireless-signals">http://www.theverge.com/2015/11/28/9811910/augmented-reality-app-lets-you-see-wireless-signals</a>
Nanoscale light resonator	<a href="http://www.eurekalert.org/pub_releases/2015-07/uow-nld071315.php">http://www.eurekalert.org/pub_releases/2015-07/uow-nld071315.php</a>
Transparent electromagnetic absorber	<a href="http://www.eurekalert.org/pub_releases/2015-07/aurdt072015.php">http://www.eurekalert.org/pub_releases/2015-07/aurdt072015.php</a>
Quantum dot-based white-blue LED	<a href="http://www.eurekalert.org/pub_releases/2015-06/hu-niu060515.php">http://www.eurekalert.org/pub_releases/2015-06/hu-niu060515.php</a>
Nanoscale diode, transistor	<a href="http://www.eurekalert.org/pub_releases/2015-07/dbnl-mth072915.php">http://www.eurekalert.org/pub_releases/2015-07/dbnl-mth072915.php</a>
Low-cost femtosecond laser	<a href="http://www.eurekalert.org/pub_releases/2015-08/fopu-sia082015.php">http://www.eurekalert.org/pub_releases/2015-08/fopu-sia082015.php</a>
Nanometre-level graphene lens	<a href="http://www.gizmag.com/optical-lens-one-billionth-meter-thick/41588/">http://www.gizmag.com/optical-lens-one-billionth-meter-thick/41588/</a>
Photonic molecules	<a href="http://phys.org/news/2013-09-scientists-never-before-seen.html">http://phys.org/news/2013-09-scientists-never-before-seen.html</a>
Risks of LED lights	<a href="http://www.iltasanomat.fi/asuminen/art-1419908515249.html">http://www.iltasanomat.fi/asuminen/art-1419908515249.html</a>
Small efficient accelerator	<a href="http://phys.org/news/2014-12-world-compact-tabletop-particle.html">http://phys.org/news/2014-12-world-compact-tabletop-particle.html</a>
Miniaturised particle accelerator	<a href="http://phys.org/news/2013-09-chip.html">http://phys.org/news/2013-09-chip.html</a>
Simulated daylight	<a href="http://www.coelux.com/">http://www.coelux.com/</a>
Smartphone & \$2 lens as microscope	<a href="http://www.3ders.org/articles/20140427-make-your-own-3d-printed-microscopes-for-as-little-as-2-dolloar.html">http://www.3ders.org/articles/20140427-make-your-own-3d-printed-microscopes-for-as-little-as-2-dolloar.html</a>
Millimetre-scale microwave laser	<a href="http://www.natureworldnews.com/articles/12016/20150116/rice-sized-laser-leads-the-way-in-quantum-computing.htm">http://www.natureworldnews.com/articles/12016/20150116/rice-sized-laser-leads-the-way-in-quantum-computing.htm</a>
Transparent aluminium	<a href="http://www.nrl.navy.mil/media/news-releases/2015/transparent-armor-from-nrl-spinel-could-also-ruggedize-your-smart-phone">http://www.nrl.navy.mil/media/news-releases/2015/transparent-armor-from-nrl-spinel-could-also-ruggedize-your-smart-phone</a>
Single-atom optical switch fabricated	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/optoelectronics/worlds-first-singleatom-optical-switch-fabricated">http://spectrum.ieee.org/nanoclast/semiconductors/optoelectronics/worlds-first-singleatom-optical-switch-fabricated</a>
Graphene nanolaser (spaser)	<a href="http://www.extremetech.com/extreme/180728-graphene-spaser-brings-optical-computing-to-the-nano-scale">http://www.extremetech.com/extreme/180728-graphene-spaser-brings-optical-computing-to-the-nano-scale</a>
Printable lightpaper	<a href="http://www.fastcompany.com/3038890/rohinnis-lightpaper-is-incredibly-thin-and-printable">http://www.fastcompany.com/3038890/rohinnis-lightpaper-is-incredibly-thin-and-printable</a>
Copper nanophotonics	<a href="http://www.eurekalert.org/pub_releases/2016-02/miop-ppa022516.php">http://www.eurekalert.org/pub_releases/2016-02/miop-ppa022516.php</a>
Ultrafast microscope for atom-level imaging	<a href="http://www.colorado.edu/news/releases/2016/02/16/ultrafast-microscope-used-make-slow-motion-electron-movie">http://www.colorado.edu/news/releases/2016/02/16/ultrafast-microscope-used-make-slow-motion-electron-movie</a>

## 7.2 Artificial intelligence (AI) and algorithmic reasoning

Artificial intelligence (AI) and algorithmic reasoning are evolving rapidly. As a result of this development, increasingly many data processing tasks can be automated. On one hand, this leads to leaderless organisations, on the other hand, bureaucracy becomes even more complicated. The development of artificial intelligence now focuses on learning. This means that machines will no longer solve problems that are programmed for it in advance. Instead, they can learn from the situations they encounter and progress towards new solutions like researchers do. For example, in demonstrations, artificial intelligence can detect diseases in people, play videogames it has never played before, identify content in pictures, solve middle school-level mathematical problems and even find scientific breakthroughs.

Many platforms have already been introduced that promote the development of AI applications. When any of these platforms becomes widespread, applications and devices developed on that platform can exchange their competencies. This means that if a robot detects and resolves a problem, it can share this information with other machines that use the same platform.

Thus, the effects of artificial intelligence are not limited to immaterial data processing. With the help of AI, robots and many other devices operated by people can recognise their environment and learn to perform tasks. This development is expected to have a very significant effect on current jobs and even the structures of society. The use of AI for military technology is consciously being restricted. Machines that can independently make decisions to kill people would change the character of war in an unpredictable manner.

Technological development after the publication of the TuV9/2013 report and needs for improvement related to reporting:

### Human recognition systems (2.14) \*\*\*

Human recognition technology has developed rapidly. Affordable DNA sequencers are being commercialised. Craig Venter has demonstrated an application that produces a recognisable facial image on the basis of human DNA sequence. Facebook and many other applications identify a person from a facial photo even if the photo of comparison was captured from a different angle. Recommendation: retain.

Technology links after September 2013	
Facebook recognises facial photos from different angles	<a href="http://money.cnn.com/2014/04/04/technology/innovation/facebook-facial-recognition/">http://money.cnn.com/2014/04/04/technology/innovation/facebook-facial-recognition/</a>
Facial image from DNA, Venter	<a href="https://www.youtube.com/watch?v=4ywJThNbfYk">https://www.youtube.com/watch?v=4ywJThNbfYk</a>
Facial image from DNA	<a href="https://www.newscientist.com/article/mg22129613.600-genetic-mugshot-recreates-faces-from-nothing-but-dna">https://www.newscientist.com/article/mg22129613.600-genetic-mugshot-recreates-faces-from-nothing-but-dna</a>

Technology links after September 2013	
Facial recognition from DNA (Penn University)	<a href="http://www.iflscience.com/health-and-medicine/forensic-scientists-build-crude-3d-mugshots-dna">http://www.iflscience.com/health-and-medicine/forensic-scientists-build-crude-3d-mugshots-dna</a>
FB facial recognition improved	<a href="http://money.cnn.com/2014/04/04/technology/innovation/face-book-facial-recognition/">http://money.cnn.com/2014/04/04/technology/innovation/face-book-facial-recognition/</a>

### Emotion management in robots and automatic recognition of emotions (2.15) \*\*\*

Human emotions can increasingly often be recognised from the face. For example, using detection of emotions and facial features, a speech given by George W. Bush has been demonstrated as an animation on the faces of different public figures. In near future, this may enable choosing your own acquaintances or any public figure to play roles in a movie. The recognition of emotions is a very useful feature for robots and automated services, as this helps to take into account human responses. Animated emotional faces are also experimented on robots and AI services. Recommendation: retain or incorporate in item 2.14.

Technology links after September 2013	
Machine that recognises emotions	<a href="http://nemohanke.blogspot.fi/2015/06/kone-tietaa-tunteesi.html">http://nemohanke.blogspot.fi/2015/06/kone-tietaa-tunteesi.html</a>
Pepper, the robot that recognises emotions	<a href="http://edition.cnn.com/2014/06/06/tech/innovation/pepper-robot-emotions/">http://edition.cnn.com/2014/06/06/tech/innovation/pepper-robot-emotions/</a>
Facial animation	<a href="http://www.indiegogo.com/projects/facerig">http://www.indiegogo.com/projects/facerig</a>
Realistic facial animation	<a href="http://www.universityherald.com/articles/26929/20151209/tom-hanks-face-the-subject-of-digital-puppet-technology.htm">http://www.universityherald.com/articles/26929/20151209/tom-hanks-face-the-subject-of-digital-puppet-technology.htm</a>
Android reads the news	<a href="https://www.youtube.com/watch?v=Wyl72Re5110">https://www.youtube.com/watch?v=Wyl72Re5110</a>

### Automatic speech recognition and translation (2.17) \*\*\*

Microsoft has included simultaneous interpretation in its free-of-charge videophone application, Skype. In the test version, the supported languages are English, Spanish, Italian and Chinese. The simultaneous interpretation application is based on a learning algorithm, and Microsoft believes that its quality will improve along with increasing use. In text-based communication, Microsoft supports translation between 50 different languages. Other companies are also including an increasing number of speech recognition and translation applications in their cloud services and smartphones. There are many paid speech recognition applications available, and the best of them exceed 95% accuracy. Speech recognition and translation are closely related to human recognition and structuring of meanings through frames of reference. The application domains range from communication of people speaking different languages to communication between humans and machines. The areas of application expand as robotisation and automated services become more common and the quality of translation software improves.

Recommendation: retain, but change as follows: speech recognition, speech synthesis and translation.

Technology links after September 2013	
Simultaneous interpretation in Skype	<a href="http://www.dailymail.co.uk/sciencetech/article-2641653/Dont-bother-learning-foreign-language-Skype-soon-let-translate-spoken-foreign-words-real-time.html">http://www.dailymail.co.uk/sciencetech/article-2641653/Dont-bother-learning-foreign-language-Skype-soon-let-translate-spoken-foreign-words-real-time.html</a>
Speech recognition top ten 2016	<a href="http://voice-recognition-software-review.toptenreviews.com/">http://voice-recognition-software-review.toptenreviews.com/</a>
Robotised telephone service Nuance	<a href="http://www.nuance.com/for-business/customer-service-solutions/loquendo-small-business-bundle/index.htm">http://www.nuance.com/for-business/customer-service-solutions/loquendo-small-business-bundle/index.htm</a>
Simultaneous interpretation in Skype	<a href="http://www.theverge.com/2014/12/15/7393665/skype-translator-features">http://www.theverge.com/2014/12/15/7393665/skype-translator-features</a>

### Pattern recognition and pattern search services (2.30) \*\*\*

Pattern recognition as algorithms and learning AI systems has increased rapidly. In research studies, psychosis has been identified from speech, cancer has been optically detected by a computer, and a stroke has been anticipated from signals measured from the body. Smartphone detects early symptoms of Parkinson’s, thoughts can be converted into words and a robot cook imitates cooking shows it has seen on TV. A number of open source code-based learning platforms for pattern recognition are available today. The development is now very rapid, speeded up by relatively recent breakthroughs. Recommendation: retain pattern recognition platforms, consider merging the most important application domains or incorporating them in new categories.

Technology links after September 2013	
AI, Google deep learning	<a href="https://medium.com/backchannel/google-search-will-be-your-next-brain-5207c26e4523">https://medium.com/backchannel/google-search-will-be-your-next-brain-5207c26e4523</a>
Stroke anticipation	<a href="http://www.cnet.com/news/samsung-prototypes-brainwave-reading-wearable-stroke-detector/">http://www.cnet.com/news/samsung-prototypes-brainwave-reading-wearable-stroke-detector/</a>
Deep learning AI	<a href="http://www.ted.com/talks/jeremy_howard_the_wonderful_and_terrifying_implications_of_computers_that_can_learn">http://www.ted.com/talks/jeremy_howard_the_wonderful_and_terrifying_implications_of_computers_that_can_learn</a>
AI learns to cook from video	<a href="http://www.hs.fi/tiede/a1305914088246?jako=df300339f3cd69f898d367d247fe73ac&amp;ref=fb-share">http://www.hs.fi/tiede/a1305914088246?jako=df300339f3cd69f898d367d247fe73ac&amp;ref=fb-share</a>
Image recognition into text	<a href="http://deeplearning.cs.toronto.edu/i2t">http://deeplearning.cs.toronto.edu/i2t</a>
Optical cancer detection	<a href="http://info.adimec.com/blogposts/interview-with-fabrice-harms-at-lltech-about-high-full-well-capacity-camera-for-non-invasive-cancer-assessment-ffoct-systems">http://info.adimec.com/blogposts/interview-with-fabrice-harms-at-lltech-about-high-full-well-capacity-camera-for-non-invasive-cancer-assessment-ffoct-systems</a>
PV calculator from satellite image	<a href="http://www.iflscience.com/technology/should-you-get-solar-panels-ask-google">http://www.iflscience.com/technology/should-you-get-solar-panels-ask-google</a>
AI learning to play unfamiliar video games	<a href="http://www.bloomberg.com/news/articles/2015-02-25/google-s-computers-learn-to-play-video-games-by-themselves">http://www.bloomberg.com/news/articles/2015-02-25/google-s-computers-learn-to-play-video-games-by-themselves</a>

Technology links after September 2013	
Psychosis detection from speech	<a href="http://medicalxpress.com/news/2015-08-psychosis-automated-speech-analysis.html">http://medicalxpress.com/news/2015-08-psychosis-automated-speech-analysis.html</a>
Diagnostic mirror	<a href="http://www.smithsonianmag.com/innovation/look-into-this-smart-mirror-and-you-get-a-one-minute-medical-checkup-180956367/">http://www.smithsonianmag.com/innovation/look-into-this-smart-mirror-and-you-get-a-one-minute-medical-checkup-180956367/</a> - RzcrJM3cvh2IZBMQ.99
Thoughts converted into words	<a href="http://www.telegraph.co.uk/science/science-news/7987821/Mind-reading-machine-can-convert-thoughts-into-speech.html">http://www.telegraph.co.uk/science/science-news/7987821/Mind-reading-machine-can-convert-thoughts-into-speech.html</a>
Bioimage informatics	<a href="https://www.doria.fi/handle/10024/97260">https://www.doria.fi/handle/10024/97260</a>
Breakthrough of machine vision	<a href="http://www.technologyreview.com/view/530561/the-revolutionary-technique-that-quietly-changed-machine-vision-forever/">http://www.technologyreview.com/view/530561/the-revolutionary-technique-that-quietly-changed-machine-vision-forever/</a>
Words read from thoughts	<a href="http://www.newscientist.com/article/mg22429934.000-brain-decoder-can-eavesdrop-on-your-inner-voice.html">http://www.newscientist.com/article/mg22429934.000-brain-decoder-can-eavesdrop-on-your-inner-voice.html</a>
Smartphone detects Parkinson's disease	<a href="http://www.ft.com/intl/cms/s/0/cb6ec31a-376b-11e4-971c-00144feabdc0.html">http://www.ft.com/intl/cms/s/0/cb6ec31a-376b-11e4-971c-00144feabdc0.html</a>
Deep learning models	<a href="http://papers.nips.cc/paper/5947-semi-supervised-learning-with-ladder-networks.pdf">http://papers.nips.cc/paper/5947-semi-supervised-learning-with-ladder-networks.pdf</a>
DR Watson	<a href="http://www.businessinsider.com/ibms-watson-may-soon-be-the-best-doctor-in-the-world-2014-4">http://www.businessinsider.com/ibms-watson-may-soon-be-the-best-doctor-in-the-world-2014-4</a>
AI looks for hidden cancer links in patient records	<a href="https://www.newscientist.com/article/2078159-ai-reads-doctors-notes-to-find-hidden-links-in-cancer-cases/">https://www.newscientist.com/article/2078159-ai-reads-doctors-notes-to-find-hidden-links-in-cancer-cases/</a>

### Self-organising virtual world from the 3D data of the Internet (2.33) \*

The information network can offer increasingly detailed pictures from different parts of the world. However, for the time being, no rapid development can be seen towards self-organising virtual world produced in a decentralised manner. It is expected that people, mobile robots and an increasing number of satellites will produce continuously changing image material from all inhabited corners of the world. Currently, however, it seems probable that an accurate 3D model of the world with real-time situations will be produced centrally, mainly through the needs and abilities of robot traffic. Recommendation: incorporate in item 2.32.

Technology links after September 2013	
All of Denmark in Minecraft	<a href="http://www.uusisuomi.fi/tiede-ja-ymparisto/68522-tanskan-valtion-huikkea-tempu-koko-maa-minecrafttiin-11-koossa">http://www.uusisuomi.fi/tiede-ja-ymparisto/68522-tanskan-valtion-huikkea-tempu-koko-maa-minecrafttiin-11-koossa</a>
Daily global picture	<a href="http://www.avaruus.fi/uutiset/maa-ja-lahiavaruus/maapallosta-julkaistaan-nyt-aidonvarinen-kokonaiskuva-paivittain.html">http://www.avaruus.fi/uutiset/maa-ja-lahiavaruus/maapallosta-julkaistaan-nyt-aidonvarinen-kokonaiskuva-paivittain.html</a>

### **Predictive analytics based on self-organising data (2.34) \*\***

The concept of self-organising data, or self-organising maps (SOM) was originally developed in Finland. It received extensive support in academic circles, and algorithms based on SOM have been used for a long time for the analysis of large data masses and for finding anomalies in fields such as financing. However, SOM is not rapidly spreading, and as regards self-organising data, learning and evolutive systems are quickly taking over. Recommendation: remove.

### **Simulation and mapping of brain (2.36) \*\*\***

Significant new details of the brain’s memory mechanism have been identified. Part of the brain of a rat has been mapped and the most important functional mechanisms have been simulated. The mapping of the human brain is progressing rapidly. Qualcomm, IBM and Intel each are developing processors and memories that efficiently imitate the functional mechanisms of the brain. Recommendation: incorporate brain-like information technology in associative memory and modelling of the brain in item 2.26, Thoughts monitored from brain and action based on them. Remove this item.

<b>Technology links after September 2013</b>	
Revealing the memory structures of the brain	<a href="http://gizmodo.com/our-brains-can-store-10-times-more-information-than-we-1754255335">http://gizmodo.com/our-brains-can-store-10-times-more-information-than-we-1754255335</a>
Digital neuron interface in the pipeline (DARPA)	<a href="http://www.darpa.mil/news-events/2015-01-19">http://www.darpa.mil/news-events/2015-01-19</a>
Functional mechanism of memory	<a href="http://phys.org/news/2015-10-biochemists-uncover-cellular-memory-mechanism.html">http://phys.org/news/2015-10-biochemists-uncover-cellular-memory-mechanism.html</a>
Modelling/printing of the brain	<a href="http://www.theguardian.com/science/neurophilosophy/2015/aug/12/3d-printed-brain-tissue">http://www.theguardian.com/science/neurophilosophy/2015/aug/12/3d-printed-brain-tissue</a>
Emulation of brain (IBM)	<a href="http://www.youtube.com/watch?v=tqeINGOzIZo">http://www.youtube.com/watch?v=tqeINGOzIZo</a>
Neuroprocessors	<a href="http://readwrite.com/2013/10/25/neural-processing-unit">http://readwrite.com/2013/10/25/neural-processing-unit</a>
Circuit imitates the brain	<a href="http://www.cnet.com.au/brain-inspired-circuit-board-9000-times-faster-than-an-average-pc-339347168.htm">http://www.cnet.com.au/brain-inspired-circuit-board-9000-times-faster-than-an-average-pc-339347168.htm</a>
Simulation of rat brain	<a href="http://www.nytimes.com/2015/10/09/science/rat-brain-digital-reconstruction-human-brain-project.html?_r=0">http://www.nytimes.com/2015/10/09/science/rat-brain-digital-reconstruction-human-brain-project.html?_r=0</a>
Talent from brain damage	<a href="http://www.hs.fi/ulkomaat/Baaritappelussa+mukiloidusta+miehest%C3%A4+tuli+nero++matkusti+tutkimuksiin+Suomeen/a1399515817870">http://www.hs.fi/ulkomaat/Baaritappelussa+mukiloidusta+miehest%C3%A4+tuli+nero++matkusti+tutkimuksiin+Suomeen/a1399515817870</a>

### **Verbot – communicative and literary robots (new) (2.113)**

Digital helpers have been a topic of discussion for a long time. Amazon’s Echo is a household appliance that can order pizza or a taxi and perform other tasks requested by the speaker. Moreover, speaking and writing robots edit news, write articles and operate

switchboards. The skills and uses of interactive applications and robots are expanding quickly. Recommendation: new category

Technology links after September 2013	
Financial news robot	<a href="http://www.theverge.com/2015/1/29/7939067/ap-journalism-automation-robots-financial-reporting">http://www.theverge.com/2015/1/29/7939067/ap-journalism-automation-robots-financial-reporting</a>
Chat bots	<a href="http://www.bbc.com/future/story/20140609-how-online-bots-are-tricking-you">http://www.bbc.com/future/story/20140609-how-online-bots-are-tricking-you</a>
Robot writing news for LA Times	<a href="http://www.bbc.com/news/technology-26614051">http://www.bbc.com/news/technology-26614051</a>
Digital helper that understand speech	<a href="http://time.com/4209859/amazon-echo-new-features-2016/">http://time.com/4209859/amazon-echo-new-features-2016/</a>
Virtual character relieves depression	<a href="http://www.tiede.fi/artikkeli/uutiset/masennus_lievenee_virtuaalialihahmon_avulla">http://www.tiede.fi/artikkeli/uutiset/masennus_lievenee_virtuaalialihahmon_avulla</a>
MS Verbot experiment in China	<a href="http://uk.businessinsider.com/microsoft-xiaoice-turing-test-in-china-2016-2">http://uk.businessinsider.com/microsoft-xiaoice-turing-test-in-china-2016-2</a>

### Artificial general intelligence (new) (2.600)

Artificial intelligence is spreading on a broad front, and startup financing is rapidly increasing. Researchers are increasingly providing new examples of artificial intelligence that is capable of learning and can manage in uncertain situations. A computer can play poker at professional level, solve previously unsolved scientific problems and recognise what is happening in a photograph. Amazon is testing a household device that is capable of interaction through speech and for which others can develop applications as well. The probably most important development is the emergence of new platforms for AI, through which new application domains can be quickly adopted by AI. These include platforms such as IBM’s Watson and Google’s Deep Mind. Some of the platforms that may have required considerable effort have been open-sourced. Learning AI methods have been developed; one of the emerging methods is Deep Learning Recommendation: this item should be structured better and at least two topics to be monitored should be created.

Technology links after September 2013	
Problem-solving by AI without complete information	<a href="http://www.nature.com/news/game-theorists-crack-poker-1.16683">http://www.nature.com/news/game-theorists-crack-poker-1.16683</a>
AI Amazon Echo	<a href="http://www.popsci.com/amazon-echo-first-artificial-intelligence-youll-want-home?dom=fb&amp;src=SOC">http://www.popsci.com/amazon-echo-first-artificial-intelligence-youll-want-home?dom=fb&amp;src=SOC</a>
Review of the threats of AI	<a href="http://www.hs.fi/kuukausiliite/%C3%84ly+hoi/a1396404764124">http://www.hs.fi/kuukausiliite/%C3%84ly+hoi/a1396404764124</a>
AI review, several links	<a href="http://www.aaai.org/ojs/index.php/aimagazine/article/download/1877/1775">http://www.aaai.org/ojs/index.php/aimagazine/article/download/1877/1775</a>
Risks of AI	<a href="http://futureoflife.org/misc/open_letter">http://futureoflife.org/misc/open_letter</a>
Deep learning framework comparison	<a href="https://github.com/zer0n/deepframeworks/blob/master/README.md">https://github.com/zer0n/deepframeworks/blob/master/README.md</a>

Technology links after September 2013	
Open AI, Musk	<a href="https://medium.com/backchannel/how-elon-musk-and-y-combinator-plan-to-stop-computers-from-taking-over-17e0e27dd02a">https://medium.com/backchannel/how-elon-musk-and-y-combinator-plan-to-stop-computers-from-taking-over-17e0e27dd02a</a>
AI startup financing on the increase	<a href="http://www.bloomberg.com/news/articles/2015-02-03/i-ll-be-back-the-return-of-artificial-intelligence">http://www.bloomberg.com/news/articles/2015-02-03/i-ll-be-back-the-return-of-artificial-intelligence</a>
AI review 2, several links	<a href="https://www.facebook.com/notes/10151609046812712/">https://www.facebook.com/notes/10151609046812712/</a>
AI solves a difficult mathematical problem	<a href="http://www.newscientist.com/article/dn25068-wikipediasize-maths-proof-too-big-for-humans-to-check.html">http://www.newscientist.com/article/dn25068-wikipediasize-maths-proof-too-big-for-humans-to-check.html</a>
Deep vision, AI, Deep Learning examples	<a href="https://github.com/kjw0612/awesome-deep-vision">https://github.com/kjw0612/awesome-deep-vision</a>
Microsoft's AI platform open-sourced	<a href="http://techcrunch.com/2016/01/25/microsoft-moves-its-cntk-machine-learning-toolkit-to-github/">http://techcrunch.com/2016/01/25/microsoft-moves-its-cntk-machine-learning-toolkit-to-github/</a>
Google Deep Mind	<a href="http://themindunleashed.org/2014/11/googles-deep-mind-plans-to-create-a-computer-able-to-program-itself.html">http://themindunleashed.org/2014/11/googles-deep-mind-plans-to-create-a-computer-able-to-program-itself.html</a>
AI review 3, several links	<a href="https://www.facebook.com/notes/juan-carlos-kuri-pinto/deep-x/10153080971122712">https://www.facebook.com/notes/juan-carlos-kuri-pinto/deep-x/10153080971122712</a>
Diagnosis robot for X-ray images, etc.	<a href="http://singularityhub.com/2016/01/18/digital-diagnosis-intelligent-machines-do-a-better-job-than-humans/">http://singularityhub.com/2016/01/18/digital-diagnosis-intelligent-machines-do-a-better-job-than-humans/</a>
Low-consumption AI processor for smartphones	<a href="http://www.engadget.com/2016/02/07/low-power-neural-network-chip/">http://www.engadget.com/2016/02/07/low-power-neural-network-chip/</a>

### 7.3 Digitalisation of the storage and processing of information

Events in our environment are increasingly being digitalised, with increasingly accurate instruments. The amount of stored information nearly doubles every two years and will increase nearly hundredfold by the end of the 2020s. This development is enabled by the continuous development of computer memory devices and processing power.

The improved availability of information can be seen as the most prominent effect of this. When all available information is stored in a digital format, it is easy to share. Along with the rapid development of processing power and presentation technique, digital information will also be much more easy to find and detect in the near future.

As a result of this development, decision-making is less and less often tied to any particular location. Online trade will become easier, tourism can become virtual, learning and research will increasingly often rely on information networks, independent of the physical location. The gathering and combination of information from different sources will become a more common revenue model, associated with strong economies of scale. The winner can easily make citizens disclose their data and achieve a strong position in the market by sharing these data.

Technological development after the publication of the TuV9/2013 report and needs for improvement related to reporting:

### Schools in the cloud (2.12) \*\*\*\*

Online learning is increasing as a well-financed business. Considerable part of online teaching is globally freely available. For example, Duolingo offers free-of-charge language courses in 23 languages. Many providers of MOOC courses finance their operations by charging fees for certificates. Khan Academy’s educational videos have been translated into more than 65 languages already. The US government is studying the efficiency if Khan Academy’s learning materials in teaching in field experiments in the academic year 2015–2016. Khan Academy’s courses already cover most subjects completely. The technology is developing and spreading as anticipated, and the effects will increase significantly in the future. Recommendation: retain.

Technology links after September 2013	
Duolingo – free-of-charge courses of 23 languages	<a href="https://en.wikipedia.org/wiki/Duolingo">https://en.wikipedia.org/wiki/Duolingo</a>
MOOC trends	<a href="https://www.class-central.com/report/5-mooc-trends-of-2015/">https://www.class-central.com/report/5-mooc-trends-of-2015/</a>
Gamification platform for learning	<a href="http://www.seppo.io/">http://www.seppo.io/</a>
Accurate neurostimulation improves the efficiency of learning	<a href="http://www.hrl.com/news/2016/0210/">http://www.hrl.com/news/2016/0210/</a>

### Augmented reality glasses (2.22) \*\*\*\*

Google Glass, predicted to be the forerunner in augmented reality, was not a success on the market, due to its modest features. Microsoft is going to launch its very advanced Hololens product. Furthermore, Magic Leap, with nearly 1.5 billion dollar financing from Google and a number of other technology companies, has demonstrated its advanced technology and is preparing to start production. Both of these AR glasses can place realistic-looking three-dimensional objects in the wearer’s normal discovery environment in a natural manner and so that the animated objects retain their location in the physical environment as the wearer moves. The test evaluations have been very positive.

Three-dimensional holograms can be produced for detection by the human eye so that the viewer does not need any special glasses or other equipment. The applications of this technology are partly overlapping with augmented reality glasses, but the technology is still in an early stage of development. Early-stage experiments include also contact lenses that add information to the visual field or modify it somehow (e.g. telescope or night vision).

Virtual reality glasses are technically less complicated than augmented reality glasses. They have rapidly progressed to a mature product stage, opening a new broad market for applications and media content of virtual reality. The New York Times has distributed virtual reality glasses to a million customers and is producing virtual reality content in its online version. The application domains of virtual reality and augmented reality will

clearly diverge from each other. Their combined market in 2020 is estimated at one hundred billion dollars, which means that the growth will be very fast. Finland has significant expertise in this area. Recommendation: retain Augmented reality glasses. Add Virtual reality glasses as a new item.

<b>Technology links after September 2013</b>	
AR glasses (2D) from Kopin	<a href="http://venturebeat.com/2016/01/04/kopin-enables-augmented-reality-glasses-with-breakthroughs-in-display-speech-and-battery-tech/">http://venturebeat.com/2016/01/04/kopin-enables-augmented-reality-glasses-with-breakthroughs-in-display-speech-and-battery-tech/</a>
Artificial (super) lens for the eye	<a href="http://www.collective-evolution.com/2015/06/19/the-8-minute-surgery-that-will-give-you-superhuman-vision-forever/">http://www.collective-evolution.com/2015/06/19/the-8-minute-surgery-that-will-give-you-superhuman-vision-forever/</a>
Artificial eyes 2027	<a href="http://3dprint.com/52616/mhox-3d-printed-eyes/">http://3dprint.com/52616/mhox-3d-printed-eyes/</a>
AR-Magic Leap, just another day	<a href="https://www.youtube.com/watch?v=kPMHcanq0xM">https://www.youtube.com/watch?v=kPMHcanq0xM</a>
AR Hololens demo	<a href="http://www.pcmag.com/article2/0,2817,2475581,00.asp">http://www.pcmag.com/article2/0,2817,2475581,00.asp</a>
Atheer, 2D AR glasses	<a href="http://atheerair.com/">http://atheerair.com/</a>
Hololens available to developers in 2016	<a href="http://uk.businessinsider.com/microsoft-hololens-augmented-reality-glasses-will-be-available-to-developers-within-a-year-2015-8?r=US&amp;IR=T">http://uk.businessinsider.com/microsoft-hololens-augmented-reality-glasses-will-be-available-to-developers-within-a-year-2015-8?r=US&amp;IR=T</a>
Thermal camera for contact lens	<a href="http://www.extremetech.com/extreme/178593-graphene-smart-contact-lenses-could-give-you-thermal-infrared-and-uv-vision">http://www.extremetech.com/extreme/178593-graphene-smart-contact-lenses-could-give-you-thermal-infrared-and-uv-vision</a>
Magic Leap AR patents	<a href="http://fortune.com/2015/09/01/magic-leap-patents-contact-lens/">http://fortune.com/2015/09/01/magic-leap-patents-contact-lens/</a>
Google's Magic Leap investment	<a href="http://www.bloomberg.com/video/google-qualcomm-are-interested-in-augmented-reality-ZsOFtgy3RxWWXA3hmP~jNQ.html">http://www.bloomberg.com/video/google-qualcomm-are-interested-in-augmented-reality-ZsOFtgy3RxWWXA3hmP~jNQ.html</a>
Oculus in remote control by drone	<a href="https://www.facebook.com/groups/TuVRadikaalit/permalink/655699724547637/">https://www.facebook.com/groups/TuVRadikaalit/permalink/655699724547637/</a> <a href="http://mashable.com/2014/04/28/oculus-rift-flying-drone/">http://mashable.com/2014/04/28/oculus-rift-flying-drone/</a>
Patent for smart contact lenses	<a href="http://phys.org/news/2014-04-patent-google-sharpens-contact-lens.html">http://phys.org/news/2014-04-patent-google-sharpens-contact-lens.html</a>
Samsung GearVR	<a href="http://www.pcworld.com/article/2986140/gadgets/samsungs-new-gearvr-virtual-reality-headset-only-costs-99.html">http://www.pcworld.com/article/2986140/gadgets/samsungs-new-gearvr-virtual-reality-headset-only-costs-99.html</a>
Telescopic contact lens	<a href="https://www.facebook.com/RichardDawkinsFoundation/photos/a.496176595154.294030.8798180154/10151870994790155/?type=3&amp;fref=fb">https://www.facebook.com/RichardDawkinsFoundation/photos/a.496176595154.294030.8798180154/10151870994790155/?type=3&amp;fref=fb</a>
Hololens 1Q2016	<a href="http://www.cnet.com/news/microsofts-hololens-priced-at-3000-for-developer-edition-shipping-early-next-year/">http://www.cnet.com/news/microsofts-hololens-priced-at-3000-for-developer-edition-shipping-early-next-year/</a>
Quadcopter flying with VR glasses	<a href="http://www.youtube.com/CharpuFPV">http://www.youtube.com/CharpuFPV</a>
Leds for contact lens	<a href="http://www.cnet.com/news/bionic-eye-3d-printing-merges-contact-lens-and-qleds/">http://www.cnet.com/news/bionic-eye-3d-printing-merges-contact-lens-and-qleds/</a>
Infrared retina implant testing	<a href="http://spectrum.ieee.org/tech-talk/biomedical/bionics/blind-patients-will-soon-try-a-new-bionic-eye">http://spectrum.ieee.org/tech-talk/biomedical/bionics/blind-patients-will-soon-try-a-new-bionic-eye</a>
Night vision glasses of graphene	<a href="http://www.sciencealert.com/graphene-can-create-super-powerful-night-vision-lenses-that-are-just-one-atom-thick">http://www.sciencealert.com/graphene-can-create-super-powerful-night-vision-lenses-that-are-just-one-atom-thick</a>
Earbuds modifying the sound environment	<a href="http://gizmodo.com/what-its-like-to-wear-bionic-earbuds-1756802862">http://gizmodo.com/what-its-like-to-wear-bionic-earbuds-1756802862</a>

Technology links after September 2013	
Google Glass in Dubai	<a href="http://nuviun.com/content/news/dubai-using-google-glass-beyond-healthcare">http://nuviun.com/content/news/dubai-using-google-glass-beyond-healthcare</a>
VR and AR \$150 billion in 2020	<a href="http://www.fastcompany.com/3052209/tech-forecast/vr-and-augmented-reality-will-soon-be-worth-150-billion-here-are-the-major-pla">http://www.fastcompany.com/3052209/tech-forecast/vr-and-augmented-reality-will-soon-be-worth-150-billion-here-are-the-major-pla</a>
AR Magic Leap development environment	<a href="http://techcrunch.com/2015/06/02/magic-leap-platform/">http://techcrunch.com/2015/06/02/magic-leap-platform/</a>
Oculus VR in military use	<a href="http://www.itviikko.fi/uutiset/2014/05/06/panssarikuskit-suunnistavat-oculus-riftilla--vaikka-pahaa-tekisi/20146372/7">http://www.itviikko.fi/uutiset/2014/05/06/panssarikuskit-suunnistavat-oculus-riftilla--vaikka-pahaa-tekisi/20146372/7</a>
Virtual (CT) autopsy	<a href="https://www.youtube.com/watch?v=9usf3kL7mc">https://www.youtube.com/watch?v=9usf3kL7mc</a>
VTT's AR display	<a href="http://www.vtt.fi/medialle/uutiset/kännykkä-osaksi-tavallisia-silmälaseja">http://www.vtt.fi/medialle/uutiset/kännykkä-osaksi-tavallisia-silmälaseja</a>
Virtual mask with laser in real-time	<a href="http://www.businessinsider.com/projection-mapping-like-digital-makeup-2014-8">http://www.businessinsider.com/projection-mapping-like-digital-makeup-2014-8</a>
3D light dots projected in the air with laser	<a href="http://www.thisiscoossal.com/2014/11/an-aerial-laser-display-capable-of-projecting-3d-objects-in-mid-air/">http://www.thisiscoossal.com/2014/11/an-aerial-laser-display-capable-of-projecting-3d-objects-in-mid-air/</a>
VR with projectors without glasses	<a href="http://www.fastcodesign.com/3036628/microsoft-can-now-turn-any-space-into-the-holodeck?partner=rss">http://www.fastcodesign.com/3036628/microsoft-can-now-turn-any-space-into-the-holodeck?partner=rss</a>
Hologram projected in mid-air	<a href="http://www.bitrebels.com/technology/realview-mid-air-holography-station/">http://www.bitrebels.com/technology/realview-mid-air-holography-station/</a>
Thinglink for AR and VR advertisement links	<a href="http://www.talouselama.fi/kasvuyritykset/ulla-engestromin-thinglink-kerasi-miljoonasijoituksen-laajentaa-virtuaalitodellisuuteen-6303424">http://www.talouselama.fi/kasvuyritykset/ulla-engestromin-thinglink-kerasi-miljoonasijoituksen-laajentaa-virtuaalitodellisuuteen-6303424</a>
360-degree video Facebook/BBC	<a href="https://www.facebook.com/bbcearth/videos/1135051163195105/?fref=nf">https://www.facebook.com/bbcearth/videos/1135051163195105/?fref=nf</a>
Evaluation of the AR/VR market segments in 2020 (150 billion)	<a href="http://www.valuewalk.com/2016/02/virtual-and-augmented-reality-the-players-and-the-game-infographic/">http://www.valuewalk.com/2016/02/virtual-and-augmented-reality-the-players-and-the-game-infographic/</a>
Hololens technology explained	<a href="https://www.youtube.com/watch?v=-606oZKLa_s">https://www.youtube.com/watch?v=-606oZKLa_s</a>

### Interfaces based on feeling of touch (2.23) \*\*\*\*

Haptic technologies have developed slowly, and no market breakthrough can be seen in the near future. However, development has not stopped. Touchable holograms have been created in the laboratory using ultrasound or laser. Haptic clothes for computer game players have been introduced in the market, but they are too expensive to become more common. Recommendation: retain.

Technology links after September 2013	
Haptic interface in the air with ultrasound	<a href="http://www.youtube.com/watch?v=2QkbVr4J7CM">http://www.youtube.com/watch?v=2QkbVr4J7CM</a>
Touchable holograms with femtosecond laser	<a href="http://spectrum.ieee.org/tech-talk/consumer-electronics/audiovideo/femtosecond-lasers-create-3d-midair-plasma-displays-you-can-touch">http://spectrum.ieee.org/tech-talk/consumer-electronics/audiovideo/femtosecond-lasers-create-3d-midair-plasma-displays-you-can-touch</a>
Finnish developer of haptic technology	<a href="http://senseg.fi/">http://senseg.fi/</a>

Technology links after September 2013	
Haptic interfaces with ultrasound (WV)	<a href="http://spectrum.ieee.org/tech-talk/consumer-electronics/gadgets/ces-2015-hands-on-with-ultrahaptics-ultrasonic-tactile-display">http://spectrum.ieee.org/tech-talk/consumer-electronics/gadgets/ces-2015-hands-on-with-ultrahaptics-ultrasonic-tactile-display</a>
Touchable holograms in mid-air	<a href="http://spectrum.ieee.org/tech-talk/consumer-electronics/audiovideo/femtosecond-lasers-create-3d-midair-plasma-displays-you-can-touch">http://spectrum.ieee.org/tech-talk/consumer-electronics/audiovideo/femtosecond-lasers-create-3d-midair-plasma-displays-you-can-touch</a>

### Large haptic screens (2.24) \*\*\*

Large haptic screens have made a breakthrough, and they can be purchased in stores. The size and accuracy of the screens will increase at a steady rate along with decreasing prices. Recommendation: remove, because this has materialised.

### Digital mirror (2.25) \*\*

The use of digital mirrors in stores has increased slowly, and their characteristics are still limited. For example, you can see a delayed image in the mirror, showing yourself from behind. Accessories, such as handbags that the store does not physically carry, can be added to the mirror image. Some mirrors enable changing the colour of accessories. Laboratories are experimenting with digital mirrors that analyse your health status or show your internal organs in the mirror image. Recommendation: incorporate as an application domain in 2.31, Effortless 3D imaging of parts.

Technology links after September 2013	
Internal organs in digital mirror	<a href="http://m.medicaldaily.com/miracle-digital-mirror-reveals-your-internal-organs-using-kinect-camera-and-pet-scans-277348">http://m.medicaldaily.com/miracle-digital-mirror-reveals-your-internal-organs-using-kinect-camera-and-pet-scans-277348</a>

### Flexible and transparent screens using cheap materials (2.27) \*\*

The category does not seem to have made significant progress and related technology news have not been observed. The impact of the technology cannot be considered very high, due to the rapid development of augmented reality. Recommendation: remove.

### Effortless 3D imaging of parts (2.31) \*\*\*

3D imaging of parts and spaces has progressed rapidly. Recognisable 3D models can be produced with a number of consumer-level devices. Prices of accurate 3D scanners have fallen rapidly. The price of laser scanning has decreased considerably, which promotes

this domain, as well as ToF-3D imaging, which is also based on the time delay in reflection. Recommendation: retain.

Technology links after September 2013	
More precise 3D imaging by exploiting polarisation	<a href="http://www.sciencedaily.com/releases/2015/12/151201141244.htm">http://www.sciencedaily.com/releases/2015/12/151201141244.htm</a>
Inexpensive 3D imaging	<a href="https://www.facebook.com/techcrunch/videos/10153485781482952/?fref=nf">https://www.facebook.com/techcrunch/videos/10153485781482952/?fref=nf</a>
3D model using Kinect Fusion	<a href="http://spectrum.ieee.org/video/consumer-electronics/audiovideo/kinect-fusion-lets-you-build-3d-models-of-anything">http://spectrum.ieee.org/video/consumer-electronics/audiovideo/kinect-fusion-lets-you-build-3d-models-of-anything</a>
(ToF) 3D camera cell	<a href="http://image-sensors-world.blogspot.fi/2015/12/pmd-and-infineon-present-improved-tof.html">http://image-sensors-world.blogspot.fi/2015/12/pmd-and-infineon-present-improved-tof.html</a>

### Real-time 3D modelling of the environment (2.32) \*\*\*\*

Nokia’s new OZO camera produces professional-level 3D video content in near real-time. Consumer-level instruments for 3D modelling of the environment are available in the market. Google’s Tango project anticipates an important breakthrough for consumer-level devices. The capacity of Lidar systems in robot cars for real-time modelling of the environment has improved rapidly. The best robot vacuum cleaners model their environment in real-time. In experiments, quadcopters recognise their environment to be able to fly near people and in the woods. Sound cameras identify problems in mechanics. This is a rapidly developing domain. Recommendation: retain.

Technology links after September 2013	
360-modelling of sounds in the environment	<a href="https://theta360.com/en/">https://theta360.com/en/</a>
Google Tango	<a href="http://www.google.com/atap/projecttango/">http://www.google.com/atap/projecttango/</a>
Nokia OZO VR camera	<a href="http://www.engadget.com/2015/07/28/nokias-virtual-reality-camera/">http://www.engadget.com/2015/07/28/nokias-virtual-reality-camera/</a>
Google Tango 3D device	<a href="http://www.gsmarena.com/project_tango_developer_tablet_ar_rives_in_the_google_play_store-news-10208.php">http://www.gsmarena.com/project_tango_developer_tablet_ar_rives_in_the_google_play_store-news-10208.php</a>
Google Tango (3D modelling) in quadcopter	<a href="http://spectrum.ieee.org/automaton/robotics/aerial-robots/autonomous-quadrotor-flight-based-on-google-project-tango">http://spectrum.ieee.org/automaton/robotics/aerial-robots/autonomous-quadrotor-flight-based-on-google-project-tango</a>
Nokia OZO VR camera \$60K	<a href="http://www.pcmag.com/article2/0,2817,2495939,00.asp">http://www.pcmag.com/article2/0,2817,2495939,00.asp</a>
3D-filmed video	<a href="https://www.facebook.com/schrep/videos/10153738792764443/?hc_location=ufi">https://www.facebook.com/schrep/videos/10153738792764443/?hc_location=ufi</a>
Sound camera for development of mechanics	<a href="http://spectrum.ieee.org/tech-talk/at-work/test-and-measurement/zero-in-on-buzz-squeak-and-rattle">http://spectrum.ieee.org/tech-talk/at-work/test-and-measurement/zero-in-on-buzz-squeak-and-rattle</a>

## Universal memory based on new materials and solutions (2.35) \*\*

A graphene memory circuit has been produced. Memristor development is considered important in many ways. Information has been stored in crystal quartz in a 3D structure. In this way, a small glass byte can hold 360 terabytes. IBM has developed an associative memory that works like the memory of the brain. IBM has fabricated one million brain-like neurons on one circuit. Many other storage techniques have been developed that, on one hand, reduce the costs of data storage or, on the other hand, make the retrieval of data faster or smarter. Recommendation: split the technology basket in two: conventional memory and associative memory.

Technology links after September 2013	
Supermemory of a quartz crystal	<a href="http://bit.ly/1jswMm1">http://bit.ly/1jswMm1</a>
128 Gbit of fast memory on a circuit	<a href="http://newsroom.intel.com/community/intel_newsroom/blog/2015/07/28/intel-and-micron-produce-breakthrough-memory-technology">http://newsroom.intel.com/community/intel_newsroom/blog/2015/07/28/intel-and-micron-produce-breakthrough-memory-technology</a>
Memristor background	<a href="http://edition.cnn.com/2015/02/26/tech/mci-eth-memristor/index.html">http://edition.cnn.com/2015/02/26/tech/mci-eth-memristor/index.html</a>
HP640TB cpu & memory unit?	<a href="http://bit.ly/1i3zSAI">http://bit.ly/1i3zSAI</a>
Graphene memory circuit	<a href="http://news.stanford.edu/news/2015/october/graphene-memory-chips-102315.html">http://news.stanford.edu/news/2015/october/graphene-memory-chips-102315.html</a>
Million neurons on IBM circuit	<a href="http://www.bbc.com/news/science-environment-28688781">http://www.bbc.com/news/science-environment-28688781</a>
Memristor from Finland	<a href="http://yle.fi/uutiset/suomessa_kehitettiin_ainutlaatuista_painet_tua_alya__muistivastus_voidaan_tulostaa_vaikka_postipaketin_kylkeen/8494473">http://yle.fi/uutiset/suomessa_kehitettiin_ainutlaatuista_painet_tua_alya__muistivastus_voidaan_tulostaa_vaikka_postipaketin_kylkeen/8494473</a>
Racetrack memory making progress	<a href="http://www.electronicweekly.com/news/glasgow-and-leeds-researchers-move-towards-racetrack-memory-2015-12/">http://www.electronicweekly.com/news/glasgow-and-leeds-researchers-move-towards-racetrack-memory-2015-12/</a>
Magnetic memory of graphene	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/graphene-becomes-magnetic-and-electric-at-same-time">http://spectrum.ieee.org/nanoclast/semiconductors/materials/graphene-becomes-magnetic-and-electric-at-same-time</a>
Associative circuit (IBM)	<a href="http://www.technologyreview.com/news/533526/new-form-of-memory-could-advance-brain-inspired-computers/">http://www.technologyreview.com/news/533526/new-form-of-memory-could-advance-brain-inspired-computers/</a>
Spintronics improve energy efficiency of ICT	<a href="http://www.natureworldnews.com/articles/6274/20140307/multiferroic-magnetic-materials-increase-power-efficiency-computers.htm">http://www.natureworldnews.com/articles/6274/20140307/multiferroic-magnetic-materials-increase-power-efficiency-computers.htm</a>
Memristor processor	<a href="http://fortune.com/2015/09/03/memristor-brain-like-chips/">http://fortune.com/2015/09/03/memristor-brain-like-chips/</a>
260 TB memory crystal fabricated	<a href="http://phys.org/news/2016-02-eternal-5d-storage-history-humankind.html">http://phys.org/news/2016-02-eternal-5d-storage-history-humankind.html</a>

## Quantum computers (2.37) \*

Many substantial problems with regard to the development of quantum computers have been solved. Google has announced that, on the basis of the tests it has conducted, the quantum computer in its use can solve many mathematical problems at a speed that is many orders of magnitude higher than the speed of conventional computers. Quantum computers are feared, as they are believed to be able to break the encryptions of current systems. This would considerably complicate businesses such as banking. Quantum

entanglement offers a possible solution to the problem, but the transition period can be difficult. Recommendation: retain.

Technology links after September 2013	
Quantum computer on silicon	<a href="http://www.smh.com.au/technology/sci-tech/australian-researchers-make-quantum-computing-breakthrough-paving-way-for-worldfirst-chip-20151005-gk1bov.html">http://www.smh.com.au/technology/sci-tech/australian-researchers-make-quantum-computing-breakthrough-paving-way-for-worldfirst-chip-20151005-gk1bov.html</a>
Quantum computer (Google)	<a href="http://www.extremetech.com/extreme/219160-googles-quantum-computer-is-100-million-times-faster-than-a-conventional-system">http://www.extremetech.com/extreme/219160-googles-quantum-computer-is-100-million-times-faster-than-a-conventional-system</a>
Quantum computer	<a href="http://www.sciencealert.com/australian-engineers-have-put-quantum-technology-in-a-silicon-chip-for-the-first-time">http://www.sciencealert.com/australian-engineers-have-put-quantum-technology-in-a-silicon-chip-for-the-first-time</a>
Multicore processors	<a href="http://spectrum.ieee.org/tech-talk/computing/hardware/tardis-memory-could-enable-huge-multicore-computer-chips">http://spectrum.ieee.org/tech-talk/computing/hardware/tardis-memory-could-enable-huge-multicore-computer-chips</a>
Quantum computer-proof encryption	<a href="http://www.wired.com/2015/09/tricky-encryption-stump-quantum-computers/">http://www.wired.com/2015/09/tricky-encryption-stump-quantum-computers/</a>
Development trends in computing performance	<a href="http://intelligence.org/2014/05/12/exponential-and-non-exponential/">http://intelligence.org/2014/05/12/exponential-and-non-exponential/</a>
Quantum computer – photon switch	<a href="http://www.scienceworldreport.com/articles/13946/20140410/new-atom-photon-switch-herald-breakthrough-quantum-computers.htm">http://www.scienceworldreport.com/articles/13946/20140410/new-atom-photon-switch-herald-breakthrough-quantum-computers.htm</a>

### DNA memory (2.67) \*

The methods for reading and writing DNA sequence have become faster, more accurate and less expensive, both at the product level and as research-level promises. In laboratory-level experiments, DNA memory has been used as the memory in nanoscale robots. However, the use of DNA sequence as mass memory has not made progress. Recommendation: incorporate in item 2.1.

Technology links after September 2013	
DNA nanobots	<a href="http://cacm.acm.org/magazines/2015/4/184703-molecular-moonshots/fulltext">http://cacm.acm.org/magazines/2015/4/184703-molecular-moonshots/fulltext</a>

### Extremely dense processors that take quantum phenomena into account (2.72)

\*\*\*\*

Processor density has continued to increase. As it is not known how to efficiently increase the complexity of processors, the increase in process density creates pressure on the development of parallel computing. This will change applications and ICT architecture.

Nearly all circuit development and, particularly, quantum computing development, has to do with quantum-level phenomena. Recommendation: incorporate in item 2.37.

Technology links after September 2013	
Cooling of quantum computer resolved at Aalto University	<a href="http://www.aalto.fi/fi/current/news/2016-02-01-002/">http://www.aalto.fi/fi/current/news/2016-02-01-002/</a>
Intel 16 billion for massive parallel computing	<a href="http://motherboard.vice.com/read/intel-bets-167-billion-on-the-massively-parallel-future">http://motherboard.vice.com/read/intel-bets-167-billion-on-the-massively-parallel-future</a>
3D circuit structure boosts efficiency of electronics	<a href="http://phys.org/news/2015-12-skyscraper-style-chip-boosts-fold.html">http://phys.org/news/2015-12-skyscraper-style-chip-boosts-fold.html</a>
Circuit speed 245THz	<a href="http://www.gizmag.com/nanoelectronic-circuits-quantum-plasmonic-tunneling/31714/">http://www.gizmag.com/nanoelectronic-circuits-quantum-plasmonic-tunneling/31714/</a>

## 7.4 Traffic, mobility and logistics

Technological development has many effects on traffic and mobility. Traffic is rapidly becoming robotised. Until now, the effect has been visible only as improved road safety. Future development is expected to have significant impact on the availability and costs of passenger and freight traffic services alike. Driverless freight traffic enables the optimisation of fleet and transport times. In passenger traffic, decreasing prices and improved availability of transport services will enable people to give up their cars. This will reduce the overall need for cars and parking space.

The development of battery technology and electric motors are paving the way for more extensive electrification of transport. In addition to cars, lighter forms of traffic are also subject to electrification. Electric airplanes are being designed, and they are seen as a sensible solution from the perspective of the anticipated future battery technology. Electricity is also an increasing source of energy in water transport. Through technological development, quadcopters and other drones have become potential candidates for use in the distribution of goods.

The development of transport has a wide-reaching impact on urban structure, people's time management and even the position of cities. Many cities have grown and prospered thanks to sea transport. Container traffic has also modified the world. The Hyperloop with its speed of 1,200 km/h will transform the economic geography in a similar way.

In the future, the technology of mobility will impact the daily life of many physically disabled people by restoring their functional ability. Furthermore, transport-related technology provides devices with an increasingly easy access to space or other less easily accessible destinations.

Technological development after the publication of the TuV9/2013 report and needs for improvement related to reporting:

**Self-driving car (2.45) \*\*\*\***

Elon Musk explains that, by the end of 2018, Tesla will drive itself without a driver to the person calling it, even if it has to drive through the entire USA. Ford has reported about the winter driving feature of its self-driving car. Toyota has joined the other big car manufacturers and believes now in the rapid development of robot transportation. Google’s cars have driven autonomously approximately two million kilometres. Google is testing more than 50 driverless cars. The technology required by self-driving cars is developing and becoming less expensive, as expected. The power of the artificial intelligence processor developed for self-driving cars equals 150 Apple laptops. Self-driving cars are being tested in many cities in normal traffic. Increasingly many investigations take into account the use of self-driving cars as a service. The taxi services Uber and Lyft have announced that they are aiming for driverless cars. Recommendation: retain.

Technology links after September 2013	
Readiness for self-driving cars	<a href="http://www.computerworld.com/s/article/9246418/Half_of_Americans_want_to_live_in_a_smart_city_with_driverless_cars">http://www.computerworld.com/s/article/9246418/Half_of_Americans_want_to_live_in_a_smart_city_with_driverless_cars</a>
Simulation of robot transportation capacity	<a href="http://www.forbes.com/sites/chunkamui/2014/04/17/mit-and-stanford-researchers-show-robotaxis-could-replace-private-cars-and-public-transit/">http://www.forbes.com/sites/chunkamui/2014/04/17/mit-and-stanford-researchers-show-robotaxis-could-replace-private-cars-and-public-transit/</a>
Robotaxi in South Korea	<a href="http://www.uusisuomi.fi/autot/166221-video-nain-saadaan-taksikusienkin-tyot-loppumaan">http://www.uusisuomi.fi/autot/166221-video-nain-saadaan-taksikusienkin-tyot-loppumaan</a>
GM to invest \$500 million in Lyft as part of self-driving car strategy	<a href="http://www.wired.com/2016/01/gm-and-lyft-are-building-a-network-of-self-driving-cars/">http://www.wired.com/2016/01/gm-and-lyft-are-building-a-network-of-self-driving-cars/</a>
Formula E roborace	<a href="http://www.fiaformulae.com/en/news/2015/november/formula-e-kinetik-announce-roborace-a-global-driverless-championship.aspx">http://www.fiaformulae.com/en/news/2015/november/formula-e-kinetik-announce-roborace-a-global-driverless-championship.aspx</a>
Processor for self-driving cars	<a href="http://www.wired.com/2015/03/nvidias-powerful-new-computer-helps-teach-cars-drive/?mbid=social_twitter">http://www.wired.com/2015/03/nvidias-powerful-new-computer-helps-teach-cars-drive/?mbid=social_twitter</a>
Self-driving Tesla	<a href="http://www.nytimes.com/2015/03/20/business/elon-musk-says-self-driving-tesla-cars-will-be-in-the-us-by-summer.html?_r=0">http://www.nytimes.com/2015/03/20/business/elon-musk-says-self-driving-tesla-cars-will-be-in-the-us-by-summer.html?_r=0</a>
Review of self-driving vehicles	<a href="http://www.usatoday.com/story/money/cars/2015/03/04/mckinsey-self-driving-benefits/24382405/">http://www.usatoday.com/story/money/cars/2015/03/04/mckinsey-self-driving-benefits/24382405/</a>
Extensive pilot project with self-driving cars in Sweden	<a href="https://www.media.volvocars.com/global/en-gb/media/pressreleases/136182/volvo-car-group-initiates-world-unique-swedish-pilot-project-with-self-driving-cars-on-public-roads">https://www.media.volvocars.com/global/en-gb/media/pressreleases/136182/volvo-car-group-initiates-world-unique-swedish-pilot-project-with-self-driving-cars-on-public-roads</a>
Self-driving cars and Here	<a href="http://360.here.com/2015/01/05/bmw-unveil-future-driving-ces/">http://360.here.com/2015/01/05/bmw-unveil-future-driving-ces/</a>
Patent race of self-driving cars	<a href="http://www.businessinsider.in/This-Chart-Shows-That-GM-Is-Making-A-Huge-Bet-On-Self-Driving-Cars/articleshow/45982459.cms">http://www.businessinsider.in/This-Chart-Shows-That-GM-Is-Making-A-Huge-Bet-On-Self-Driving-Cars/articleshow/45982459.cms</a>

Technology links after September 2013	
Toyota's robotics	<a href="http://spectrum.ieee.org/automaton/robotics/artificial-intelligence/gill-pratt-on-toyota-robot-plans">http://spectrum.ieee.org/automaton/robotics/artificial-intelligence/gill-pratt-on-toyota-robot-plans</a>
Self-driving cars and Finland	<a href="http://www.ess.fi/uutiset/kotimaa/article1820116.ece?ref=ece_frontend-section-teaser-groupSection-default">http://www.ess.fi/uutiset/kotimaa/article1820116.ece?ref=ece_frontend-section-teaser-groupSection-default</a>
Uber to participate in research on self-driving cars	<a href="http://techcrunch.com/2015/02/02/uber-opening-robotics-research-facility-in-pittsburgh-to-build-self-driving-cars/">http://techcrunch.com/2015/02/02/uber-opening-robotics-research-facility-in-pittsburgh-to-build-self-driving-cars/</a>
Uber and self-driving cars	<a href="http://m.fastcompany.com/3050250/what-makes-uber-run">http://m.fastcompany.com/3050250/what-makes-uber-run</a>
Test driving Tesla in Finland	<a href="http://www.stara.fi/2015/10/25/tesla-model-s-autopilot-autosteer/">http://www.stara.fi/2015/10/25/tesla-model-s-autopilot-autosteer/</a>
Driverless cars in field tests in the UK	<a href="http://www.bbc.com/news/technology-30316458">http://www.bbc.com/news/technology-30316458</a>
Finnish Ministry of Transport and Communications and driverless transportation plan	<a href="http://www.lvm.fi/julkaisu/4444104/robotit-maalla-merella-ja-ilmassa-liikenteen-alykkaan-automaation-edistamissuunnitelma">http://www.lvm.fi/julkaisu/4444104/robotit-maalla-merella-ja-ilmassa-liikenteen-alykkaan-automaation-edistamissuunnitelma</a>
Self-driving car processor – Deep learning	<a href="http://www.hpcwire.com/2016/01/06/nvidia-pascal-gpus-coming-to-automotive-supercomputer/">http://www.hpcwire.com/2016/01/06/nvidia-pascal-gpus-coming-to-automotive-supercomputer/</a>

### 1- or 2-wheeled vehicles for personal or goods transport (2.46) \*\*\*

Lightweight electric vehicles have become legal in Finland. There are a number of one- and two-wheeled electric vehicles for personal transport in the market. Many of them are small or foldable so that they can easily be carried along on public transport vehicles. Small-sized transport vehicles for goods have been demonstrated. Their development potential continues to be significant. Recommendation: retain.

Technology links after September 2013	
Bicycle radar	<a href="http://www.techcentral.co.za/sa-made-radar-to-keep-cyclists-safe/50704/">http://www.techcentral.co.za/sa-made-radar-to-keep-cyclists-safe/50704/</a>
2-Wheel Self Balance Drifting Electric Vehicle	<a href="http://www.dx.com/p/eyu-x1-2-wheel-self-balance-drifting-electric-vehicle-white-black-370426?utm_source=facebook&amp;utm_medium=banner&amp;utm_campaign=20150104fbsku370426">http://www.dx.com/p/eyu-x1-2-wheel-self-balance-drifting-electric-vehicle-white-black-370426?utm_source=facebook&amp;utm_medium=banner&amp;utm_campaign=20150104fbsku370426</a>
Robotic shopping bag	<a href="http://nextbigfuture.com/2015/11/skype-cofounders-make-ground-delivery.html">http://nextbigfuture.com/2015/11/skype-cofounders-make-ground-delivery.html</a>
Lightweight electric vehicles legal in Finland	<a href="http://valtioneuvosto.fi/artikkeli/-/asset_publisher/muutosta-aletaan-valmistella-kevyet-sahkokulkuneuvot-laillisiksi-liikennekaytossa?utm_source=dlvr.it&amp;utm_medium=twitter">http://valtioneuvosto.fi/artikkeli/-/asset_publisher/muutosta-aletaan-valmistella-kevyet-sahkokulkuneuvot-laillisiksi-liikennekaytossa?utm_source=dlvr.it&amp;utm_medium=twitter</a>
Urb-E electric scooter	<a href="http://techcrunch.com/2014/02/10/urb-e-the-fold-up-electric-scooter-goes-live-on-indiegogo/">http://techcrunch.com/2014/02/10/urb-e-the-fold-up-electric-scooter-goes-live-on-indiegogo/</a>

## Quadcopters (2.47) \*\*\*

Quadcopters have evolved fast. In many countries, legislation has been amended to make it more permissive for quadcopters and other drones. In demonstrations, quadcopters can deliver parcels, perform assembly tasks and carry out monitoring and measurements. In many countries, they have received permissions to fly outside of visual connection. A number of creative ideas have been tested. Examples of developed applications include quadcopters that take a defibrillator to a heart attack patient, build rope bridges or carry guns. Amazon promises to deliver the goods you ordered to your home in 30 minutes, once the authorities grant the permission to launch the service. Special processors have been developed for quadcopters that recognise patterns and plan routes, in order to enable their autonomous activity. Quadcopters have been demonstrated to fly without problems in the woods and among people. Recommendation: retain.

Technology links after September 2013	
Quadcopter test by Posti	<a href="http://www.posti.fi/lennot/">http://www.posti.fi/lennot/</a>
Quadcopters build a rope bridge	<a href="http://www.bbc.co.uk/news/technology-34327364">http://www.bbc.co.uk/news/technology-34327364</a>
Quadcopters for medicine deliveries (DHL)	<a href="http://online.wsj.com/articles/deutsche-post-dhl-to-deliver-medicine-via-drone-1411576151?mod=e2tw">http://online.wsj.com/articles/deutsche-post-dhl-to-deliver-medicine-via-drone-1411576151?mod=e2tw</a>
Microfilament drone	<a href="http://phys.org/news/2015-11-parc-limit-flight-microfilament.html">http://phys.org/news/2015-11-parc-limit-flight-microfilament.html</a>
Tree planting by quadcopters – at 15% of current cost	<a href="http://www.iflscience.com/environment/former-nasa-engineer-plans-plant-1-billion-trees-year-using-drones">http://www.iflscience.com/environment/former-nasa-engineer-plans-plant-1-billion-trees-year-using-drones</a>
Amazon’s quadcopter with hybrid design	<a href="http://techcrunch.com/2015/11/29/amazon-shows-off-new-prime-air-drone-with-hybrid-design/">http://techcrunch.com/2015/11/29/amazon-shows-off-new-prime-air-drone-with-hybrid-design/</a>
Quadcopters in farming	<a href="http://www.bloomberg.com/news/articles/2015-03-16/what-the-french-know-about-drones-that-americans-don-t">http://www.bloomberg.com/news/articles/2015-03-16/what-the-french-know-about-drones-that-americans-don-t</a>
Biodegradable body material in quadcopter	<a href="http://www.newscientist.com/article/mg22429952.400-biodrone-simply-melts-away-when-it-crashes.html">http://www.newscientist.com/article/mg22429952.400-biodrone-simply-melts-away-when-it-crashes.html</a>
Quadcopter regulation in the USA	<a href="http://econ.st/1B4ywgh">http://econ.st/1B4ywgh</a>
Armed quadcopter	<a href="http://www.ibtimes.co.uk/drone-shoots-handgun-while-flying-alarming-video-raises-safety-concerns-1511294">http://www.ibtimes.co.uk/drone-shoots-handgun-while-flying-alarming-video-raises-safety-concerns-1511294</a>
Quadcopter saving lives	<a href="https://www.facebook.com/groups/TuVRadikaalit/permalink/738858082898467/">https://www.facebook.com/groups/TuVRadikaalit/permalink/738858082898467/</a>
Gimball quadcopter manages tight spots	<a href="http://spectrum.ieee.org/automaton/robotics/aerial-robots/flyabilitys-gimball-drone-exploring-ice-caves">http://spectrum.ieee.org/automaton/robotics/aerial-robots/flyabilitys-gimball-drone-exploring-ice-caves</a>
FAA approves medical delivery quadcopter	<a href="http://www.ibtimes.co.uk/faa-approves-first-drone-delivery-service-amazon-prime-air-loses-race-medical-supply-firm-flirtey-1511175">http://www.ibtimes.co.uk/faa-approves-first-drone-delivery-service-amazon-prime-air-loses-race-medical-supply-firm-flirtey-1511175</a>
Quadcopter drone	<a href="https://www.youtube.com/watch?v=kXqI26sF5uc&amp;feature=youtu.be">https://www.youtube.com/watch?v=kXqI26sF5uc&amp;feature=youtu.be</a>
Quadcopter defibrillator	<a href="https://www.facebook.com/stjohnfirstaid/videos/857910784251727/">https://www.facebook.com/stjohnfirstaid/videos/857910784251727/</a>
Quadcopter defibrillator	<a href="https://www.facebook.com/photo.php?fbid=10152974941624909&amp;set=gm.705484976235778&amp;type=3">https://www.facebook.com/photo.php?fbid=10152974941624909&amp;set=gm.705484976235778&amp;type=3</a>
Quadcopter regulation – Trafi	<a href="http://www.trafi.fi/tietoa_trafista/ajankohtaista/3174/miehittamattomille_ilma-aluksille_erittain_liberaalia_saantelya">http://www.trafi.fi/tietoa_trafista/ajankohtaista/3174/miehittamattomille_ilma-aluksille_erittain_liberaalia_saantelya</a>

Technology links after September 2013	
Lightweight camera quadcopter	<a href="http://www.wired.com/2015/09/dont-fooled-adorable-little-drone-means-business/">http://www.wired.com/2015/09/dont-fooled-adorable-little-drone-means-business/</a>
Hoverboard with quadcopter	<a href="http://www.avweb.com/avwebflash/news/Hoverboard-On-The-Market-By-Christmas-224136-1.html">http://www.avweb.com/avwebflash/news/Hoverboard-On-The-Market-By-Christmas-224136-1.html</a>
Amazon's quadcopter announcement in 2013	<a href="http://www.theverge.com/2013/12/1/5164340/delivery-drones-are-coming-jeff-bezos-previews-half-hour-shipping">http://www.theverge.com/2013/12/1/5164340/delivery-drones-are-coming-jeff-bezos-previews-half-hour-shipping</a>
Google to start quadcopter delivery in 2017	<a href="http://myfox8.com/2015/11/28/google-x-hopes-to-launch-drone-deliveries-by-2017/">http://myfox8.com/2015/11/28/google-x-hopes-to-launch-drone-deliveries-by-2017/</a>
Public transport and quadcopters	<a href="https://www.facebook.com/worldbulletin/videos/1136275596399437/?fref=nf">https://www.facebook.com/worldbulletin/videos/1136275596399437/?fref=nf</a>
Drone fighter	<a href="http://gizmodo.com/unmanned-drones-landing-autonomously-next-to-f-18s-is-a-1623368962">http://gizmodo.com/unmanned-drones-landing-autonomously-next-to-f-18s-is-a-1623368962</a>
Tracking of quadcopters	<a href="https://wtvox.com/robotics/verizon-and-nasa-are-developing-a-system-to-track-drones/">https://wtvox.com/robotics/verizon-and-nasa-are-developing-a-system-to-track-drones/</a>
Autonomous quadcopters	<a href="https://youtu.be/ZIHNM37maK0">https://youtu.be/ZIHNM37maK0</a>
A crowd of robots building things	<a href="http://www.dvice.com/2014-4-22/watch-swarms-micro-robots-run-around-making-stuff">http://www.dvice.com/2014-4-22/watch-swarms-micro-robots-run-around-making-stuff</a>
Quadcopter delivery	<a href="http://in.reuters.com/article/2015/10/27/wal-mart-stores-drones-idINKCNOSLOB120151027">http://in.reuters.com/article/2015/10/27/wal-mart-stores-drones-idINKCNOSLOB120151027</a>
Festo robotic bird	<a href="http://www.ted.com/talks/a_robot_that_flies_like_a_bird.html">http://www.ted.com/talks/a_robot_that_flies_like_a_bird.html</a>
FAA to launch drone tests	<a href="http://www.youtube.com/watch?v=E2stferhRgU">http://www.youtube.com/watch?v=E2stferhRgU</a>
EU-RPAS (drone) regulation	<a href="https://www.facebook.com/download/1397695460508596/NPA%202014-09.pdf">https://www.facebook.com/download/1397695460508596/NPA%202014-09.pdf</a>
Quadcopterboarding on snow	<a href="https://www.facebook.com/verge/videos/1031743590195317/?fref=nf">https://www.facebook.com/verge/videos/1031743590195317/?fref=nf</a>
Quadcopter sports	<a href="https://www.facebook.com/nrkliivsstil/videos/10154044139728619/">https://www.facebook.com/nrkliivsstil/videos/10154044139728619/</a>

### On-demand personal aviation services (2.48) \*

Many light aircrafts have been developed, in the belief that batteries will rapidly become lighter. The production of a Finnish electric aircraft, Flynano, has started. It weighs 70 kg and carries a pilot. It takes off from and lands on water. Large-scale quadcopter technology has been applied to personal transport. Recommendation: retain.

Technology links after September 2013	
Bicyclecopter	<a href="https://www.facebook.com/haberaycom/videos/113485556539984/?fref=nf">https://www.facebook.com/haberaycom/videos/113485556539984/?fref=nf</a>
Volocopter	<a href="https://www.youtube.com/watch?v=tNulEa8LTHI">https://www.youtube.com/watch?v=tNulEa8LTHI</a>
VTOL light aircraft	<a href="http://www.jobyaviation.com/S2/">http://www.jobyaviation.com/S2/</a>
Light aircraft	<a href="http://www.bloomberg.com/news/articles/2015-09-17/the-icon-a5-is-the-closest-thing-to-a-flying-car-you-can-buy-today">http://www.bloomberg.com/news/articles/2015-09-17/the-icon-a5-is-the-closest-thing-to-a-flying-car-you-can-buy-today</a>

Quadcopter for person transport	<a href="https://www.facebook.com/DrSaiSatish/videos/693522244049344/">https://www.facebook.com/DrSaiSatish/videos/693522244049344/</a>
Arca Hoverboard	<a href="http://nextbigfuture.com/2015/12/arcaspace-makes-true-125-mph-battery.html">http://nextbigfuture.com/2015/12/arcaspace-makes-true-125-mph-battery.html</a>
Person copter	<a href="https://www.facebook.com/groups/TuVRadikaalit/permalink/851170468333894/">https://www.facebook.com/groups/TuVRadikaalit/permalink/851170468333894/</a>
Electric aircraft 2017 Nasa	<a href="http://nextbigfuture.com/2015/12/nasa-will-test-distributed-electric.html">http://nextbigfuture.com/2015/12/nasa-will-test-distributed-electric.html</a>
Electric aircraft Airbus	<a href="http://www.airbusgroup.com/int/en/innovation-citizenship/airbus-e-fan-the-future-of-electric-aircraft.html">http://www.airbusgroup.com/int/en/innovation-citizenship/airbus-e-fan-the-future-of-electric-aircraft.html</a>
Electric aircraft	<a href="http://www.talkmarkets.com/content/us-markets/the-airbus-e-fan-takes-to-the-skies?post=70721">http://www.talkmarkets.com/content/us-markets/the-airbus-e-fan-takes-to-the-skies?post=70721</a>

### Vactrains (2.49) \*

At the time of finalising the TuVRad9/2013 report, vactrain development focused on the Hyperloop technology introduced by Elon Musk. The calculated speed of the Hyperloop is 1,200 km/h, and its calculated construction cost is half of the cost of a motorway. After Musk introduced the idea, many parties have started building a test track and developing carriage technology according to plan. So far, Hyperloop projects have continuously been receiving more support. Recommendation: retain, change the name to Vactrain – Hyperloop.

Technology links after September 2013	
Hyperloop tests are advancing	<a href="http://www.wired.com/2015/12/the-hyperloops-testing-its-propulsion-system-next-month/?mbid=nl_12915">http://www.wired.com/2015/12/the-hyperloops-testing-its-propulsion-system-next-month/?mbid=nl_12915</a>
Interest in Hyperloop from Helsinki to Stockholm	<a href="http://www.mtv.fi/uutiset/kotimaa/artikkeli/junalla-helsingista-tukholmaan-tulevaisuuden-junafirma-kiinnostui-tunnelihankkeesta/5573288">http://www.mtv.fi/uutiset/kotimaa/artikkeli/junalla-helsingista-tukholmaan-tulevaisuuden-junafirma-kiinnostui-tunnelihankkeesta/5573288</a>
Hyperloop test track	<a href="http://techcrunch.com/2015/01/15/elon-musk-will-build-a-hyperloop-track-for-ultra-high-speed-transport-tests/?fb_action_ids=10152776187049635&amp;fb_action_types=og.shares">http://techcrunch.com/2015/01/15/elon-musk-will-build-a-hyperloop-track-for-ultra-high-speed-transport-tests/?fb_action_ids=10152776187049635&amp;fb_action_types=og.shares</a>
Hyperloop test track	<a href="https://www.youtube.com/watch?v=1dXliqyGa5M">https://www.youtube.com/watch?v=1dXliqyGa5M</a>
Hyperloop towards testing	<a href="http://www.wired.com/2014/12/jumpstartfund-hyperloop-elon-musk/">http://www.wired.com/2014/12/jumpstartfund-hyperloop-elon-musk/</a>
Building of Hyperloop track started	<a href="http://www.popularmechanics.com/technology/infrastructure/a18872/hyperloop-technologies-physical-tubes-ready-assemble/">http://www.popularmechanics.com/technology/infrastructure/a18872/hyperloop-technologies-physical-tubes-ready-assemble/</a>

### CubeSat and other minisatellites (2.51) \*\*

One litre of volume, one kilogram of weight, miniaturisation of electronics is turning Cubesat from a challenge to normal routine for satellite developers. Satellite launching costs are rapidly decreasing as commercial activity in space is expanding. Many actors,

including commercial rocket companies, are developing affordable solutions for the launching of satellites. Worth noting is the Space-X company’s attempt to develop a landing and reusable carrier rocket. Satellite applications are evolving. For example, there are plans to build a global WiFi network supported by thousands of satellites. The collection of meteorites and valuable lunar minerals is being planned at a slightly longer time span. Rocket engines are being developed for carrier rockets and for travelling from the orbit of Earth to interplanetary orbit and into outer space. It has also been planned to facilitate access to space using a space lift and buildings that reach the upper layers of the atmosphere. The development is continuous and rapid. Recommendation: retain.

Technology links after September 2013	
Inexpensive access to orbit	<a href="http://www.rocketlabusa.com/index.html">http://www.rocketlabusa.com/index.html</a>
Cubesat WiFi connection	<a href="http://www.ibtimes.com/introducing-outernet-free-worldwide-wi-fi-access-beamed-space-1556016">http://www.ibtimes.com/introducing-outernet-free-worldwide-wi-fi-access-beamed-space-1556016</a>
Inexpensive launching of satellites	<a href="https://www.facebook.com/RichardBranson/photos/a.10150152138395872.292541.31325960871/10152552306725872/?type=3">https://www.facebook.com/RichardBranson/photos/a.10150152138395872.292541.31325960871/10152552306725872/?type=3</a>
Satellite Internet with 4,000 satellites	<a href="http://www.cnet.com/news/elon-musk-is-trying-to-bring-the-internet-to-space/">http://www.cnet.com/news/elon-musk-is-trying-to-bring-the-internet-to-space/</a>
Law on the rights of space miners (USA)	<a href="http://www.planetaryresources.com/2015/11/president-obama-signs-bill-recognizing-asteroid-resource-property-rights-into-law/">http://www.planetaryresources.com/2015/11/president-obama-signs-bill-recognizing-asteroid-resource-property-rights-into-law/</a>
Inexpensive satellites (launched by jet planes, NASA)	<a href="http://www.upi.com/Science_News/2015/02/06/Can-jet-planes-launch-small-satellites-into-orbit-on-the-cheap/7371423260087/">http://www.upi.com/Science_News/2015/02/06/Can-jet-planes-launch-small-satellites-into-orbit-on-the-cheap/7371423260087/</a>
Landing of carrier rocket (Space-X)	<a href="http://www.nytimes.com/2015/12/22/science/spacex-rocket-landing.html">http://www.nytimes.com/2015/12/22/science/spacex-rocket-landing.html</a>
Reusable rocket	<a href="http://nextbigfuture.com/2015/08/australia-working-on-reusable-rockets.html">http://nextbigfuture.com/2015/08/australia-working-on-reusable-rockets.html</a>
Ion space drive	<a href="http://nextbigfuture.com/2015/09/new-ion-drive-achieves-14600-isp-which.html">http://nextbigfuture.com/2015/09/new-ion-drive-achieves-14600-isp-which.html</a>
Nasa EmDrive (unverified)	<a href="http://blogs.discovermagazine.com/outthere/2014/08/06/nasa-validate-impossible-space-drive-word/">http://blogs.discovermagazine.com/outthere/2014/08/06/nasa-validate-impossible-space-drive-word/</a>
Ramjet	<a href="http://nextbigfuture.com/2015/08/russia-shows-off-supersonic-combusting.html">http://nextbigfuture.com/2015/08/russia-shows-off-supersonic-combusting.html</a>
EM Drive	<a href="http://www.sciencedirect.com/science/article/pii/S0094576515002726?np=y">http://www.sciencedirect.com/science/article/pii/S0094576515002726?np=y</a>
Ionic thruster	<a href="http://newsoffice.mit.edu/2013/ionic-thrusters-0403">http://newsoffice.mit.edu/2013/ionic-thrusters-0403</a>

**Light continuously flying equipment (2.52) \*\*\***

Strong lightweight structures, efficient solar panels based on thin sheets, light electric engines and light high-capacity batteries enable the construction of a light aircraft that supplies its energy by itself during flight. Such an aircraft can fly continuously, without having to land except for service or loading of cargo. The goal has become closer and many companies, such as Google and Facebook, have made considerable investments in the development. The current prototype of Google’s Solara weighs 160 kg and has a wingspan

of 50 metres. The first flight in 2015 failed, but the project continues. Air balloons have also been developed with the objective of establishing Internet access for regions that do not have base stations for a variety of reasons. Recommendation: retain.

Technology links after September 2013	
Google Loon to India	<a href="http://fosbytes.com/googles-project-loon-gets-indian-govt-in-principle-nod/">http://fosbytes.com/googles-project-loon-gets-indian-govt-in-principle-nod/</a>
Google Loon around the world in 22 days	<a href="http://www.techtimes.com/articles/5216/20140405/googles-loon-balloon-circles-globe-in-just-22-days-internet-for-all-remains-goal.htm">http://www.techtimes.com/articles/5216/20140405/googles-loon-balloon-circles-globe-in-just-22-days-internet-for-all-remains-goal.htm</a>
Atm satellites Facebook	<a href="https://www.facebook.com/zuck/videos/10102274951725301/">https://www.facebook.com/zuck/videos/10102274951725301/</a>
Google Project Loon	<a href="http://www.theverge.com/2015/3/2/8130759/project-loon">http://www.theverge.com/2015/3/2/8130759/project-loon</a>
24h hybrid drone Airstrato	<a href="http://nextbigfuture.com/2015/12/stratospheric-solar-electric-and-hybrid.html">http://nextbigfuture.com/2015/12/stratospheric-solar-electric-and-hybrid.html</a>
Atmospheric satellite aircraft Solara being tested	<a href="http://www.theguardian.com/technology/2016/jan/29/project-skybender-google-drone-tests-internet-spaceport-virgin-galactic">http://www.theguardian.com/technology/2016/jan/29/project-skybender-google-drone-tests-internet-spaceport-virgin-galactic</a>
Hovering carriers Darpa	<a href="http://sploid.gizmodo.com/call-the-avengers-the-pentagon-wants-to-make-helicarri-1656968348">http://sploid.gizmodo.com/call-the-avengers-the-pentagon-wants-to-make-helicarri-1656968348</a>
Glider at 30 km	<a href="http://www.bloomberg.com/news/articles/2015-09-23/gliding-at-the-edge-of-space-for-science">http://www.bloomberg.com/news/articles/2015-09-23/gliding-at-the-edge-of-space-for-science</a>
Airship freight carrier	<a href="http://www.sahkolamppu.com/2014/09/ilmalaiva-kuljettamaan-puuhiilta.html">http://www.sahkolamppu.com/2014/09/ilmalaiva-kuljettamaan-puuhiilta.html</a>
Solar-powered 81-hour flight	<a href="http://www.suasnews.com/2015/07/37499/solar-powered-81-hours-flight-successful-a-new-endurance-world-record/">http://www.suasnews.com/2015/07/37499/solar-powered-81-hours-flight-successful-a-new-endurance-world-record/</a>
Google's base station balloons	<a href="http://bit.ly/1D94lb3">http://bit.ly/1D94lb3</a>
Atmospheric satellite (Facebook)	<a href="http://www.nytimes.com/2015/03/26/technology/drones-beaming-web-access-are-in-the-stars-for-facebook.html?_r=0">http://www.nytimes.com/2015/03/26/technology/drones-beaming-web-access-are-in-the-stars-for-facebook.html?_r=0</a>
Solar-powered aircraft around the world	<a href="http://www.solarimpulse.com/">http://www.solarimpulse.com/</a>

### A walking robot with hands (2.54) \*\*\*

The gait of the two-legged robot has been demonstrated outdoors, such as on forest paths. Four-legged robots can already walk smoothly in rugged terrain. A number of robots have been developed that can walk in a built-up environment. Honda's Asimo has demonstrated running movement and it remains standing when shoved. The hands of robots have also developed rapidly. A walking robot with hands has been demonstrated to perform simple household chores. The durability of batteries and smoothness of movements require further development. Mostly, the development of smooth gait and useful hands takes place in separate projects. The interfaces in robotisation are not yet mature enough for combining the best features without problems. Recommendation: incorporate the section on robot legs in item 2.70 and the section on robot hands in item 2.61.

Technology links after September 2013	
Two-legged robot walking outside	<a href="http://venturebeat.com/2015/08/15/watch-a-boston-dynamics-humanoid-robot-wander-around-outside/">http://venturebeat.com/2015/08/15/watch-a-boston-dynamics-humanoid-robot-wander-around-outside/</a>
Personal robot	<a href="http://spectrum.ieee.org/automaton/robotics/home-robots/robotbase-personal-robot">http://spectrum.ieee.org/automaton/robotics/home-robots/robotbase-personal-robot</a>
Robot walking across terrain	<a href="http://www.sciencedaily.com/releases/2015/10/151027132928.htm">http://www.sciencedaily.com/releases/2015/10/151027132928.htm</a>
Walking robot equipped with hands in the woods and warehouse	<a href="https://www.facebook.com/ThinkInc.org.au/videos/1072335462819210/?fref=nf">https://www.facebook.com/ThinkInc.org.au/videos/1072335462819210/?fref=nf</a>

### The cyber insect (2.55) \*

The development of extremely small robots has progressed, but slowly. The flight of an insect can now be imitated with a mosquito-sized gadget that, however, cannot carry its own power source. Robots have been developed that are the size of a cockroach and move like one. The applications include rescue operations, espionage and research. Recommendation: remove, due to low significance and slow progress.

Technology links after September 2013	
Cyber insect	<a href="http://www.popsci.com/article/technology/rise-insect-drones">http://www.popsci.com/article/technology/rise-insect-drones</a>
Flying/swimming microbot	<a href="http://www.smithsonianmag.com/innovation/robobees-can-fly-and-swim-whats-next-laser-vision-180957308">http://www.smithsonianmag.com/innovation/robobees-can-fly-and-swim-whats-next-laser-vision-180957308</a>
Robot cockroach, flexible structure	<a href="http://qz.com/616386/cockroaches-inspire-the-creation-of-a-cool-robot/">http://qz.com/616386/cockroaches-inspire-the-creation-of-a-cool-robot/</a>

### Robotic legs and exoskeleton that reinforces movement (2.70) \*\*\*\*

Robotic legs and gait assistants have developed rapidly. Honda is renting out a lightweight (2.6 kg) knee-lifting gait assistant at EUR 350 per month. Many companies have introduced robot legs and exoskeletons in the market for people with weak legs and for heavy jobs. Robotic legs are available also for patients with paralysed lower limbs. Robotic legs made of soft materials and artificial muscles are being experimented. Robotisation involves great advantages for the leg prosthesis industry. Robotised prostheses enable very natural-looking movements. The products are in a rapid stage of development and their spreading in the market is only beginning. Recommendation: retain.

Technology links after September 2013	
Robotic leg prostheses	<a href="http://www.ted.com/talks/hugh_herr_the_new_bionics_that_let_us_run_climb_and_dance">http://www.ted.com/talks/hugh_herr_the_new_bionics_that_let_us_run_climb_and_dance</a>
Exoskeleton for lifting (Korea)	<a href="http://cir.ca/news/daewoo-develops-heavy-lifting-exoskeleton-suit">http://cir.ca/news/daewoo-develops-heavy-lifting-exoskeleton-suit</a>

Technology links after September 2013	
Prosthetic leg with sense of touch	<a href="http://europe.newsweek.com/worlds-first-feeling-prosthetic-leg-revealed-328387">http://europe.newsweek.com/worlds-first-feeling-prosthetic-leg-revealed-328387</a>
Exoskeleton chair	<a href="http://edition.cnn.com/2014/08/20/tech/innovation/the-chairless-chair/index.html">http://edition.cnn.com/2014/08/20/tech/innovation/the-chairless-chair/index.html</a>
Augmented human – prosthesis summary	<a href="https://www.facebook.com/futurism/videos/520599168119287/?fref=nf">https://www.facebook.com/futurism/videos/520599168119287/?fref=nf</a>
Soft exoskeleton	<a href="http://www.technologyreview.com/news/530751/motorized-pants-to-help-soldiers-and-stroke-victims/">http://www.technologyreview.com/news/530751/motorized-pants-to-help-soldiers-and-stroke-victims/</a>
Robotic legs for paralysed patients	<a href="http://www.hs.fi/tiede/a1441168890154?jako=a829b8b0e33960c08e33e9dcef3a91ef&amp;ref=tw-share">http://www.hs.fi/tiede/a1441168890154?jako=a829b8b0e33960c08e33e9dcef3a91ef&amp;ref=tw-share</a>
Robotic leg prostheses	<a href="https://www.ted.com/talks/hugh_herr_the_new_bionics_that_get_us_run_climb_and_dance">https://www.ted.com/talks/hugh_herr_the_new_bionics_that_get_us_run_climb_and_dance</a>
Robotic leg prosthesis	<a href="http://bit.ly/1FMbFat">http://bit.ly/1FMbFat</a>
Honda rents out a gait assistant robot at EUR 350/month.	<a href="http://www.japantimes.co.jp/news/2015/07/22/business/tech/honda-start-leasing-walking-assistance-device/">http://www.japantimes.co.jp/news/2015/07/22/business/tech/honda-start-leasing-walking-assistance-device/</a>
Robotic leg prosthesis	<a href="https://www.youtube.com/watch?v=CDsNZJTWw0w">https://www.youtube.com/watch?v=CDsNZJTWw0w</a>
Robotic legs	<a href="http://gizmodo.com/wheelchair-bound-woman-walks-again-with-a-3d-printed-ex-1528719886">http://gizmodo.com/wheelchair-bound-woman-walks-again-with-a-3d-printed-ex-1528719886</a>
Gait assistant from Honda	<a href="http://www.youtube.com/watch?v=SLSOsy7MRHA">http://www.youtube.com/watch?v=SLSOsy7MRHA</a>

### (new) New power sources for vehicles (2.103)

Electric cars, electric aircrafts and electric ships are gradually becoming more common. Recovery of mechanical and potential energy improves their energy-efficiency. For example, partial capture of rolling friction reduces the energy-efficiency benefit of rail traffic compared with wheel traffic. Sweden is implementing trolley truck lines. In addition to electric cars, cars running on compressed air and hydrogen cell cars are being experimented. Recommendation: new category either for electric car technology or energy solutions for vehicles.

Technology links after September 2013	
Rolling friction into energy	<a href="http://www.eurekalert.org/pub_releases/2015-06/uow-nnh062915.php">http://www.eurekalert.org/pub_releases/2015-06/uow-nnh062915.php</a>
Compressed air/gas hybrid car	<a href="http://www.engadget.com/2014/10/03/citroen-airflow-2l-concept-hands-on/">http://www.engadget.com/2014/10/03/citroen-airflow-2l-concept-hands-on/</a>
Tesla 800 km on a single charge	<a href="http://nextbigfuture.com/2015/09/tesla-model-s-driven-452-miles-on.html">http://nextbigfuture.com/2015/09/tesla-model-s-driven-452-miles-on.html</a>
Compressed air car AIRPod	<a href="http://themindunleashed.org/2014/05/10000-car-runs-air.html">http://themindunleashed.org/2014/05/10000-car-runs-air.html</a>
Airless tyre (Michelin)	<a href="http://www.kauppalehti.fi/etusivu/michelin+avasi+ilmattomien+renkaiden+tehtaan/201411709584">http://www.kauppalehti.fi/etusivu/michelin+avasi+ilmattomien+renkaiden+tehtaan/201411709584</a>
Trolley truck in Sweden, electric car	<a href="http://www.helahalsingland.se/allmant/halsingland/nu-borjarden-varldsunika-elvagen-mellan-sandviken-och-storvik-byggas">http://www.helahalsingland.se/allmant/halsingland/nu-borjarden-varldsunika-elvagen-mellan-sandviken-och-storvik-byggas</a>

## **(new) Radical development of water-borne traffic (2.104)**

Unmanned ships are being planned for waterborne traffic. The advantages include no need for a crew, possibility to travel more slowly and optimisation of vessel size. New durable and light materials affect the structures of ships. Ships can also capture energy from wind through kite power plants, as well as wave and solar power. Vessels running on continuously renewable power are possible and they are being experimented with for research purposes. They may also be practical for monitoring purposes, as well as the transportation of inexpensive non-perishable materials and the collection of plastic pollution from the sea. Robotisation influences waterborne traffic, favouring inland navigation, as loading and unloading can be automated. Robotisation also influences ship structures, as quick foiling becomes automatic. Recommendation: new category.

<b>Technology links after September 2013</b>	
Plug-in hybrid ship	<a href="http://cleantechnica.com/2015/10/26/norway-plans-to-construct-a-fleet-of-plug-in-hybrid-ships/">http://cleantechnica.com/2015/10/26/norway-plans-to-construct-a-fleet-of-plug-in-hybrid-ships/</a>
Robotic ships RR+VTT	<a href="http://www.tekniikkatalous.fi/Liikenne/suomalaiset+kehittavat+automaattiohjaus-ta+laivoihin++kapteeni+tuijottaa+naytto/a1036716">http://www.tekniikkatalous.fi/Liikenne/suomalaiset+kehittavat+automaattiohjaus-ta+laivoihin++kapteeni+tuijottaa+naytto/a1036716</a>
SeaOrbiter funded	<a href="http://inhabitat.com/the-seaorbiter-futuristic-marine-research-vessel-reaches-crowdfunding-goal-nears-construction-start/">http://inhabitat.com/the-seaorbiter-futuristic-marine-research-vessel-reaches-crowdfunding-goal-nears-construction-start/</a>
Foiling	<a href="http://edition.cnn.com/videos/tv/2015/03/11/spc-mainsail-design-special-a.cnn">http://edition.cnn.com/videos/tv/2015/03/11/spc-mainsail-design-special-a.cnn</a>

## **7.5 Production of goods and services**

An important rising trend in goods production is the decentralisation of production enabled by flexible robotisation. Conventional automation systems have been rigid and difficult to decentralise. Typically, automation has promoted economies of scale, regional specialisation and global exchange. Flexibility is an important characteristic associated with robotisation and new production methods. Flexible production lines equipped with IT applications can manufacture short series and diverse products. At the extreme end of the development, a 3D printer or handy robot can manufacture almost any number of different products even individually. The strongest impact of this development may be the decentralisation of production, so that it comes closer to the market. Simple products can even be produced at home.

In service production, logistics have played an even more important role compared with the production of goods, excluding areas such as telephone services. Either the customer or the service provider has travelled to meet the other. Virtual reality is immaterialising an increasing number of services. Robotisation enables automated production of physical services. In addition to fully automated service, robotisation enables providing services through remote presence, so that the service provider and customer meet through a

machine in the service situation. For example, snow-ploughing can be controlled remotely, so that only the machine that physically performs the service goes to the customer’s place.

The transition in goods and service production has an impact on the character of jobs, the location of and need for work and the need for expertise. Robotisation and digitalisation will have a radical impact on jobs over the next twenty years.

Technological development after the publication of the TuV9/2013 report and needs for improvement related to reporting:

### 3D printing of goods (2.56) \*\*\*\*

The number of 3D printers and revenue from the business have multiplied since the publication of the previous report. Large players, such as Hewlett-Packard and Canon, are about to launch important products in the market. Methods are being developed faster, and the new printing methods are radically faster and more precise than their predecessors. The quality of the produced goods has also improved. The aviation industry is adopting 3D printing as a production method; the first mainly 3D-printed automobile is about to be launched; and high-quality optics have been 3D-printed successfully. 3D printing is rapidly evolving from a production method for prototypes and peculiarities into a commercial production method. The market is predicted to multiply by the beginning of 2020. Recommendation: retain.

Technology links after September 2013	
3D-microprinting of copper structures	<a href="http://phys.org/news/2016-01-copper-deposition-fabricate-tiny-3d.html">http://phys.org/news/2016-01-copper-deposition-fabricate-tiny-3d.html</a>
3D-printed cellulose	<a href="http://www.aalto.fi/fi/current/news/2015-11-05-007/">http://www.aalto.fi/fi/current/news/2015-11-05-007/</a>
3D-printed titanium bicycle	<a href="http://www.gizmag.com/3d-printed-titanium-bicycle-frame/30760/">http://www.gizmag.com/3d-printed-titanium-bicycle-frame/30760/</a>
3D-printed fully functional speaker	<a href="http://gizmodo.com/you-can-now-3d-print-a-fully-functional-speaker-1484084187">http://gizmodo.com/you-can-now-3d-print-a-fully-functional-speaker-1484084187</a>
3D-printed car in the market	<a href="http://www.forbes.com/sites/eshachhabra/2015/12/30/the-3d-printed-car-that-could-transform-the-auto-industry-on-sale-in-2016/">http://www.forbes.com/sites/eshachhabra/2015/12/30/the-3d-printed-car-that-could-transform-the-auto-industry-on-sale-in-2016/</a>
Individual 3D-printed products from Amazon	<a href="http://www.cnet.com/news/amazon-launches-store-to-sell-3d-printed-products/">http://www.cnet.com/news/amazon-launches-store-to-sell-3d-printed-products/</a>
3D-printed car	<a href="https://t.co/jkM47ycKTC">https://t.co/jkM47ycKTC</a>
Quick 3D-printing	<a href="http://wpo.st/Tf990">http://wpo.st/Tf990</a>
Multimaterial extrusion	<a href="http://www.eurekalert.org/pub_releases/2015-09/hu-plf092115.php">http://www.eurekalert.org/pub_releases/2015-09/hu-plf092115.php</a>
Efficient 3D-printing of metals	<a href="http://www.eurekalert.org/pub_releases/2016-01/nu-anw011116.php">http://www.eurekalert.org/pub_releases/2016-01/nu-anw011116.php</a>
3D-printed knee joint	<a href="http://techcrunch.com/2014/12/15/watch-doctors-successfully-3d-print-a-knee-joint/">http://techcrunch.com/2014/12/15/watch-doctors-successfully-3d-print-a-knee-joint/</a>

Technology links after September 2013	
3D-printing – market forecast 2020	<a href="http://techcrunch.com/2014/12/17/innovation-and-investment-in-3d-printing-surges/">http://techcrunch.com/2014/12/17/innovation-and-investment-in-3d-printing-surges/</a>
Improvement of metal printing – 10-fold speed	<a href="http://3dprint.com/116276/nvbots-launches-nvlabs/">http://3dprint.com/116276/nvbots-launches-nvlabs/</a>
3D-printed lenses	<a href="https://l.facebook.com/l.php?u=http%3A%2F%2Fyle.fi%2Ftuutiset%2Fnyt_se_on_todellisuutta_taysin_3d-tulostetut_silmalasi%2F7884470&amp;h=LAQHws7E5">https://l.facebook.com/l.php?u=http%3A%2F%2Fyle.fi%2Ftuutiset%2Fnyt_se_on_todellisuutta_taysin_3d-tulostetut_silmalasi%2F7884470&amp;h=LAQHws7E5</a>
Close manufacturing/Adidas	<a href="http://www.reuters.com/article/2015/10/20/us-adidas-robots-idUSKCN0SE1RL20151020">http://www.reuters.com/article/2015/10/20/us-adidas-robots-idUSKCN0SE1RL20151020</a>
3D-printing of ceramics (strong, precise)	<a href="http://www.popularmechanics.com/science/a18801/3d-printed-wonder-ceramics-wont-shatter/">http://www.popularmechanics.com/science/a18801/3d-printed-wonder-ceramics-wont-shatter/</a>
3D-printed graphene	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/graphene-filament-enables-fabrication-of-electronic-devices-with-3d-printing">http://spectrum.ieee.org/nanoclast/semiconductors/materials/graphene-filament-enables-fabrication-of-electronic-devices-with-3d-printing</a>
3D-printing of an electronic device	<a href="http://www.geek.com/chips/voxel8-3d-printer-can-print-a-complete-quadcopter-including-the-electronics-1613166/">http://www.geek.com/chips/voxel8-3d-printer-can-print-a-complete-quadcopter-including-the-electronics-1613166/</a>
HP MJF 3D-printer	<a href="http://www.engadget.com/2014/10/29/hp-multi-jet-fusion-3d-printer/">http://www.engadget.com/2014/10/29/hp-multi-jet-fusion-3d-printer/</a>
Growth of the 3D-printer market	<a href="http://usfinancepost.com/3d-printer-market-is-about-to-go-growth-fold-in-next-four-years-11511.html">http://usfinancepost.com/3d-printer-market-is-about-to-go-growth-fold-in-next-four-years-11511.html</a>
Miniaturisation of hydraulics (robot) through 3D-printing	<a href="http://www.technologyreview.com/view/544766/how-to-3-d-print-a-hydraulic-powered-robot/">http://www.technologyreview.com/view/544766/how-to-3-d-print-a-hydraulic-powered-robot/</a>
3D-printing of lenses	<a href="http://www.azom.com/article.aspx?ArticleID=11129">http://www.azom.com/article.aspx?ArticleID=11129</a>
3D-printing of cars	<a href="http://www.wired.com/autopia/2014/03/edag-3-d-printed-car/?mbid=social_twitter">http://www.wired.com/autopia/2014/03/edag-3-d-printed-car/?mbid=social_twitter</a>
3D-printed carbon fibre cast	<a href="http://www.iflscience.com/health-and-medicine/3d-printed-cast-speeds-bone-recovery-using-ultrasound">http://www.iflscience.com/health-and-medicine/3d-printed-cast-speeds-bone-recovery-using-ultrasound</a>
3D-colour coating method	<a href="http://www.eurekalert.org/pub_releases/2015-05/cuso-nct052215.php">http://www.eurekalert.org/pub_releases/2015-05/cuso-nct052215.php</a>
Inexpensive SLS laser on the basis of open-source code	<a href="http://www.eurekalert.org/pub_releases/2016-02/ru-mlc022116.php">http://www.eurekalert.org/pub_releases/2016-02/ru-mlc022116.php</a>

### 3D printing of buildings (2.57) \*\*

Chinese Winsun has printed the concrete elements for an apartment building. Finnish Fimatec has introduced the first 3D-printed prefabricated wall unit that includes, in addition to the concrete exterior and interior walls, concrete reinforcement and insulation. A steel bridge has been 3D-printed without support structures under the bridge being printed or the printing robots. Sculptural interior of a room has been 3D-printed. The printing of buildings is in the experimental stage, and this area can be expected to develop rather quickly. Recommendation: retain, change the name to 3D-printing of buildings and structures.

Technology links after September 2013	
3D-printing of houses in China	<a href="http://gizmodo.com/how-a-chinese-company-3d-printed-ten-houses-in-a-single-1557613229">http://gizmodo.com/how-a-chinese-company-3d-printed-ten-houses-in-a-single-1557613229</a>
3D-printing of buildings	<a href="http://www.taloussanomat.fi/ulkomaat/2014/04/19/kiinalaisyhtio-rakensi-kymmenen-kotia-valtavalla-3d-printterilla/20145607/12">http://www.taloussanomat.fi/ulkomaat/2014/04/19/kiinalaisyhtio-rakensi-kymmenen-kotia-valtavalla-3d-printterilla/20145607/12</a>
3D-printed bridge MX-3D	<a href="https://www.youtube.com/watch?v=NFFOQQIQDXE">https://www.youtube.com/watch?v=NFFOQQIQDXE</a>
Fimatec 3D printer for concrete	<a href="http://3dprint.com/75836/fimatec-3d-printed-homes/">http://3dprint.com/75836/fimatec-3d-printed-homes/</a>
3D-printed steel bridge	<a href="http://voc.tv/1cRrjAQ">http://voc.tv/1cRrjAQ</a>
3D-printed room	<a href="http://www.youtube.com/watch?v=BV_6QUXFnuE">http://www.youtube.com/watch?v=BV_6QUXFnuE</a>
3D-printed apartment building (Winsun)	<a href="http://3dprint.com/38144/3d-printed-apartment-building/">http://3dprint.com/38144/3d-printed-apartment-building/</a>

### Sensitive robot fingers and hands capable of remote work (2.61) \*\*\*

Sense of touch-enabling materials have advanced so that it is possible to equip robot fingers and prostheses with a sense of touch that is more sensitive than the human finger. Flexible materials for robot hands have been tested. Robot hands have been developed into prostheses that can be controlled by thoughts, or nerves from the arm can be connected to them. The sense of touch of separate robot hands used for remote work can also be connected to be sensed by humans. Instruments have been developed for remote controlling of robot hands that recognise the exact position of the human hand and pass the sense of touch from robot fingers to human fingers. Cooking with robot hands installed in the kitchen has been demonstrated very convincingly, using cooking methods and utensils that humans use. Recommendation: retain.

Technology links after September 2013	
Sensitive robot hand for remote work	<a href="https://www.shadowrobot.com/products/dexterous-hand/">https://www.shadowrobot.com/products/dexterous-hand/</a>
Kitchen robot (high-quality hands)	<a href="https://www.facebook.com/thisisinsider/videos/1502461713394555/">https://www.facebook.com/thisisinsider/videos/1502461713394555/</a>
Sensitive robot fingers with artificial muscles	<a href="http://europe.newsweek.com/robotic-fingers-use-artificial-muscles-lift-eggs-without-breaking-them-421701?rm=eu">http://europe.newsweek.com/robotic-fingers-use-artificial-muscles-lift-eggs-without-breaking-them-421701?rm=eu</a>
Robot hand senses touch	<a href="http://edition.cnn.com/2015/09/15/health/prosthetic-hand-senses-touch/index.html">http://edition.cnn.com/2015/09/15/health/prosthetic-hand-senses-touch/index.html</a>
Synthetic skin with sense of touch	<a href="http://www.cnet.com/news/prosthetic-smart-skin-can-feel-all-of-the-things/">http://www.cnet.com/news/prosthetic-smart-skin-can-feel-all-of-the-things/</a>
Sensitive robot hand	<a href="http://news.mit.edu/2015/soft-robotic-hand-can-pick-and-identify-wide-array-of-objects-0930">http://news.mit.edu/2015/soft-robotic-hand-can-pick-and-identify-wide-array-of-objects-0930</a>

### **Robo-tailoring (2.62) \***

As regards robo-tailoring plans, only the imaging of the human body, that is, automatic measuring, is currently becoming reality. Fitting rooms that measure the body and prepare a 3D model for the sewing of clothes are coming to the market. Robotised manufacture of accessories according to the customer's individual measurements has progressed for shoes, according to the reports from Adidas. However, there are no reports available on the progress of robo-tailoring in the making of clothes. Thus, the progress is not as fast as expected. Recommendation: remove.

### **(new) New methods for transferring goods/materials (2.106)**

In industrial manufacturing, components or materials are transferred between locations. Transfer methods have changed very rarely. However, inventions such as the assembly line had a great impact on manufacturing processes and even the products themselves. It has been found that material and objects can be transferred using sound waves. On the other hand, shapeshifting surfaces have been successfully developed, and they can move objects. A water-based 'tractor beam' has been created. A modular table surface is more flexible than a conveyor belt, transferring objects in two dimensions in a precise manner. The use of quadcopters equipped with cables for the assembly and picking of goods could possibly also be included in this group. Recommendation: describe a new category for transfer related to the manufacture and picking of goods.

<b>Technology links after September 2013</b>	
'Tractor beam' in water	<a href="http://www.sciencealert.com.au/news/20141108-26002.html">http://www.sciencealert.com.au/news/20141108-26002.html</a>
Soundwave-based manipulation of materials	<a href="http://futurism.com/links/new-class-of-sound-wave/">http://futurism.com/links/new-class-of-sound-wave/</a>
Shapeshifting surface	<a href="https://www.facebook.com/verge/videos/979655132070830/?fref=nf">https://www.facebook.com/verge/videos/979655132070830/?fref=nf</a>
Motorised 3D table surface	<a href="http://www.dezeen.com/2014/04/16/mit-media-lab-transform-table-technology-milan-2014/">http://www.dezeen.com/2014/04/16/mit-media-lab-transform-table-technology-milan-2014/</a>
Soundwave levitation	<a href="http://www.kurzweilai.net/holographic-sonic-tractor-beam-lifts-and-moves-objects-using-soundwaves">http://www.kurzweilai.net/holographic-sonic-tractor-beam-lifts-and-moves-objects-using-soundwaves</a>

### **(new) Robotic manufacturing/service (2.107)**

Service robotics are expected to grow faster than other robotics. Industrial robotics are also becoming more flexible. In the future, it may be difficult to distinguish between industrial and service robotics, if this flexibility means that the manufacture of goods is transferred from the industrial sector to the service sector. In the field of robotics, studies have been conducted on self-assembling robots, waste sorting robots, robotic parking systems, robotic cooks, robotic waiters and a number of other robots related to services

and manufacturing. Recommendation: One or two new categories should be established in the field of robotic manufacturing and services.

Technology links after September 2013	
Yumi assembly robot	<a href="http://new.abb.com/products/robotics/yumi">http://new.abb.com/products/robotics/yumi</a>
Trash collector robot	<a href="http://www.theverge.com/2015/9/16/9336229/volvos-robots-roar-trash-collection">http://www.theverge.com/2015/9/16/9336229/volvos-robots-roar-trash-collection</a>
Digitalisation of engineering workshops – flowing production	<a href="http://www.hermiagroup.fi/champion/TTP_Lehtonen.pdf">http://www.hermiagroup.fi/champion/TTP_Lehtonen.pdf</a>
Robotic parking	<a href="https://www.facebook.com/bintjbeil.org/videos/849625878437994/?fref=nf">https://www.facebook.com/bintjbeil.org/videos/849625878437994/?fref=nf</a>
MIT review of the state of robotics in 2015	<a href="http://www.technologyreview.com/news/544901/what-robots-and-ai-learned-in-2015/">http://www.technologyreview.com/news/544901/what-robots-and-ai-learned-in-2015/</a>
Robotic cook 2017	<a href="http://www.bbc.com/news/science-environment-32282131">http://www.bbc.com/news/science-environment-32282131</a>
Co-operation between humans and robots	<a href="http://qz.com/255093/human-workers-will-take-orders-from-robots-and-they-will-like-it/">http://qz.com/255093/human-workers-will-take-orders-from-robots-and-they-will-like-it/</a>
Self-assembling robot	<a href="http://gizmodo.com/this-tiny-self-folding-robot-will-destroy-itself-when-i-1707655885">http://gizmodo.com/this-tiny-self-folding-robot-will-destroy-itself-when-i-1707655885</a>
Roof trusses made by robots	<a href="http://www.trussmatic.fi/">http://www.trussmatic.fi/</a>
Self-repair techniques for robots	<a href="http://cacm.acm.org/magazines/2016/2/197416-self-repair-techniques-point-to-robots-that-design-themselves/fulltext">http://cacm.acm.org/magazines/2016/2/197416-self-repair-techniques-point-to-robots-that-design-themselves/fulltext</a>

**(new) Ubique environment (IOT) (2.108)**

The built environment is becoming increasingly intelligent and interactive. The IOT development is mainly the development of the intelligence immersed in our environment. An example is on-demand street lighting. Recommendation: identify one important technology in this domain, such as NFC, the spreading of which will have a significant impact.

Technology links after September 2013	
Street lighting on demand	<a href="http://www.tekniikkatalous.fi/innovaatiot/90+miljoonaa+katuvaloa++suomalainen+startup+aikoo+valloittaa+ne+kaikki/a1028485">http://www.tekniikkatalous.fi/innovaatiot/90+miljoonaa+katuvaloa++suomalainen+startup+aikoo+valloittaa+ne+kaikki/a1028485</a>
NFC-based user interface (IOT?)	<a href="http://vimeo.com/96316406">http://vimeo.com/96316406</a>
IOT – the big picture	<a href="https://www.linkedin.com/pulse/article/20140925043829-1409028-what-is-internet-of-things?rk=object-photo">https://www.linkedin.com/pulse/article/20140925043829-1409028-what-is-internet-of-things?rk=object-photo</a>
IOT development	<a href="https://www.facebook.com/photo.php?fbid=10152009298118472&amp;set=gm.504216893029255&amp;type=3">https://www.facebook.com/photo.php?fbid=10152009298118472&amp;set=gm.504216893029255&amp;type=3</a>
Inexpensive IOT controller	<a href="https://www.olimex.com/Products/IoT/ESP8266-EVB/open-source-hardware">https://www.olimex.com/Products/IoT/ESP8266-EVB/open-source-hardware</a>
Paper surface with artificial sensory functions	<a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/paper-skin-mimics-the-real-thing">http://spectrum.ieee.org/tech-talk/biomedical/devices/paper-skin-mimics-the-real-thing</a>

## **7.6 Material technology**

At the research level, the development of nanotechnology is fast. Nanomaterials have been launched in the market in the form of various coatings that make surfaces frictionless, dirt-repellent or electronically and optically active. Many nanomaterials can also now be produced as three-dimensional structures and so cost-efficiently that they can be used for purposes that require mechanical strength or other special characteristics. Nanomaterials are also used as composites.

In the future, the new materials will have a substantial impact on electronics, optics, electromechanics and other mechanics, construction, chemical and biological processes and a vast number of product features. As a result of the great change in material technology, industry will have to modify its processes, product design and product characteristics. According to preliminary estimates, the change in goods manufacturing will be as remarkable as the change that resulted from the advent of iron or plastics.

Technological development after the publication of the TuV9/2013 report and needs for improvement related to reporting:

### **Magnetic or superconductor based levitation (2.50) \***

Technology related to magnetic locking and levitation achieved through superconductors has not progressed very much after the previous report. The low temperature associated with superconductors continues to be a problem. Even though there has been news about lithium-coated graphene that works like a superconductor, other than nanoscale applications have not been speculated for this. Recommendation: incorporate in item 2.79.

### **3D and 4D printing of material (2.58) \*\***

3D printing of pharmaceuticals and food has progressed. Electronically and optically as well as chemically active material structures have been printed. Shapeshifting materials have been printed, and printing techniques that can mix different materials during printing have been introduced. The progress has been relatively fast. Recommendation: retain.

Technology links after September 2013	
3D printing of medicines	<a href="http://www.theguardian.com/science/2013/oct/13/craig-ventner-mars">http://www.theguardian.com/science/2013/oct/13/craig-ventner-mars</a>
Nano-level printing of graphene structures	<a href="http://3dprint.com/27324/graphene-nano-3d-print/">http://3dprint.com/27324/graphene-nano-3d-print/</a>
3D printed medicine/FDA	<a href="http://www.washingtonpost.com/news/to-your-health/wp/2015/08/04/fdas-approval-of-first-3-d-printed-pill-opens-up-endless-possibilities-for-personalized-medicine/">http://www.washingtonpost.com/news/to-your-health/wp/2015/08/04/fdas-approval-of-first-3-d-printed-pill-opens-up-endless-possibilities-for-personalized-medicine/</a>
3D printed rhino horn	<a href="http://www.digitaljournal.com/news/environment/biotech-firm-creates-fake-rhino-horn-to-help-save-real-rhinos/article/436325">http://www.digitaljournal.com/news/environment/biotech-firm-creates-fake-rhino-horn-to-help-save-real-rhinos/article/436325</a>
Foodini 3D food printer	<a href="http://www.cnn.com/2014/11/06/tech/innovation/foodini-machine-print-food/index.html?sr=sharebar_facebook">http://www.cnn.com/2014/11/06/tech/innovation/foodini-machine-print-food/index.html?sr=sharebar_facebook</a>
Quick nanoscale 3D manufacturing using electron beam	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/nanotechnology/electron-beam-nanofabrication-made-up-to-five-thousand-times-faster">http://spectrum.ieee.org/nanoclast/semiconductors/nanotechnology/electron-beam-nanofabrication-made-up-to-five-thousand-times-faster</a>

### Nanosurfaces that convert air moisture to water (2.63) \*

New methods are continuously being developed for the purification of water to make it drinkable or usable for cultivation, as well as methods for collecting water from air moisture. The fastest-progressing methods have been condensation and separation methods that use electricity. Recommendation: change the name to Production of fresh water from air moisture and salty/dirty water.

Technology links after September 2013	
Water from air	<a href="http://timesofindia.indiatimes.com/home/science/Now-a-machine-that-makes-drinking-water-from-thin-air/articleshow/34332827.cms">http://timesofindia.indiatimes.com/home/science/Now-a-machine-that-makes-drinking-water-from-thin-air/articleshow/34332827.cms</a>

### Artificial muscles (2.65) \*\*

A sensitive, functional robotic hand has been fabricated from memory material that contracts as muscles. The functioning of shape-memory materials, or artificial muscle materials, is based on moisture, heat, electric current, etc. Shape-memory metal has been tested to endure millions of transformations. Artificial muscles may be a hundred or even a thousand times stronger than a human myofibril of similar size. The development is relatively extensive and rapid. Recommendation: retain.

Technology links after September 2013	
Artificial muscle powered by moisture	<a href="http://qz.com/429309/these-machines-can-capture-a-new-source-of-clean-energy-evaporating-water/">http://qz.com/429309/these-machines-can-capture-a-new-source-of-clean-energy-evaporating-water/</a>
Artificial muscles – robotic hand	<a href="http://www.scienceworldreport.com/articles/23648/20150325/new-robotic-hand-respond-sensitively-muscles-created-smart-wires.htm">http://www.scienceworldreport.com/articles/23648/20150325/new-robotic-hand-respond-sensitively-muscles-created-smart-wires.htm</a>
Biobot/artificial muscle	<a href="https://www.youtube.com/watch?v=skCzl7FIM34">https://www.youtube.com/watch?v=skCzl7FIM34</a>
Shape-memory metal remains strong after millions of transformations	<a href="http://www.popularmechanics.com/technology/a15773/shape-shifting-metal-alloy/">http://www.popularmechanics.com/technology/a15773/shape-shifting-metal-alloy/</a>
Artificial muscles	<a href="http://mashable.com/2014/07/14/shape-shifting-robot/">http://mashable.com/2014/07/14/shape-shifting-robot/</a>
Synthetic muscle	<a href="http://www.eurekalert.org/pub_releases/2015-01/du-fch011315.php">http://www.eurekalert.org/pub_releases/2015-01/du-fch011315.php</a>
Shapeshifting materials from fibres	<a href="http://spectrum.ieee.org/tech-talk/computing/hardware/4d-printing-turns-carbon-fiber-wood-into-shapeshifting-programmable-materials">http://spectrum.ieee.org/tech-talk/computing/hardware/4d-printing-turns-carbon-fiber-wood-into-shapeshifting-programmable-materials</a>
Synthetic micromuscles	<a href="http://nextbigfuture.com/2013/12/a-micro-muscular-break-through-1000.html">http://nextbigfuture.com/2013/12/a-micro-muscular-break-through-1000.html</a>
Synthetic muscle 100 times stronger	<a href="https://www.sciencerecorder.com/news/2014/02/22/could-superhero-muscle-solve-problem-of-muscle-waste-in-space/">https://www.sciencerecorder.com/news/2014/02/22/could-superhero-muscle-solve-problem-of-muscle-waste-in-space/</a>

### Artificial, self-renewing skin (2.66) \*

After the publication of the previous report, at least two important self-healing materials have been found. Researchers at IBM have developed a polymer that is stronger than bone, recyclable, lightweight, corrosion-resistant and self-healing. Smithsonian has developed a material that heals itself quickly in an anoxic space. Recommendation: retain.

Technology links after September 2013	
Self-healing polymer	<a href="http://www.gizmag.com/ibm-polymer-discovery-plastic/32088/">http://www.gizmag.com/ibm-polymer-discovery-plastic/32088/</a>
Self-healing plastic	<a href="http://www.smithsonianmag.com/innovation/this-plastic-heals-itself-180956495/">http://www.smithsonianmag.com/innovation/this-plastic-heals-itself-180956495/</a>

### New building materials that replace reinforced concrete (2.73) \*

This domain has progressed to some extent. Carbon-neutral cement is being developed at a number of locations, including Finland. Porous, water-permeable cement will probably find applications in buildings and the built-up environment. Quick-setting cement suitable for 3D printing, fibre-based steel-replacing reinforcement materials for tensile strength and new fillers are being developed. Recommendation: retain.

Technology links after September 2013	
Concrete substitutes in Finland	<a href="https://www.kamk.fi/en/Business-Services/Research-and-Development/Mechanical-and-Mining/GeoMaterials">https://www.kamk.fi/en/Business-Services/Research-and-Development/Mechanical-and-Mining/GeoMaterials</a>
Porous concrete	<a href="https://www.facebook.com/techinsider/videos/419013808296981/?fref=nf">https://www.facebook.com/techinsider/videos/419013808296981/?fref=nf</a>
Emission-free concrete substitute	<a href="http://www.pbs.org/newshour/bb/cement-alternative-absorbs-carbon-dioxide-like-sponge/">http://www.pbs.org/newshour/bb/cement-alternative-absorbs-carbon-dioxide-like-sponge/</a>
Carbon-neutral cement	<a href="http://nextbigfuture.com/2015/09/carbon-neutral-cement-manufacturing.html">http://nextbigfuture.com/2015/09/carbon-neutral-cement-manufacturing.html</a>
Bacterial curing of bricks at room temperature	<a href="http://www.inc.com/kevin-j-ryan/best-industries-2016-sustainable-building-materials.html">http://www.inc.com/kevin-j-ryan/best-industries-2016-sustainable-building-materials.html</a>

### Antibacterial and other dirt repellent materials and surfaces (2.74) \*\*\*\*

Antibacterial and other dirt repellent surfaces are continuously being developed of nanomaterials. For example, nanocarbon coating has been found to prevent freezing of an aircraft's wings. Self-cleaning, self-healing painted surface and the use of copper for antibacterial surfaces are research findings that have emerged after the publication of the previous report. Recommendation: retain.

Technology links after September 2013	
Self-cleaning painted surface	<a href="http://www.scienceworldreport.com/articles/23182/20150310/new-tough-paint-super-water-repellent-self-cleans-video.htm">http://www.scienceworldreport.com/articles/23182/20150310/new-tough-paint-super-water-repellent-self-cleans-video.htm</a>
Antibacterial surfaces	<a href="http://www.eurekalert.org/pub_releases/2015-11/uos-uct110915.php">http://www.eurekalert.org/pub_releases/2015-11/uos-uct110915.php</a>

### Carbon nanotube yarn or thread (2.75) \*\*

Great progress has been made in the spinning of carbon nanofibres. In practice, however, the fibres are still far from the strength enabled by the theoretical structure of graphene and carbon nanotubes, and they are still lagging behind conventional carbon fibres. Furthermore, despite their rapid development, the production methods are still expensive. However, it seems evident that as techniques evolve, nanocarbons will surpass carbon fibres and many other materials in many applications, just as they should in theory. Other strong fibres are being developed on the basis of spider webs, etc. However, practical applications will not be seen for some time yet. Recommendation: retain, change the name to Nanomaterials as strong fibres and reinforcement materials in composites.

Technology links after September 2013	
Growing laser nanowires	<a href="http://www.eurekalert.org/pub_releases/2015-04/uow-snm041015.php">http://www.eurekalert.org/pub_releases/2015-04/uow-snm041015.php</a>
Conductive graphene yarn	<a href="http://www.gizmag.com/stretchable-graphene-yarn/32657/">http://www.gizmag.com/stretchable-graphene-yarn/32657/</a>
Spinning of nanofibres	<a href="http://www.eurekalert.org/pub_releases/2015-06/miot-unp060415.php">http://www.eurekalert.org/pub_releases/2015-06/miot-unp060415.php</a>
Extensive review of nano carbon fibres	<a href="http://www.sciencedirect.com/science/article/pii/S1369702115002084">http://www.sciencedirect.com/science/article/pii/S1369702115002084</a>
Mass production of spider web	<a href="http://www.wired.com/2015/06/bolt-threads-spider-silk/?mbid=social_fb">http://www.wired.com/2015/06/bolt-threads-spider-silk/?mbid=social_fb</a>
Strong spider web launched in the market	<a href="https://l.facebook.com/l.php?u=http%3A%2F%2Fwww.iflscience.com%2Ftechnology%2Fsuperhero-strength-spider-silk-coming-market&amp;h=-AQHoFJ06">https://l.facebook.com/l.php?u=http%3A%2F%2Fwww.iflscience.com%2Ftechnology%2Fsuperhero-strength-spider-silk-coming-market&amp;h=-AQHoFJ06</a>
Graphen fibre conductors	<a href="http://phys.org/news/2015-09-layering-technique-graphene-fiber-strength.html - jCp">http://phys.org/news/2015-09-layering-technique-graphene-fiber-strength.html - jCp</a>
Magnetospinning of nanofibres	<a href="http://www.eurekalert.org/pub_releases/2015-05/uog-rdn052015.php">http://www.eurekalert.org/pub_releases/2015-05/uog-rdn052015.php</a>

### Nanocarbons in salt or bacteria removal and other separation techniques based on nanocarbons (2.76) \*

Nanocarbons are becoming increasingly promising materials in separation technology. In water purification, there is promise of less rapid filter blocking and lower need for energy. Compared with conventional techniques, the separation accuracy of nanocarbons is often much better. Graphene has been successfully tested for the filtering of nuclear waste and the filtering of different gases. Researchers have succeeded in developing a diode for the separation of fluids; part of the fluid is flowing only in one direction. Recommendation: change the heading to New separation techniques and move the section on water purification to item 2.63.

Technology links after September 2013	
Diode for fluids	<a href="http://physics.aps.org/synopsis-for/10.1103/PhysRevLett.115.134503">http://physics.aps.org/synopsis-for/10.1103/PhysRevLett.115.134503</a>
Water purification	<a href="http://spectrum.ieee.org/energywise/energy/environment/shocking-trick-to-desalinate-water">http://spectrum.ieee.org/energywise/energy/environment/shocking-trick-to-desalinate-water</a>
Graphene filter for nuclear waste	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/graphene-filter-offers-a-tenfold-reduction-in-energy-requirements-for-cleaning-nuclear-waste">http://spectrum.ieee.org/nanoclast/semiconductors/materials/graphene-filter-offers-a-tenfold-reduction-in-energy-requirements-for-cleaning-nuclear-waste</a>
Water purification with graphene	<a href="http://phys.org/news/2014-02-graphene-affair.html">http://phys.org/news/2014-02-graphene-affair.html</a>
New filtering method for heavy metals	<a href="http://www.eurekalert.org/pub_releases/2016-01/ez-heh012216.php">http://www.eurekalert.org/pub_releases/2016-01/ez-heh012216.php</a>
Energy-efficient separation of salt from water	<a href="http://interestingengineering.com/mit-discovers-new-way-to-separate-salt-from-water/">http://interestingengineering.com/mit-discovers-new-way-to-separate-salt-from-water/</a>
Porous liquid	<a href="http://www.eurekalert.org/pub_releases/2015-11/qub-qub111115.php">http://www.eurekalert.org/pub_releases/2015-11/qub-qub111115.php</a>

Mining-water purification using electric charge	<a href="http://www.eurekalert.org/pub_releases/2015-12/uof-qcn121015.php">http://www.eurekalert.org/pub_releases/2015-12/uof-qcn121015.php</a>
Water desalination using battery technology	<a href="http://www.eurekalert.org/pub_releases/2016-02/uoia-btc020416.php">http://www.eurekalert.org/pub_releases/2016-02/uoia-btc020416.php</a>

### Nanocarbon as a reinforcement or functional surface (2.77) \*\*

Nanocarbons have been tested as reinforcement material, conductivity enhancers and surfaces that prevent corrosion or ice. Nanocarbons are already in use in applications such as touch screens. The category is scattered and partially overlapping with other domains. Recommendation: remove, incorporate the reinforcement aspect in item 2.75.

Technology links after September 2013	
Graphene coating keeps wing ice-free	<a href="http://www.eurekalert.org/pub_releases/2016-01/ru-gcm012516.php">http://www.eurekalert.org/pub_releases/2016-01/ru-gcm012516.php</a>
Carbon improves the insulation of conductors	<a href="http://www.nyteknik.se/nyheter/energi_miljo/vindkraft/article3879035.ece">http://www.nyteknik.se/nyheter/energi_miljo/vindkraft/article3879035.ece</a>

### Materials that levitate on nanolevel (2.79) \*

Better understanding of nanolevel phenomena and improved simulation models have resulted in considerable progress in the area of frictionless surfaces. Acoustic levitation, increasingly inexpensive magnetic levitation solutions and frictionless surfaces provide a potential solution for many problems related to machines, surfaces of the built-up environment and measuring devices. Recommendation: retain, extend the heading to Frictionless materials and levitation.

Technology links after September 2013	
Frictionless material	<a href="http://www.sciencedaily.com/releases/2015/07/150721194001.htm">http://www.sciencedaily.com/releases/2015/07/150721194001.htm</a>
Acoustic levitation	<a href="http://www.tekniikkatalous.fi/innovaatiot/akustinen+levitaatio+paranee++aani+saa+pienet+esineet+leijumaan+ja+liikkumaan+ilmassa/a1040361?service=mobile">http://www.tekniikkatalous.fi/innovaatiot/akustinen+levitaatio+paranee++aani+saa+pienet+esineet+leijumaan+ja+liikkumaan+ilmassa/a1040361?service=mobile</a>
Frictionless surface	<a href="http://www.rsc.org/chemistryworld/2015/05/graphene-wrapped-diamond-ball-bearings-cut-friction-nothing">http://www.rsc.org/chemistryworld/2015/05/graphene-wrapped-diamond-ball-bearings-cut-friction-nothing</a>

### Ultralight and strong materials (2.80) \*\*\*

Aerogels are the lightest strong materials known, even lighter than air. Their production techniques have improved. Aerogels have been found to be excellent insulators in layers that are one order of magnitude thinner than conventional insulation materials. Moreover, ultralight and strong materials enable the development of new, more energy-efficient flying or floating devices. For example, aluminium foam has been produced that is lighter than water and strong enough to be used for the main body of a ship. A material that is twice as strong as steel in proportion to weight has been developed of magnesium alloy. Carbon fibre can now be 3D printed and cured with electricity. Welded joints have been made essentially stronger than before, enabling lighter steel structures. A strong glue bond has been developed for metals. It is considered possible to build a 20 kilometres high tower using the new materials. Access to space would be essentially less expensive from the top of such tower. This domain has developed very fast. Recommendation: retain.

Technology links after September 2013	
Light and strong magnesium alloy	<a href="http://www.eurekalert.org/pub_releases/2015-12/uoc--urc122315.php">http://www.eurekalert.org/pub_releases/2015-12/uoc--urc122315.php</a>
Strong welded joint	<a href="http://www.eurekalert.org/pub_releases/2015-10/osu-mco102915.php">http://www.eurekalert.org/pub_releases/2015-10/osu-mco102915.php</a>
Lightweight metal foams	<a href="http://www.eurekalert.org/pub_releases/2015-07/ncsu-sfm071715.php">http://www.eurekalert.org/pub_releases/2015-07/ncsu-sfm071715.php</a>
Aerogel as thermal insulation material	<a href="http://www.tekniikkatalous.fi/tekniikka/kemia/2012-02-02/Halpa-aerogeeli-on-tulevaisuuden-supereriste-3307075.html">http://www.tekniikkatalous.fi/tekniikka/kemia/2012-02-02/Halpa-aerogeeli-on-tulevaisuuden-supereriste-3307075.html</a>
Strong aluminium foam	<a href="http://www.wired.com/2014/12/aluminum-foam-trains/">http://www.wired.com/2014/12/aluminum-foam-trains/</a>
Electrical curing of carbon fibre	<a href="http://www.eurekalert.org/pub_releases/2015-04/miot-tam041415.php">http://www.eurekalert.org/pub_releases/2015-04/miot-tam041415.php</a>
Floating metal foam	<a href="http://www.eurekalert.org/pub_releases/2015-05/nyup-amc051215.php">http://www.eurekalert.org/pub_releases/2015-05/nyup-amc051215.php</a>
Lightweight and strong materials	<a href="http://www.eurekalert.org/pub_releases/2015-12/dbnl-tam121115.php">http://www.eurekalert.org/pub_releases/2015-12/dbnl-tam121115.php</a>
Strong and light lattice structure through pyrolysis	<a href="http://www.nature.com/nmat/journal/vaop/ncurrent/full/nmat4561.html">http://www.nature.com/nmat/journal/vaop/ncurrent/full/nmat4561.html</a>
Metallic glue bond	<a href="http://phys.org/news/2016-01-metallic-soldering-welding.html">http://phys.org/news/2016-01-metallic-soldering-welding.html</a>
3D printable aerogel	<a href="http://www.eurekalert.org/pub_releases/2015-04/dlnl-co042215.php">http://www.eurekalert.org/pub_releases/2015-04/dlnl-co042215.php</a>
20 km high tower	<a href="http://nextbigfuture.com/2015/08/canadian-inflated-tower-would-be-20.html">http://nextbigfuture.com/2015/08/canadian-inflated-tower-would-be-20.html</a>
Titanium strength at 1/10 of the price	<a href="http://www.roadandtrack.com/new-cars/car-technology/a24939/new-steel-alloy-titanium/">http://www.roadandtrack.com/new-cars/car-technology/a24939/new-steel-alloy-titanium/</a>

### Spray-on textiles (2.81) \*\*

Fabrican is still the only possessor of the technology. Recommendation: remove, due to slow progress.

## (new) Production of graphene and other nanocarbons (2.109)

Nanocarbons have been found to possess dozens of very exceptional characteristics. These characteristics are associated with the nanostructures of materials; the size of uniform surfaces; the integrity of strands or faultlessness of the surface; and possible blend components, laminates and other molecules joined to the surface. AMI has increased its graphene production to a thousand tons. The price of a flawless graphene crystal is falling rapidly, which enables producing larger touchscreen surfaces using graphene. High-quality graphene is produced by treating inexpensive plastic with a laser beam, using the so-called LIG method. Production methods are developing rapidly. In addition to new characteristics, they make the use of nanocarbons in an increasing number of applications financially realistic. Recommendation: add nanocarbon production methods as a new area to be monitored.

Technology links after September 2013	
CNT, Graphene & optical transistors	<a href="http://www.eurekaalert.org/pub_releases/2015-09/nurcn090815.php">http://www.eurekaalert.org/pub_releases/2015-09/nurcn090815.php</a>
Several news about graphene	<a href="http://phys.org/news/2014-12-future-batteries-lithium-sulfur-graphene-wrapper.html">http://phys.org/news/2014-12-future-batteries-lithium-sulfur-graphene-wrapper.html</a>
Price of flawless graphene crystal falls	<a href="http://nextbigfuture.com/2015/01/price-of-flawless-graphene-will-be.html">http://nextbigfuture.com/2015/01/price-of-flawless-graphene-will-be.html</a>
Graphene improves thermal conductivity of PET plastic	<a href="http://physicsworld.com/cws/article/news/2014/oct/28/graphene-boosts-thermal-conductivity-of-popular-plastic">http://physicsworld.com/cws/article/news/2014/oct/28/graphene-boosts-thermal-conductivity-of-popular-plastic</a>
Less expensive graphene production	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/new-production-method-could-make-graphene-100-times-cheaper-to-manufacture">http://spectrum.ieee.org/nanoclast/semiconductors/materials/new-production-method-could-make-graphene-100-times-cheaper-to-manufacture</a>
Very affordable graphene	<a href="http://delta.tudelft.nl/article/making-graphene-affordable/29377">http://delta.tudelft.nl/article/making-graphene-affordable/29377</a>
Energy-efficiency of graphene production	<a href="http://www.popularmechanics.com/science/a14651/this-scientist-invented-a-simply-way-to-mass-produce-graphene/">http://www.popularmechanics.com/science/a14651/this-scientist-invented-a-simply-way-to-mass-produce-graphene/</a>
LIG graphene	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/nanotechnology/graphenebased-supercapacitors-enable-wearable-electronics">http://spectrum.ieee.org/nanoclast/semiconductors/nanotechnology/graphenebased-supercapacitors-enable-wearable-electronics</a>
Graphene production in China	<a href="http://english.eastday.com/e/131226/u1a7852709.html">http://english.eastday.com/e/131226/u1a7852709.html</a>
Faultless graphene surfaces for displays from Samsung	<a href="http://androidcommunity.com/samsung-producing-graphene-the-material-for-flexible-displays-20140404/">http://androidcommunity.com/samsung-producing-graphene-the-material-for-flexible-displays-20140404/</a>
AMI's graphene production to reach 1,000 tons in 2016	<a href="http://www.nanotech-now.com/news.cgi?story_id=52605">http://www.nanotech-now.com/news.cgi?story_id=52605</a>
High-quality graphene surface on sodium glass for electronic applications	<a href="http://phys.org/news/2016-02-scientists-common-glass-optimize-graphene.html">http://phys.org/news/2016-02-scientists-common-glass-optimize-graphene.html</a>

## A collection of material technology breakthroughs that need to be categorised (2.500)

Material technology is progressing rapidly. New opportunities become available in the fields of physics, chemistry and biology. Recommendation: identify one new category, possibly relating to clothing or wearable electronics.

Technology links after September 2013	
Nanomaterials for textiles	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/capabilities-of-nanomaterials-in-textiles-continue-to-expand">http://spectrum.ieee.org/nanoclast/semiconductors/materials/capabilities-of-nanomaterials-in-textiles-continue-to-expand</a>
Flexible RAM memory	<a href="http://www.eurekalert.org/pub_releases/2015-06/tkai-akr061515.php">http://www.eurekalert.org/pub_releases/2015-06/tkai-akr061515.php</a>
Heat-controlling textiles	<a href="http://www.technologyreview.com/view/539626/how-next-generation-fabrics-will-keep-you-cool-in-summer-heat/">http://www.technologyreview.com/view/539626/how-next-generation-fabrics-will-keep-you-cool-in-summer-heat/</a>
Graphene radiator	<a href="http://spectrum.ieee.org/nanoclast/green-tech/conservation/graphene-heating-system-dramatically-reduces-home-energy-costs">http://spectrum.ieee.org/nanoclast/green-tech/conservation/graphene-heating-system-dramatically-reduces-home-energy-costs</a>
Soft batteries made from wood pulp	<a href="http://www.eurekalert.org/pub_releases/2015-06/kriotas060215.php">http://www.eurekalert.org/pub_releases/2015-06/kriotas060215.php</a>
Foldable device (MS)	<a href="http://www.neowin.net/news/microsoft-is-serious-about-foldable-and-printable-electronics">http://www.neowin.net/news/microsoft-is-serious-about-foldable-and-printable-electronics</a>
Lightweight sound-proofing metamaterial	<a href="http://scitation.aip.org/content/aip/journal/apl/106/17/10.1063/1.4919235">http://scitation.aip.org/content/aip/journal/apl/106/17/10.1063/1.4919235</a>
Low-cost magnetic material	<a href="http://www.eurekalert.org/pub_releases/2015-04/dl-als042415.php">http://www.eurekalert.org/pub_releases/2015-04/dl-als042415.php</a>
Silicon dioxide at room temperature	<a href="http://www.eurekalert.org/pub_releases/2015-04/uog-ucs042315.php">http://www.eurekalert.org/pub_releases/2015-04/uog-ucs042315.php</a>
Metsä Group – review of new technology	<a href="http://biotuotetehdas.fi/biotuotteet">http://biotuotetehdas.fi/biotuotteet</a>
Wooden skyscraper to Vienna	<a href="http://www.popsci.com/next-futuristic-building-material-wood">http://www.popsci.com/next-futuristic-building-material-wood</a>
Nanometal process VTT	<a href="http://www.tekniikkatalous.fi/innovaatiot/3+000+grammaa+pai+vassa+vtt+puskee+metallinahiukkasia/a1053682">http://www.tekniikkatalous.fi/innovaatiot/3+000+grammaa+pai+vassa+vtt+puskee+metallinahiukkasia/a1053682</a>
Nano reinforcements, hybtonite	<a href="http://www.ess.fi/uutiset/kotimaa/2014/09/12/suomalaisen-nanotekniikan-keksinnon-ymparilla-jattiriita---sijoittaja-vaatii-140-miljoonaa-euroa">http://www.ess.fi/uutiset/kotimaa/2014/09/12/suomalaisen-nanotekniikan-keksinnon-ymparilla-jattiriita---sijoittaja-vaatii-140-miljoonaa-euroa</a>
Dangers of carbon nanotubes	<a href="http://www.helsinki.fi/farmasia/uutiset2014/Nanohiukkasten_tunkeutumisen_elimistoon_riippuu_hiukkasten_ominaisuksista.html">http://www.helsinki.fi/farmasia/uutiset2014/Nanohiukkasten_tunkeutumisen_elimistoon_riippuu_hiukkasten_ominaisuksista.html</a>
Soft robots	<a href="http://www.kurzweilai.net/robotic-fabric-could-bring-active-clothing-wearable-robots?">http://www.kurzweilai.net/robotic-fabric-could-bring-active-clothing-wearable-robots?</a>
Chargeless electric current in graphene	<a href="http://www.natureworldnews.com/articles/9010/20140912/using-graphene-spin-electrons-new-directions.htm">http://www.natureworldnews.com/articles/9010/20140912/using-graphene-spin-electrons-new-directions.htm</a>
Graphene transistor	<a href="http://www.extremetech.com/extreme/183653-the-first-fully-2d-wonder-material-graphene-molybdenite-transistor-could-be-the-future-of-fast-electronics">http://www.extremetech.com/extreme/183653-the-first-fully-2d-wonder-material-graphene-molybdenite-transistor-could-be-the-future-of-fast-electronics</a>
Goods from biomaterials	<a href="http://www.hs.fi/tiede/a1398344570326">http://www.hs.fi/tiede/a1398344570326</a>
Industrial symbioses	<a href="http://www.sitra.fi/talous/teolliset-symbioosit">http://www.sitra.fi/talous/teolliset-symbioosit</a>

Technology links after September 2013	
New materials	<a href="http://www.businessinsider.com/futuristic-construction-materials-2014-4">http://www.businessinsider.com/futuristic-construction-materials-2014-4</a>
Unipolar magnet	<a href="http://yle.fi/uutiset/suomalaistutkija_loysi_kauan_etsityn_yksin_apaisten_magneetin/7059297">http://yle.fi/uutiset/suomalaistutkija_loysi_kauan_etsityn_yksin_apaisten_magneetin/7059297</a>
Report on the sufficiency of resources	<a href="http://www.mckinsey.com/insights/energy_resources_materials/reverse_the_curse_maximizing_the_potential_of_resource_driven_economies">http://www.mckinsey.com/insights/energy_resources_materials/reverse_the_curse_maximizing_the_potential_of_resource_driven_economies</a>
Carbyne – the toughest material	<a href="http://gajitz.com/the-tough-polyyne-family-has-a-new-heavyweight-champ/">http://gajitz.com/the-tough-polyyne-family-has-a-new-heavyweight-champ/</a>
Q-carbon, harder than diamond	<a href="http://phys.org/news/2015-11-phase-carbon-diamond-room-temperature.html">http://phys.org/news/2015-11-phase-carbon-diamond-room-temperature.html</a>
IONCell method for treatment of wood fibres	<a href="https://www.facebook.com/suomentulevaisuus/videos/953278928054552/?fref=nf">https://www.facebook.com/suomentulevaisuus/videos/953278928054552/?fref=nf</a>
Very fast semiconductor of 3D tin	<a href="http://www.gizmag.com/2d-semiconductor-tin-monoxide/41843/">http://www.gizmag.com/2d-semiconductor-tin-monoxide/41843/</a>
Mushrooms to replace polystyrene (decompose)	<a href="http://news.nationalpost.com/news/world/ikea-fungus-mushrooms-for-packaging">http://news.nationalpost.com/news/world/ikea-fungus-mushrooms-for-packaging</a>

## 7.7 Biotechnology and pharmacology

Gene manipulation has become substantially more accurate and easier than before. The change after the publication of the TuVRad9/2013 report has been radical. This, and the massive increase in genetic information as a result of continuously easier sequencing impact drug development and biotechnology alike.

Genetic information-based medication is more accurate than before. On the other hand, medicines will be much easier to produce in the future. Radical opportunities may be associated with the possible solving of the mystery of aging and considerable extension of healthy lifetime, but also with the revealing of causes of serious illnesses and discovery of new treatments. For example, the use of RNA-silencing for medication opens up completely new treatment options. Control of the body's own mechanisms, such as the immune system, offers many efficient means for health care.

Considerable advances have been seen in the regrowth of organs and cell cultivation, as well as the development of prostheses that restore the functional ability of the body. The production of biomaterials and food have also advanced substantially.

Technological development after the publication of the TuV9/2013 report and needs for improvement related to reporting:

## Drugs based on genetically modified organisms (2.4) \*\*\*

Genetic manipulation has been successfully applied to produce a virus that kills cancer. Cancer and HIV have been arrested with gene therapy and modification of the immune system of the body. Stem cell therapy has been successfully used for treatment of Parkinson's disease. Gene-manipulated bacteria have produced drugs. Six-letter DNA successfully replicated It can be used for developing artificial life, the features of which are not transferred to nature. News about solutions related to genetic information and gene manipulation are increasing at an accelerating rate. Recommendation: change the name of the category to Drugs, organs and other materials enabled by gene manipulation.

Technology links after September 2013	
Universal solution for the treatment of different cancers	<a href="http://www.sciencecodex.com/new_general_concept_for_the_treatment_of_cancer-131015">http://www.sciencecodex.com/new_general_concept_for_the_treatment_of_cancer-131015</a>
HIV gene therapy CCR5	<a href="http://www.nejm.org/doi/full/10.1056/NEJMoa1300662">http://www.nejm.org/doi/full/10.1056/NEJMoa1300662</a>
Anti-CD47 cancer treatment to begin human testing	<a href="http://blog.planprescriber.com/2014/03/28/anti-cd47-cancer-drug/">http://blog.planprescriber.com/2014/03/28/anti-cd47-cancer-drug/</a>
Cancer-killing virus	<a href="http://www.wired.com/2015/10/fda-approves-first-virus-will-kill-cancer-cells">http://www.wired.com/2015/10/fda-approves-first-virus-will-kill-cancer-cells</a>
HIV gene therapy	<a href="http://www.nejm.org/doi/full/10.1056/NEJMoa1300662">http://www.nejm.org/doi/full/10.1056/NEJMoa1300662</a>
Six-letter DNA replicated	<a href="http://www.cbsnews.com/news/artificial-dna-breakthrough-could-lead-to-new-drugs-treatments/">http://www.cbsnews.com/news/artificial-dna-breakthrough-could-lead-to-new-drugs-treatments/</a>
Programming of bacteria	<a href="http://www.scienceworldreport.com/articles/9855/20131001/scientists-uncover-hidden-feature-genetic-code-control-protein-production.htm">http://www.scienceworldreport.com/articles/9855/20131001/scientists-uncover-hidden-feature-genetic-code-control-protein-production.htm</a>
Stem cell treatment for Parkinson's disease	<a href="http://www.bbc.com/news/health-29935449">http://www.bbc.com/news/health-29935449</a>
GMO immune cell cured leukaemia	<a href="http://www.gosh.nhs.uk/news/press-releases/2015-press-release-archive/world-first-use-gene-edited-immune-cells-treat-incurable-leukaemia">http://www.gosh.nhs.uk/news/press-releases/2015-press-release-archive/world-first-use-gene-edited-immune-cells-treat-incurable-leukaemia</a>
Six-letter DNA replicated	<a href="http://www.cbsnews.com/news/artificial-dna-breakthrough-could-lead-to-new-drugs-treatments/">http://www.cbsnews.com/news/artificial-dna-breakthrough-could-lead-to-new-drugs-treatments/</a>
Gene therapy to treat cancer	<a href="http://www.cell.com/cell/fulltext/S0092-8674%2815%2900623-6">http://www.cell.com/cell/fulltext/S0092-8674%2815%2900623-6</a>
Generic flu vaccine	<a href="http://www.bbc.co.uk/news/health-24175030">http://www.bbc.co.uk/news/health-24175030</a>
Virus-based treatment for Ebola	<a href="http://www.eurekalert.org/pub_releases/2016-02/uop-nsh021216.php">http://www.eurekalert.org/pub_releases/2016-02/uop-nsh021216.php</a>

## Nanorobots (nanobots) in health promotion (2.5) \*

Swallowed capsules or capsules that travel in the blood vessels are developing fast. A pill camera that uses energy from the body; motorised nanoscale robots that move inside a cell; nanolevel medicine administration inside the body; remote-controlled and biodegradable medicinal implants and other remote-controlled subcutaneous medicine chips; nanobots that look for cancer; and activation of a paralysed limb with neuroimplants are all news that were published after the previous report.

Recommendation: retain, but extend the heading to Nanoparticles and microbots in the body.

<b>Technology links after September 2013</b>	
Programmable subcutaneous medicine chip	<a href="http://www.cnet.com/news/remote-controlled-chip-implant-could-be-the-future-of-contraceptives/">http://www.cnet.com/news/remote-controlled-chip-implant-could-be-the-future-of-contraceptives/</a>
Rice grain-sized biodegradable sensor for the brain	<a href="http://arstechnica.com/science/2016/01/in-a-brain-dissolvable-electronics-monitor-health-then-vanish/">http://arstechnica.com/science/2016/01/in-a-brain-dissolvable-electronics-monitor-health-then-vanish/</a>
Remote-controlled medicine implant	<a href="http://www.technologyreview.com/news/528121/a-contraceptive-implant-with-remote-control/">http://www.technologyreview.com/news/528121/a-contraceptive-implant-with-remote-control/</a>
Nanosensors for the body	<a href="http://www.engadget.com/2014/11/19/mit-polymer-medicine-nanotech/">http://www.engadget.com/2014/11/19/mit-polymer-medicine-nanotech/</a>
Nanolevel medicine administration	<a href="http://www.rdmag.com/news/2015/10/halloysite-finally-promising-natural-nanomaterial?et_cid=4898946">http://www.rdmag.com/news/2015/10/halloysite-finally-promising-natural-nanomaterial?et_cid=4898946</a>
DNA-programmable nanobots	<a href="http://www.popsci.com/article/science/nano-robots-compute-dna-installed-living-cockroach">http://www.popsci.com/article/science/nano-robots-compute-dna-installed-living-cockroach</a>
Biodegradable implant	<a href="https://www.facebook.com/photo.php?fbid=10152824561419909&amp;set=gm.672970076153935&amp;type=3">https://www.facebook.com/photo.php?fbid=10152824561419909&amp;set=gm.672970076153935&amp;type=3</a>
Robotic dive into the cell	<a href="http://www.scienceworldreport.com/articles/12786/20140210/first-nanomotors-ever-controlled-inside-living-cells.htm">http://www.scienceworldreport.com/articles/12786/20140210/first-nanomotors-ever-controlled-inside-living-cells.htm</a>
Controlling nanobots in the body with magnets	<a href="http://www.theverge.com/2014/10/28/7085023/google-wants-to-flood-your-body-with-tiny-magnets-to-search-for">http://www.theverge.com/2014/10/28/7085023/google-wants-to-flood-your-body-with-tiny-magnets-to-search-for</a>
Subcutaneous antenna & graphene based electronics	<a href="http://phys.org/news/2015-12-graphene-wearable-devices.html">http://phys.org/news/2015-12-graphene-wearable-devices.html</a>
Nanobots in the body	<a href="http://singularityhub.com/2015/10/12/ray-kurzweils-wildest-prediction-nanobots-will-plug-our-brains-into-the-web-by-the-2030s/">http://singularityhub.com/2015/10/12/ray-kurzweils-wildest-prediction-nanobots-will-plug-our-brains-into-the-web-by-the-2030s/</a>
Faster growth through radiation	<a href="http://spectrum.ieee.org/tech-talk/energy/environment/a-blast-of-plasma-makes-plants-grow-faster">http://spectrum.ieee.org/tech-talk/energy/environment/a-blast-of-plasma-makes-plants-grow-faster</a>
Rice grain-sized microbattery for biotelemetry	<a href="http://spectrum.ieee.org/nanoclast/biomedical/devices/graphenebased-microbattery-ushers-in-new-age-for-biotelemetry">http://spectrum.ieee.org/nanoclast/biomedical/devices/graphenebased-microbattery-ushers-in-new-age-for-biotelemetry</a>
Pill camera, Smithsonian	<a href="https://www.facebook.com/curiositydotcom/photos/a.293459797348511.88330.206936646000827/1003795746314909/?type=3">https://www.facebook.com/curiositydotcom/photos/a.293459797348511.88330.206936646000827/1003795746314909/?type=3</a>
Nanobots for the treatment of leukaemia	<a href="http://nextbigfuture.com/2015/03/ido-bachelet-dna-nanobots-summary-with.html">http://nextbigfuture.com/2015/03/ido-bachelet-dna-nanobots-summary-with.html</a>
Nanorobot looking for cancer	<a href="http://www.scientificamerican.com/video.cfm?id=south-korea-develops-worlds-first-c2014-01-05">http://www.scientificamerican.com/video.cfm?id=south-korea-develops-worlds-first-c2014-01-05</a>
Nanobot micromotors deliver medicine into the body of mice	<a href="http://www.gizmag.com/nanobot-micromotors-deliver-nanoparticles-living-creature/35700/">http://www.gizmag.com/nanobot-micromotors-deliver-nanoparticles-living-creature/35700/</a>
Activation of paralysed limb with neuroimplants	<a href="http://www.fiercemedicaldevices.com/story/nsf-awards-16m-researchers-developing-implants-reanimate-paralyzed-limbs/2016-01-04">http://www.fiercemedicaldevices.com/story/nsf-awards-16m-researchers-developing-implants-reanimate-paralyzed-limbs/2016-01-04</a>
Chip powered by cellular energy	<a href="http://www.ecnmag.com/news/2015/12/columbia-engineers-build-biologically-powered-chip">http://www.ecnmag.com/news/2015/12/columbia-engineers-build-biologically-powered-chip</a>

## Longer lifetime and slower aging processes (2.6) \*\*

Using a number of techniques, the healthy lifespan of mice has been extended by approximately 30%. For example, the blood of a young mouse rejuvenates an old mouse. Many proteins used for signaling between cells and organs seem to affect the lifespan, as well as more efficient elimination of old cells. Aging-related symptoms in the skin, muscles and heart have been relieved and the aging process has been slowed down. As regards the brain, even memory diseases have been cured in tests related to the extending the lifespan in mice, using a number of different techniques. First tests on humans have started. An on/off switch has been found in telomerase. New companies, funded by considerable investments and manned by experienced researchers, have evolved around this topic. Recommendation: retain.

Technology links after September 2013	
Young blood rejuvenates the brain of old mice	<a href="http://news.sciencemag.org/biology/2014/05/young-blood-renews-old-mice">http://news.sciencemag.org/biology/2014/05/young-blood-renews-old-mice</a>
Google to research extension of lifespan	<a href="http://www.usatoday.com/story/tech/2013/09/18/google-calico-health-aging/2833675/">http://www.usatoday.com/story/tech/2013/09/18/google-calico-health-aging/2833675/</a>
Extending the lifespan	<a href="http://io9.com/do-these-startling-animal-studies-mean-your-lifespan-co-486041314">http://io9.com/do-these-startling-animal-studies-mean-your-lifespan-co-486041314</a>
Prevention of aging	<a href="http://cmns.umd.edu/news-events/features/3352">http://cmns.umd.edu/news-events/features/3352</a>
Mitochondrial manipulation to slow down the aging of hepatic cells	<a href="http://emboj.embopress.org/content/early/2016/02/02/embj.201592862">http://emboj.embopress.org/content/early/2016/02/02/embj.201592862</a>
Human Longevity Inc	<a href="http://www.humanlongevity.com/">http://www.humanlongevity.com/</a>
Promotion of longevity	<a href="http://www.pnas.org/content/early/2015/07/16/1505451112">http://www.pnas.org/content/early/2015/07/16/1505451112</a>
HLI Human Longevity Inc	<a href="http://www.humanlongevity.com/">http://www.humanlongevity.com/</a>
Reversal of aging process with blood	<a href="http://www.theguardian.com/science/2015/aug/04/can-we-reverse-ageing-process-young-blood-older-people">http://www.theguardian.com/science/2015/aug/04/can-we-reverse-ageing-process-young-blood-older-people</a>
Genetics of aging	<a href="http://www.sciencedaily.com/releases/2015/12/151201113917.htm">http://www.sciencedaily.com/releases/2015/12/151201113917.htm</a>
Anti-aging drug trial begins	<a href="http://www.iflscience.com/health-and-medicine/preliminary-results-early-human-trials-anti-aging-formulas-reveal-no-adverse">http://www.iflscience.com/health-and-medicine/preliminary-results-early-human-trials-anti-aging-formulas-reveal-no-adverse</a>
Young blood rejuvenates old mouse	<a href="http://www.nature.com/news/young-blood-anti-ageing-mechanism-called-into-question-1.17583">http://www.nature.com/news/young-blood-anti-ageing-mechanism-called-into-question-1.17583</a>
Slowing down aging	<a href="http://onlinelibrary.wiley.com/doi/10.1111/accel.12344/abstract">http://onlinelibrary.wiley.com/doi/10.1111/accel.12344/abstract</a>
Muscle cells rejuvenated	<a href="http://www.bbc.co.uk/news/health-25445748">http://www.bbc.co.uk/news/health-25445748</a>
Prevention of aging (skin)	<a href="http://www.geek.com/science/scientists-accidentally-stop-skin-aging-in-mice-1611888/">http://www.geek.com/science/scientists-accidentally-stop-skin-aging-in-mice-1611888/</a>
On/off switch in telomerase	<a href="http://www.sciencealert.com.au/news/20142409-26223.html">http://www.sciencealert.com.au/news/20142409-26223.html</a>
Sirt1 prevents metabolic stress, aging	<a href="http://phys.org/news/2014-01-protein-sirt1.html">http://phys.org/news/2014-01-protein-sirt1.html</a>

## Inside brain implants that restore or develop brain functions (2.8) \*\*

Implants for the brain have been developed in many ways. A biologically compatible connection to the nervous system can be established with graphene. Neuroprostheses have been used for treatment. A connection between the brain and the immune system has been found. Eye implants have been tested and they are being developed. An infrared retina implant is under development. Electromagnetic methods external to the brain have been used to successfully influence the brain. Investigation into the question of coding of memory and development of memory implants has made some breakthroughs. The progress is fast. Recommendation: retain.

Technology links after September 2013	
Eye implant – 60 pixels	<a href="http://www.medicalnewstoday.com/articles/289863.php">http://www.medicalnewstoday.com/articles/289863.php</a>
Brain implant detects infrared light	<a href="http://www.telegraph.co.uk/news/science/science-news/9875931/Scientists-create-sixth-sense-brain-implant-to-detect-infrared-light.html">http://www.telegraph.co.uk/news/science/science-news/9875931/Scientists-create-sixth-sense-brain-implant-to-detect-infrared-light.html</a>
Nanobots for the body	<a href="https://www.linkedin.com/pulse/rays-wildest-prediction-peter-diamandis">https://www.linkedin.com/pulse/rays-wildest-prediction-peter-diamandis</a>
Neuroprostheses repair neurological disorders	<a href="http://www.npr.org/sections/health-shots/2014/05/27/316129491/military-plans-to-test-brain-implants-to-fight-mental-disorders">http://www.npr.org/sections/health-shots/2014/05/27/316129491/military-plans-to-test-brain-implants-to-fight-mental-disorders</a>
A review of brain implants – neuroprostheses	<a href="http://www.businessinsider.com/brain-implants-will-give-us-superpowers-2014-4?IR=T">http://www.businessinsider.com/brain-implants-will-give-us-superpowers-2014-4?IR=T</a>
Brain implants	<a href="http://www.eurekalert.org/pub_releases/2015-07/nion-fbp071615.php">http://www.eurekalert.org/pub_releases/2015-07/nion-fbp071615.php</a>
Spinal cord implant restores gait	<a href="http://gizmodo.com/watch-this-spinal-cord-implant-revive-the-legs-of-a-par-1560697896">http://gizmodo.com/watch-this-spinal-cord-implant-revive-the-legs-of-a-par-1560697896</a>
Retinal prosthesis	<a href="http://www.medicalnewstoday.com/articles/286352.php">http://www.medicalnewstoday.com/articles/286352.php</a>
Connection between the brain and the immune system	<a href="http://www.sciencedaily.com/releases/2015/06/150601122445.htm">http://www.sciencedaily.com/releases/2015/06/150601122445.htm</a>
Artificial eye implanted in human	<a href="http://bionicvision.org.au/eye">http://bionicvision.org.au/eye</a>
Memory coding and memory implants	<a href="http://www.technologyreview.com/featuredstory/513681/memory-implants/">http://www.technologyreview.com/featuredstory/513681/memory-implants/</a>
Biocompatible artificial neuron	<a href="http://www.ecnmag.com/news/2015/06/artificial-neuron-mimicks-function-human-cells?et_cid=4641606">http://www.ecnmag.com/news/2015/06/artificial-neuron-mimicks-function-human-cells?et_cid=4641606</a>

## Drugs that prevent dementia (2.9) \*\*\*\*

Researchers have developed a method that cures 70% of Alzheimer’s cases in mice. The KLOTHO gene that protects against dementia has been identified. The significance of amyloid and tau protein in the mechanism of Alzheimer’s have been investigated. Research is progressing rather rapidly. Recommendation: retain, but change to Prevention of dementia and alleviation of symptoms.

Technology links after September 2013	
Susceptibility to dementia KLOTHO	<a href="https://www.ucsf.edu/news/2015/01/122761/brain-region-vulnerable-aging-larger-those-longevity-gene-variant">https://www.ucsf.edu/news/2015/01/122761/brain-region-vulnerable-aging-larger-those-longevity-gene-variant</a>
70% of Alzheimer's cases in mice were cured	<a href="http://www.sciencealert.com/new-alzheimer-s-treatment-fully-restores-memory-function">http://www.sciencealert.com/new-alzheimer-s-treatment-fully-restores-memory-function</a>
Review of Alzheimer's research	<a href="http://www.alz.org/research/science/alzheimers_treatment_horizon.asp">http://www.alz.org/research/science/alzheimers_treatment_horizon.asp</a>
Alzheimer's research tau vs. amyloid	<a href="http://www.scienceworldreport.com/articles/23679/20150325/tau-protein-not-amyloid-now-thought-to-be-responsible-for-alzheimers.htm">http://www.scienceworldreport.com/articles/23679/20150325/tau-protein-not-amyloid-now-thought-to-be-responsible-for-alzheimers.htm</a>
Alzheimer's research	<a href="http://www.nature.com/ncomms/2015/151127/ncomms9836/full/ncomms9836.html">http://www.nature.com/ncomms/2015/151127/ncomms9836/full/ncomms9836.html</a>
KLOTHO gene protects against Alzheimer's and improves intelligence	<a href="https://www.ucsf.edu/news/2014/05/114196/better-cognition-seen-gene-variant">https://www.ucsf.edu/news/2014/05/114196/better-cognition-seen-gene-variant</a>
Gene protects against Alzheimer's	<a href="http://www.ucsf.edu/news/2014/05/114196/better-cognition-seen-gene-variant">http://www.ucsf.edu/news/2014/05/114196/better-cognition-seen-gene-variant</a>

### Repairing and regrowing of human organs, (stem) cell cultivation (2.10) \*\*

Technology suitable for dental stem cell implants has been developed. An efficient method has been developed for the production of blood from stem cells. Sixty genes of pig have been modified so that pig's organs can be used for organ transplantations. Regeneration of the nervous system has succeeded. The immune system has been 'trained' to cure celiac disease. A kidney has been grown and a number of other organs have been 3D printed. This is a rapidly developing domain. Recommendation: retain.

Technology links after September 2013	
The body is independently destroying cancer	<a href="http://yle.fi/uutiset/syopahoito_on_mullistumassa__elimisto_voi_itse_tuhota_syopakasvaimia/8321028">http://yle.fi/uutiset/syopahoito_on_mullistumassa__elimisto_voi_itse_tuhota_syopakasvaimia/8321028</a>
Dental stem cell implants	<a href="http://worldtruth.tv/stem-cell-dental-implants-grow-new-teeth-in-your-mouth/">http://worldtruth.tv/stem-cell-dental-implants-grow-new-teeth-in-your-mouth/</a>
Large quantities of insulin-producing cells have been cultivated	<a href="http://www.webmd.com/diabetes/news/20141009/stem-cell-success-raises-hopes-of-type-1-diabetes-cure">http://www.webmd.com/diabetes/news/20141009/stem-cell-success-raises-hopes-of-type-1-diabetes-cure</a>
Lab-grown kidney	<a href="http://www.sciencealert.com/lab-grown-kidneys-shown-to-be-fully-functional-in-animal-recipients">http://www.sciencealert.com/lab-grown-kidneys-shown-to-be-fully-functional-in-animal-recipients</a>
Review of growing of artificial organs	<a href="http://discovermagazine.com/2014/jan-feb/05-stem-cell-future">http://discovermagazine.com/2014/jan-feb/05-stem-cell-future</a>
Regeneration of the nervous system	<a href="http://factor-tech.com/3d-printing/19785-complex-damaged-nerves-re-grown-for-first-time-using-3d-printed-guide/">http://factor-tech.com/3d-printing/19785-complex-damaged-nerves-re-grown-for-first-time-using-3d-printed-guide/</a>
'Training' the immune system	<a href="http://www.sciencedaily.com/releases/2014/09/140925100929.htm">http://www.sciencedaily.com/releases/2014/09/140925100929.htm</a>
Cultivated cardiac cells	<a href="http://www.sciencedaily.com/releases/2015/07/150714124129.htm">http://www.sciencedaily.com/releases/2015/07/150714124129.htm</a>

Technology links after September 2013	
Cell cultivation (blood)	<a href="http://medicalxpress.com/news/2015-10-gene-lab-based-red-blood-cell.html">http://medicalxpress.com/news/2015-10-gene-lab-based-red-blood-cell.html</a>
GMO organ transplantations	<a href="http://www.iflscience.com/health-and-medicine/scientists-break-gene-editing-record-create-animal-organs-human-transplantation">http://www.iflscience.com/health-and-medicine/scientists-break-gene-editing-record-create-animal-organs-human-transplantation</a>
Artificial blood from factories	<a href="http://www.telegraph.co.uk/health/healthnews/10765132/Artificial-blood-will-be-manufactured-in-factories.html">http://www.telegraph.co.uk/health/healthnews/10765132/Artificial-blood-will-be-manufactured-in-factories.html</a>
Type 1 diabetes treated with cultivated stem cells	<a href="http://gizmodo.com/stem-cell-breakthrough-could-put-an-end-to-daily-insuli-1754981810">http://gizmodo.com/stem-cell-breakthrough-could-put-an-end-to-daily-insuli-1754981810</a>
Obstacles for human spare parts in Finland	<a href="http://yle.fi/uutiset/tutkijat_selvittavat_ihmisen_varaosateo_llisuuden_synnyn_esteita_suomessa/7144293">http://yle.fi/uutiset/tutkijat_selvittavat_ihmisen_varaosateo_llisuuden_synnyn_esteita_suomessa/7144293</a>
Cardiac booster	<a href="http://www.independent.co.uk/news/science/3dprinted-electronic-glove-could-help-keep-your-heart-beating-for-ever-9166004.html">http://www.independent.co.uk/news/science/3dprinted-electronic-glove-could-help-keep-your-heart-beating-for-ever-9166004.html</a>
Healing dressing	<a href="http://www.tekniikkatalous.fi/innovaatiot/mullistus-vaikeiden-haavojen-hoitoon-tulee-suomesta-startup-esitteli-hopeaa-hyodyntavan-haavataitoksensa-3326347">http://www.tekniikkatalous.fi/innovaatiot/mullistus-vaikeiden-haavojen-hoitoon-tulee-suomesta-startup-esitteli-hopeaa-hyodyntavan-haavataitoksensa-3326347</a>
DNA-guided 3D printing of cells DPAC	<a href="http://www.ucsf.edu/news/2015/08/131431/dna-guided-3d-printing-human-tissue-unveiled">http://www.ucsf.edu/news/2015/08/131431/dna-guided-3d-printing-human-tissue-unveiled</a>
Cancer tumour, cultivated & 3D printed	<a href="http://phys.org/news/2014-04-breakthrough-cancer-tumors-3d-printer.html">http://phys.org/news/2014-04-breakthrough-cancer-tumors-3d-printer.html</a>
3D-printing of blood vessels	<a href="http://www.iflscience.com/health-and-medicine/scientists-use-3d-printing-produce-blood-vessels">http://www.iflscience.com/health-and-medicine/scientists-use-3d-printing-produce-blood-vessels</a>
Modification of immune system put 90% of terminally ill leukaemia patients into remission	<a href="http://www.bbc.com/news/health-35586834">http://www.bbc.com/news/health-35586834</a>

### Synthetic cartilage in human joints (2.11) \*

3D printing of cartilage has advanced. In addition, experiments with cartilage prosthesis produced from synthetic plastic material have progressed to testing in patients. Recommendation: due to overlap, incorporate in items 2.11 and 2.59 as applicable.

Technology links after September 2013	
Synthetic cartilage tested in patients	<a href="http://www.foxnews.com/health/2015/03/12/artificial-cartilage-implants-may-reduce-need-for-knee-replacement-surgery.html">http://www.foxnews.com/health/2015/03/12/artificial-cartilage-implants-may-reduce-need-for-knee-replacement-surgery.html</a>
Artificial 3D printed cartilage	<a href="http://www.iflscience.com/health-and-medicine/made-order-cartilage-could-combat-osteoarthritis">http://www.iflscience.com/health-and-medicine/made-order-cartilage-could-combat-osteoarthritis</a>
3D printed cartilage	<a href="http://www.iflscience.com/health-and-medicine/made-order-cartilage-could-combat-osteoarthritis">http://www.iflscience.com/health-and-medicine/made-order-cartilage-could-combat-osteoarthritis</a>

### 3D printing of organs (2.59) \*

3D printing of organs has advanced rapidly. 3D printers specialising in the printing of biomaterials have been launched in the market. Many organs have been printed experimentally. The functionality of 3D-prints of bone, cartilage, joints, skin, liver, kidneys, bladder, blood vessel and nervous system has improved. Recommendation: retain.

Technology links after September 2013	
3D printed organs	<a href="http://yle.fi/uutiset/japanilaistutkijat_tuottavat_ruumiinosia_3d-tulostimella/7742395">http://yle.fi/uutiset/japanilaistutkijat_tuottavat_ruumiinosia_3d-tulostimella/7742395</a>
3D printing of organs: blood vessels	<a href="https://www.facebook.com/StemCellAndRegenerativeScience/posts/234949486711227">https://www.facebook.com/StemCellAndRegenerativeScience/posts/234949486711227</a>
Biomaterial that grows and changes shape	<a href="http://www.eurekalert.org/pub_releases/2015-09/qmuo-smt092415.php">http://www.eurekalert.org/pub_releases/2015-09/qmuo-smt092415.php</a>
3D printing of bone and tissue	<a href="http://3dprint.com/37745/bone-and-tissue-bioprinting/">http://3dprint.com/37745/bone-and-tissue-bioprinting/</a>
Spinal implant	<a href="http://www.telegraph.co.uk/news/science/science-news/11333719/Cyborg-spinal-implant-could-help-paralysed-walk-again.html">http://www.telegraph.co.uk/news/science/science-news/11333719/Cyborg-spinal-implant-could-help-paralysed-walk-again.html</a>
3D printing of organs in gel	<a href="http://www.vocativ.com/video/tech/machines/3d-printing-in-gel-could-bring-us-closer-to-replacement-organs/">http://www.vocativ.com/video/tech/machines/3d-printing-in-gel-could-bring-us-closer-to-replacement-organs/</a>
3D printed heart in 10 years	<a href="http://www.wired.co.uk/news/archive/2013-11/21/3d-printed-whole-heart">http://www.wired.co.uk/news/archive/2013-11/21/3d-printed-whole-heart</a>
3D printing to produce tissue constructs with structural integrity	<a href="http://www.nature.com/nbt/journal/vaop/ncurrent/full/nbt.3413.html">http://www.nature.com/nbt/journal/vaop/ncurrent/full/nbt.3413.html</a>
Mini-brains for testing purposes	<a href="http://hub.jhu.edu/2016/02/12/mini-brains-drug-testing">http://hub.jhu.edu/2016/02/12/mini-brains-drug-testing</a>

### Robotic surgery and other cutting of biological objects (2.60) \*\*

A robot has been developed that can draw blood successfully. A surgical microscope has been developed. It is used in cancer surgery to examine if cancer cells have been successfully removed from the surgical site. Robotic surgery is routinely used in many operations. The progress does not seem very fast, with the exception of the food industry. Recommendation: remove.

Technology links after September 2013	
Surgical microscope.	<a href="http://www.scienceworldreport.com/articles/12903/20140214/next-gen-surgical-microscopes-see-tumor-cells-in-real-time.htm">http://www.scienceworldreport.com/articles/12903/20140214/next-gen-surgical-microscopes-see-tumor-cells-in-real-time.htm</a>
Blood drawing robot	<a href="http://forums.xilinx.com/t5/Xcell-Daily-Blog/Vision-guided-robotic-phlebotomist-draws-blood-with-near-100/ba-p/504873">http://forums.xilinx.com/t5/Xcell-Daily-Blog/Vision-guided-robotic-phlebotomist-draws-blood-with-near-100/ba-p/504873</a>

### **Biobots (2.64) \***

A cockroach has been harnessed with sensors, and a cockroach carrying a miniaturised camera can be remote-controlled at a tolerable accuracy. Electric wires and electronics have been absorbed in living plants, including a transistor and logic circuit. Recommendation: remove as a slowly progressing domain with limited significance, or incorporate under 2.8 as Cyborg-like combinations of electronics and biological organisms.

<b>Technology links after September 2013</b>	
Electronics in cyborg plant	<a href="http://gizmodo.com/scientists-have-created-a-cyborg-rose-1743933339">http://gizmodo.com/scientists-have-created-a-cyborg-rose-1743933339</a>
Remote controller for camera-carrying cockroach	<a href="https://www.theguardian.com/science/2015/mar/04/cockroach-robots-not-nightmare-fantasy-but-science-lab-reality">https://www.theguardian.com/science/2015/mar/04/cockroach-robots-not-nightmare-fantasy-but-science-lab-reality</a>

### **Artificial cell and simulating life on cell level (2.68) \*\*\***

The functions of a cell can be simulated with software. However, simulation of human cells at a level that would be useful for drug testing is not yet possible. It is estimated that this goal could be reached by 2025. Artificial cells have been produced for a variety of purposes. For example, researchers have created a cell that they believe is similar to early prehistoric cells, and it has proliferated independently. Recommendation: retain.

<b>Technology links after September 2013</b>	
Cell simulation model	<a href="http://www.scientificamerican.com/article.cfm?id=scientists-successfully-model-a-living-cell-with-software&amp;WT.mc_id=SA_Facebook">http://www.scientificamerican.com/article.cfm?id=scientists-successfully-model-a-living-cell-with-software&amp;WT.mc_id=SA_Facebook</a>

### **In-vitro meat and meat-like plant protein (2.69) \***

The production process of synthetically grown meat has improved, and the production costs have fallen rapidly. However, commercial profitability is not yet in sight. The quality of plant-based imitation eggs is now equal to real eggs. It has been found that roots of leguminous plants contain an ingredient that gives blood aroma to plant-based imitation meat. Imitation meat has received considerable funding and is going commercial. Recommendation: retain.

Technology links after September 2013	
Vegetarian 'egg'	<a href="https://www.facebook.com/gary.yourofsky/videos/892932674095315/?fref=nf">https://www.facebook.com/gary.yourofsky/videos/892932674095315/?fref=nf</a>
Taste of meat for vegetarian burger	<a href="http://impossiblefoods.com/">http://impossiblefoods.com/</a>
Imitation meat and its funding	<a href="https://www.facebook.com/gary.yourofsky/videos/855040404551209/?fref=nf">https://www.facebook.com/gary.yourofsky/videos/855040404551209/?fref=nf</a>
Synthetic meat is becoming cheaper	<a href="http://www.sciencealert.com/lab-grown-burger-patty-cost-drops-from-325-000-to-12">http://www.sciencealert.com/lab-grown-burger-patty-cost-drops-from-325-000-to-12</a>
Synthetic meat	<a href="http://www.sciencealert.com/lab-grown-burgers-could-be-on-your-plate-by-2020">http://www.sciencealert.com/lab-grown-burgers-could-be-on-your-plate-by-2020</a>
Vegetarian patty tastes like meat	<a href="http://www.sciencealert.com/news/20140910-26310.html">http://www.sciencealert.com/news/20140910-26310.html</a>

### Genetically modified organisms as producers of multi-use materials (2.71) \*\*\*

Genetic modification is becoming routine, thanks to the new Crispr-Cas9 method. One complete yeast chromosome has been produced synthetically and reimplanted in yeast, after which it has propagated. Genetically modified bacteria have been used for producing biofilm and nanoscale electric wires for the biofilm, assembled of gold particles. A self-luminous, seeding plant has been created through genetic modification. Recommendation: retain.

Technology links after September 2013	
Crispr-Cas9 for faster biomaterial production	<a href="http://phys.org/news/2016-01-crispr-cas9-tool-production-biofuel-precursors.html">http://phys.org/news/2016-01-crispr-cas9-tool-production-biofuel-precursors.html</a>
Electricity-'eating' bacterium	<a href="http://www.tekniikkatalous.fi/kemia/tallaista+elamaa+ei+pitany+t+olla+olemassakaan++sahkoa+syovat+bakteerit+laittavat+oppik+irjat+uusiksi/a1044302">http://www.tekniikkatalous.fi/kemia/tallaista+elamaa+ei+pitany+t+olla+olemassakaan++sahkoa+syovat+bakteerit+laittavat+oppik+irjat+uusiksi/a1044302</a>
Electromagnetic characteristics for biofilms using bacteria	<a href="http://www.natureworldnews.com/articles/6420/20140324/mit-researchers-develop-living-material-using-e-coli.htm">http://www.natureworldnews.com/articles/6420/20140324/mit-researchers-develop-living-material-using-e-coli.htm</a>
Self-luminous seeding plant	<a href="http://www.smh.com.au/technology/sci-tech/glowinthedark-plants-a-step-closer-as-avatars-seeds-bear-fruit-20140117-30zhe.html">http://www.smh.com.au/technology/sci-tech/glowinthedark-plants-a-step-closer-as-avatars-seeds-bear-fruit-20140117-30zhe.html</a>

### Cellulose nanofibre and microfibre (2.78) \*\*\*\*

There have not been many news on nanocellulose. A recent market analysis anticipates over 20% growth and a market of nearly EUR 300 million by 2020. The development has been slower than anticipated, even though the theoretical potential of nanocellulose is very high. Despite the slow progress, this area is significant for Finland. Recommendation: retain.

Technology links after September 2013	
Inexpensive nanocellulose production method	<a href="http://www.fstjournal.org/news/new-low-cost-process-make-nanocellulose/670">http://www.fstjournal.org/news/new-low-cost-process-make-nanocellulose/670</a>
Nanocellulose applications (VTT)	<a href="http://oske.ketek.fi/Nanoselluloosa - Kokkola_31_5_2012.pdf">http://oske.ketek.fi/Nanoselluloosa - Kokkola_31_5_2012.pdf</a>
Nanocellulose design	<a href="http://www.eurekalert.org/pub_releases/2015-10/nunmb100215.php">http://www.eurekalert.org/pub_releases/2015-10/nunmb100215.php</a>
Small but growing market for nanocellulose	<a href="https://globenewswire.com/news-release/2016/01/29/805894/0/en/Global-Nanocellulose-Market-Analysis-Trends-Report-2016-2020-Industry-Forecasts-for-the-295-Million-Industry.html">https://globenewswire.com/news-release/2016/01/29/805894/0/en/Global-Nanocellulose-Market-Analysis-Trends-Report-2016-2020-Industry-Forecasts-for-the-295-Million-Industry.html</a>

### (new) Urban multilayer cultivation/LED cultivation (2.101)

LED cultivation has been in the headlines after the publication of the TuVRad9/2013 report. In Japan, a plantation has been established in an industrial hall, producing 10,000 heads of lettuce per day. Other similar, fully robotised facilities are about to be launched. In Finland, Silmusalaatti has started LED cultivation. The advantages of artificial light cultivation are minimisation of heating costs, plant diseases, evaporation, fertiliser emissions, area costs and logistics costs and maximum length of the growing season. The main disadvantage is the energy cost associated with artificial light. This is reduced by lighting the surface of the plant only and using only the wavelengths and light intensity that the plant needs. Container-sized automatic plantations and cultivation devices intended for households have rapidly appeared in the market. Recommendation: new category

Technology links after September 2013	
Commercialised container cultivation, EUR 20,000/year	<a href="https://www.facebook.com/HuffingtonPost/videos/10153593374106130/">https://www.facebook.com/HuffingtonPost/videos/10153593374106130/</a>
MIT invests in LED/vertical cultivation	<a href="http://spectrum.ieee.org/computing/embedded-systems/mits-food-computer-the-future-of-urban-agriculture">http://spectrum.ieee.org/computing/embedded-systems/mits-food-computer-the-future-of-urban-agriculture</a>
LED cultivation at Silmusalaatti	<a href="http://www.hs.fi/tiede/a1439520997977?jako=65a7ada6a9f2a41fd8d132dbdfb3863e&amp;ref=tw-share">http://www.hs.fi/tiede/a1439520997977?jako=65a7ada6a9f2a41fd8d132dbdfb3863e&amp;ref=tw-share</a>
LED cultivation in Finland	<a href="http://www.silmusalaatti.fi/viljely/">http://www.silmusalaatti.fi/viljely/</a>
LED multi-layer cultivation (Japan)	<a href="http://upriser.com/posts/largest-indoor-farm-100x-more-productive-99-less-water-40-less-power-80-less-waste">http://upriser.com/posts/largest-indoor-farm-100x-more-productive-99-less-water-40-less-power-80-less-waste</a>
Product of LED/container cultivation	<a href="https://www.facebook.com/HuffingtonPost/videos/10153593374106130/?fref=nf">https://www.facebook.com/HuffingtonPost/videos/10153593374106130/?fref=nf</a>
Kitchen cultivation product	<a href="http://www.kauppalehti.fi/omayritys/suomalainen+alypuutarha+leviaa+tanskassa+ja+saksassa/201412711806">http://www.kauppalehti.fi/omayritys/suomalainen+alypuutarha+leviaa+tanskassa+ja+saksassa/201412711806</a>
Critical (incompletely) view to vertical cultivation	<a href="https://usu.app.box.com/s/6t2qfa3xng2bb4rpa2536lg4yrqf4sug">https://usu.app.box.com/s/6t2qfa3xng2bb4rpa2536lg4yrqf4sug</a>
Cultivation experiment on the Moon	<a href="http://newswatch.nationalgeographic.com/2013/12/05/nasa-may-test-its-lunar-green-thumb/">http://newswatch.nationalgeographic.com/2013/12/05/nasa-may-test-its-lunar-green-thumb/</a>
LED cultivation (Philips)	<a href="http://www.fastcoexist.com/3048492/in-this-huge-urban-farming-lab-led-recipes-grow-juicier-tomatoes-and-sweeter-basil">http://www.fastcoexist.com/3048492/in-this-huge-urban-farming-lab-led-recipes-grow-juicier-tomatoes-and-sweeter-basil</a>

Technology links after September 2013	
Grasshoppers grown in containers	<a href="http://www.kauppalehti.fi/uutiset/tama-keksinto-ratkaisee-nalanhadan-maailmasta/3ESU7BiR">http://www.kauppalehti.fi/uutiset/tama-keksinto-ratkaisee-nalanhadan-maailmasta/3ESU7BiR</a>
Vertical cultivation	<a href="http://iq.intel.com/could-high-tech-vertical-farming-feed-the-future/">http://iq.intel.com/could-high-tech-vertical-farming-feed-the-future/</a>
Indoor cultivation, hemp	<a href="http://www.mielleyhtyma.com/wp/there-no-business-like-business/kivi-paperi-hamppu/">http://www.mielleyhtyma.com/wp/there-no-business-like-business/kivi-paperi-hamppu/</a>
Urban/multilayer cultivation	<a href="http://weburbanist.com/2015/04/02/plantlab-urban-farms-40-times-more-productive-than-open-fields/">http://weburbanist.com/2015/04/02/plantlab-urban-farms-40-times-more-productive-than-open-fields/</a>
Lighting and milk production	<a href="http://www.nyteknik.se/nyheter/energi_miljo/article3933600.ace">http://www.nyteknik.se/nyheter/energi_miljo/article3933600.ace</a>
Vertical cultivation	<a href="http://www.youtube.com/watch?v=2nFQOkzEjxQ">http://www.youtube.com/watch?v=2nFQOkzEjxQ</a>

### (new) Medicine – protein map (2.150)

Important development takes place in medicine all the time. This is a general code related to the topic, including a collection of recent examples without a particular theme: Faster methods have been developed for vaccine manufacturing. Some antibiotic treatments can be replaced with electric treatment; graphene has shown anticancer potential; an antibiotic that kills MRSA has been found; liposomes can be used for treating bacterial infections; a comprehensive map of human proteins has been prepared; surgical results in emergencies can possibly be improved by cooling trauma patients and suspended animation; malaria vaccine is being tested in mice; a cholesterol vaccine has been developed; and UV-LED light has a disinfecting effect. Recommendation: review the category and consider if it should be made into a new monitored category.

Technology links after September 2013	
Human Protein Atlas	<a href="http://yle.fi/uutiset/ruotsalaiset_piirsivat_ihmisen_proteiinikartaston__13_miljoonaa_kuvaa_julki_internetissa/7606422">http://yle.fi/uutiset/ruotsalaiset_piirsivat_ihmisen_proteiinikartaston__13_miljoonaa_kuvaa_julki_internetissa/7606422</a>
UV LED for disinfection	<a href="http://www.savonsanommat.fi/uutiset/talous/led-sutari-saikansainvalisen-laaturapalkinnon/1971147?pwbi=d845cd2b75ec522f8b82403277f0555b">http://www.savonsanommat.fi/uutiset/talous/led-sutari-saikansainvalisen-laaturapalkinnon/1971147?pwbi=d845cd2b75ec522f8b82403277f0555b</a>
Suspended animation to be tested on humans	<a href="http://www.extremetech.com/extreme/179296-humans-will-be-kept-between-life-and-death-in-the-first-suspended-animation-trials">http://www.extremetech.com/extreme/179296-humans-will-be-kept-between-life-and-death-in-the-first-suspended-animation-trials</a>
Cooling of trauma patients (hibernation)	<a href="http://io9.com/humanity-is-now-officially-ready-for-suspended-animation-1581727874">http://io9.com/humanity-is-now-officially-ready-for-suspended-animation-1581727874</a>
Getting bacteria under control with liposomes	<a href="http://www.tekniikkatalous.fi/innovaatiot/rasvalla+tulehdusten+kimppuun+antibioottien+sijaan++kokeet+ihmispotilailla+alkavat+ensi+vuonna/a1027451">http://www.tekniikkatalous.fi/innovaatiot/rasvalla+tulehdusten+kimppuun+antibioottien+sijaan++kokeet+ihmispotilailla+alkavat+ensi+vuonna/a1027451</a>
Cholesterol vaccine	<a href="http://news.unm.edu/news/unm-nih-researchers-develop-vaccine-to-treat-high-cholesterol">http://news.unm.edu/news/unm-nih-researchers-develop-vaccine-to-treat-high-cholesterol</a>
Health effects of spruce resin	<a href="http://www.uusisuomi.fi/tiede-ja-ymparisto/59304-tutkija-osoitti-perimatiedon-todeksi-suomen-metsissa-kasvaa">http://www.uusisuomi.fi/tiede-ja-ymparisto/59304-tutkija-osoitti-perimatiedon-todeksi-suomen-metsissa-kasvaa</a>

Technology links after September 2013	
Graphene with anticancer potential	<a href="http://www.medicalnewstoday.com/articles/289978.php">http://www.medicalnewstoday.com/articles/289978.php</a>
Antibiotic that works on MRSA	<a href="http://yle.fi/uutiset/tutkijat_uskovat_loytaneensa_mullistavan_antibiootin_oli_kaivettuna_maahan_takapihalle/7724435">http://yle.fi/uutiset/tutkijat_uskovat_loytaneensa_mullistavan_antibiootin_oli_kaivettuna_maahan_takapihalle/7724435</a>
Electrical stimulation replaces antibiotics	<a href="http://www.eurekalert.org/pub_releases/2015-11/wsu-rda110915.php">http://www.eurekalert.org/pub_releases/2015-11/wsu-rda110915.php</a>
Malaria vaccine tested in mice	<a href="http://news.sciencemag.org/health/2014/05/new-malaria-vaccine-shows-promise-mice">http://news.sciencemag.org/health/2014/05/new-malaria-vaccine-shows-promise-mice</a>
Map of human proteins	<a href="http://www.iflscience.com/health-and-medicine/first-complete-mapping-human-proteome-discovers-193-new-proteins">http://www.iflscience.com/health-and-medicine/first-complete-mapping-human-proteome-discovers-193-new-proteins</a>
Faster vaccine manufacturing	<a href="http://www.eurekalert.org/pub_releases/2015-11/byu-ceh111815.php">http://www.eurekalert.org/pub_releases/2015-11/byu-ceh111815.php</a>
Rabbit's brain frozen without breaking the structure	<a href="http://www.sciencealert.com/a-mammal-s-brain-has-been-cryonically-frozen-and-recovered-for-the-first-time">http://www.sciencealert.com/a-mammal-s-brain-has-been-cryonically-frozen-and-recovered-for-the-first-time</a>

## 7.8 Energy technology

Energy technology is developing quickly. Commercialisation of solar power is a significant trend in many countries. Considering the development of battery technology and fuel cells, it is anticipated that, for example, in Australia profitable withdrawal from the grid will be possible for half of the households by 2020.

The growing use of solar power and wind power will increase energy price fluctuations. Decentralised energy production for personal need reduces the use of transmission network, at the same time increasing the unit cost of the transmission of electricity. Increasing price fluctuations will improve the profitability of energy storages and, particularly in northern conditions, increases the importance of heat storages.

The development of battery technology promotes the electrification of transport. Electrification of aviation is also in sight. The development of fuel cells and production of synthetic fuels with solar and wind power provide the opportunity to benefit from solar and wind power during all seasons, also in northern conditions.

Technological development after the publication of the TuV9/2013 report and needs for improvement related to reporting:

### Rapidly cheapening solar energy (2.82) \*\*\*\*

The price of installed solar energy systems has decreased over the long term by 7–15% per year. According to studies, the decreasing price trend may still continue for a long time. Using thin-film technology, solar panels can be made flexible, light and easy to integrate into other structures. In the future, they will require less and less materials that are expensive. Thin-film technology can surpass the performance of conventional

technology already in 2017. Solar panels are being planned to use for covering roads, building walls and, with translucent panels, also windows. It has been calculated that in many countries, solar energy has already surpassed the grid parity, and repayment periods are continuously becoming shorter. Solar energy investments are continuously increasing at the global level. Recommendation: retain.

Technology links after September 2013	
Roof tile solar panel	<a href="http://inhabitat.com/heat-your-home-with-soltech-energys-beautiful-glass-roof-tiles/">http://inhabitat.com/heat-your-home-with-soltech-energys-beautiful-glass-roof-tiles/</a>
Jobs in solar power industry	<a href="http://greenpeaceblogs.org/2014/07/10/us-senator-claims-us-jobs-solar-coal-hes-right/">http://greenpeaceblogs.org/2014/07/10/us-senator-claims-us-jobs-solar-coal-hes-right/</a>
Solar power captured and projected to Earth	<a href="http://www.wired.com/dangerroom/2014/03/space-solar/">http://www.wired.com/dangerroom/2014/03/space-solar/</a>
Solar panel road	<a href="https://www.facebook.com/pakscienceclub/videos/10152510729393518/">https://www.facebook.com/pakscienceclub/videos/10152510729393518/</a>
Rooftop solar power becoming cheaper	<a href="http://www.vox.com/2014/10/16/6987915/solar-power-cheaper-balance-of-systems-costs">http://www.vox.com/2014/10/16/6987915/solar-power-cheaper-balance-of-systems-costs</a>
Transparent solar panel to turn windows into solar power generators.	<a href="https://www.facebook.com/futurism/videos/519521464893724/?fref=nf">https://www.facebook.com/futurism/videos/519521464893724/?fref=nf</a>
Perovskite PV film	<a href="http://spectrum.ieee.org/energywise/green-tech/solar/new-trick-promises-perovskite-solar-films-for-windows-and-walls">http://spectrum.ieee.org/energywise/green-tech/solar/new-trick-promises-perovskite-solar-films-for-windows-and-walls</a>
Perovskite PV	<a href="http://spectrum.ieee.org/energywise/green-tech/solar/cheap-solar-cells-offer-hydrogen-hope">http://spectrum.ieee.org/energywise/green-tech/solar/cheap-solar-cells-offer-hydrogen-hope</a>
Solar windows of quantum dots	<a href="http://www.iflscience.com/technology/quantum-dot-technology-could-lead-solar-panel-windows">http://www.iflscience.com/technology/quantum-dot-technology-could-lead-solar-panel-windows</a>
Solar power 2–4 c/KWh in 2050 conservative	<a href="http://www.agora-ener-giewende.org/fileadmin/downloads/publikationen/Studien/PV_Cost_2050/AgoraEnergiewende_Current_and_Future_Cost_of_PV_Feb2015_web.pdf">http://www.agora-ener-giewende.org/fileadmin/downloads/publikationen/Studien/PV_Cost_2050/AgoraEnergiewende_Current_and_Future_Cost_of_PV_Feb2015_web.pdf</a>
Solar panel roof tiles	<a href="http://awareness-time.com/award-winning-design-glass-roof-tiles-capture-solar-energy-to-heat-your-home-during-winter/">http://awareness-time.com/award-winning-design-glass-roof-tiles-capture-solar-energy-to-heat-your-home-during-winter/</a>
PV effect on oil countries	<a href="http://www.telegraph.co.uk/finance/comment/ambroseevans_pritchard/10755598/Global-solar-dominance-in-sight-as-science-trumps-fossil-fuels.html">http://www.telegraph.co.uk/finance/comment/ambroseevans_pritchard/10755598/Global-solar-dominance-in-sight-as-science-trumps-fossil-fuels.html</a>
Stable, efficient perovskite solar cell	<a href="http://spectrum.ieee.org/energywise/green-tech/solar/stable-perovskite-cell-boosts-solar-power">http://spectrum.ieee.org/energywise/green-tech/solar/stable-perovskite-cell-boosts-solar-power</a>
Solar panel bike lane	<a href="http://www.collective-evolution.com/2014/11/09/netherlands-is-the-first-country-to-open-solar-road-for-public/">http://www.collective-evolution.com/2014/11/09/netherlands-is-the-first-country-to-open-solar-road-for-public/</a>
Solar panel road	<a href="http://www.wired.com/2014/05/solar-road/">http://www.wired.com/2014/05/solar-road/</a>
Solar cell that stores power	<a href="http://www.sciencedaily.com/releases/2014/10/141003064336.htm">http://www.sciencedaily.com/releases/2014/10/141003064336.htm</a>
DIY solar panel	<a href="http://bit.ly/1v6XQez">http://bit.ly/1v6XQez</a>
Investment in oil vs. PV	<a href="http://www.impactlab.net/2014/09/18/100b-invested-in-wind-or-solar-will-produce-more-energy-than-oil/">http://www.impactlab.net/2014/09/18/100b-invested-in-wind-or-solar-will-produce-more-energy-than-oil/</a>

Technology links after September 2013	
FS: efficient thin-film PV 2017	<a href="http://www.firstsolar.com/en/Technologies-and-Capabilities/PV-Modules/First-Solar-Series-3-Black-Module/CdTe-Technology.aspx">http://www.firstsolar.com/en/Technologies-and-Capabilities/PV-Modules/First-Solar-Series-3-Black-Module/CdTe-Technology.aspx</a>
Transparent solar cell	<a href="http://www.extremetech.com/extreme/188667-a-fully-transparent-solar-cell-that-could-make-every-window-and-screen-a-power-source">http://www.extremetech.com/extreme/188667-a-fully-transparent-solar-cell-that-could-make-every-window-and-screen-a-power-source</a>
Transparent solar panel	<a href="http://www.offgridquest.com/extra/a-fully-transparent-solar-cell-that-coul">http://www.offgridquest.com/extra/a-fully-transparent-solar-cell-that-coul</a>
Solar power from light and heat	<a href="http://mitei.mit.edu/news/how-make-perfect-solar-absorber">http://mitei.mit.edu/news/how-make-perfect-solar-absorber</a>
Coloured solar panels 35%	<a href="http://www.economist.com/news/science-and-technology/21596924-way-double-efficiency-solar-cells-about-go-mainstream-stacking">http://www.economist.com/news/science-and-technology/21596924-way-double-efficiency-solar-cells-about-go-mainstream-stacking</a>
Valoe: 40-year guarantee for solar panels	<a href="http://fi.valoe.com/aurinkomoduuli/">http://fi.valoe.com/aurinkomoduuli/</a>
Solar panel road being tested	<a href="http://www.aljazeera.com/news/2015/05/150510092535171.html">http://www.aljazeera.com/news/2015/05/150510092535171.html</a>
Perovskite stability problem about to be solved	<a href="http://spectrum.ieee.org/energywise/green-tech/solar/stable-perovskite-cell-boosts-solar-power">http://spectrum.ieee.org/energywise/green-tech/solar/stable-perovskite-cell-boosts-solar-power</a>
Solar power in Finland in 2050	<a href="http://yle.fi/uutiset/tutkijaryhma_lyo_laskelmat_poytaan_suomeen_rakennettava_yli_100_000_aurinkovoimalaa_2050_mennessa/8053034">http://yle.fi/uutiset/tutkijaryhma_lyo_laskelmat_poytaan_suomeen_rakennettava_yli_100_000_aurinkovoimalaa_2050_mennessa/8053034</a>
Solar power integrated into tin roof	<a href="http://www.virtesolar.fi/">http://www.virtesolar.fi/</a>
Sun Power PV 22.8%	<a href="http://www.pv-magazine.com/news/details/beitrag/sunpower-claims-228-module-record_100023318/">http://www.pv-magazine.com/news/details/beitrag/sunpower-claims-228-module-record_100023318/</a>

### Efficient and light solar panels (2.83) \*\*

The efficiency of solar panels has increased significantly. The development has been fastest in thin films. The efficiency of commercially available thin films has increased from 5% to 14%. In the laboratory, thin films have achieved over 20% efficiency. Solar panels based on combination methods have reached over 40% efficiency in the laboratory. However, thin film technology does not yet promise such performance. Light and efficient solar panels are needed for applications such as flying devices running on solar power and the production of tents and other foldable and portable solar power-producing surfaces. As the efficiency is improving and costs falling, the market share of thin film technology is expected to increase to a significant level also in fixed solar panel installations. Recommendation: incorporate in item 2.82.

Technology links after September 2013	
Solar panels printed on rolls	<a href="https://www.youtube.com/watch?v=5evOle4ivP8">https://www.youtube.com/watch?v=5evOle4ivP8</a>
Finnish solar cell technology	<a href="http://www.aalto.fi/fi/current/news/2015-05-18-002/">http://www.aalto.fi/fi/current/news/2015-05-18-002/</a>
Thin solar cells	<a href="http://www.eurekaalert.org/pub_releases/2015-07/anut072015.php">http://www.eurekaalert.org/pub_releases/2015-07/anut072015.php</a>

Magnetic nanoparticles in PV films	<a href="http://spectrum.ieee.org/nanoclast/green-tech/solar/magnetic-nanoparticles-boost-polymer-solar-cells">http://spectrum.ieee.org/nanoclast/green-tech/solar/magnetic-nanoparticles-boost-polymer-solar-cells</a>
40% solar cell	<a href="http://www.businessinsider.com.au/australian-solar-energy-researchers-have-found-a-way-to-get-40-efficiency-for-converting-sunlight-into-electricity-2014-12">http://www.businessinsider.com.au/australian-solar-energy-researchers-have-found-a-way-to-get-40-efficiency-for-converting-sunlight-into-electricity-2014-12</a>
Solar power with 34% efficiency	<a href="http://gizmodo.com/this-could-be-the-worlds-most-efficient-solar-system-1705184079">http://gizmodo.com/this-could-be-the-worlds-most-efficient-solar-system-1705184079</a>
PV printed on rolls	<a href="https://www.minds.com/blog/view/488083692665712640/mass-produced-printable-solar-cells-enter-market-and-could-change-everything">https://www.minds.com/blog/view/488083692665712640/mass-produced-printable-solar-cells-enter-market-and-could-change-everything</a>
Rectenna: Electricity from light	<a href="http://www.kurzweilai.net/first-optical-rectenna-converts-light-to-dc-current">http://www.kurzweilai.net/first-optical-rectenna-converts-light-to-dc-current</a>
Graphene converts photon into multiple electrons (PV)	<a href="http://spectrum.ieee.org/nanoclast/green-tech/solar/graphene-gets-another-boost-in-high-conversion-efficiency-photovoltaics">http://spectrum.ieee.org/nanoclast/green-tech/solar/graphene-gets-another-boost-in-high-conversion-efficiency-photovoltaics</a>
Flexible electronics	<a href="http://phys.org/news/2015-09-scientists-approach-quest-solar-panels.html">http://phys.org/news/2015-09-scientists-approach-quest-solar-panels.html</a>
Flexible graphene PV 15.6%	<a href="http://www.gizmag.com/graphene-solar-cell-record-efficiency/30466/">http://www.gizmag.com/graphene-solar-cell-record-efficiency/30466/</a>
PV record with silicon cells	<a href="http://yle.fi/uutiset/suomalainen_aurinkokenno_teki_maailmanennatyksen__markkinoille_viel_a_vuosien_matka/8127155">http://yle.fi/uutiset/suomalainen_aurinkokenno_teki_maailmanennatyksen__markkinoille_viel_a_vuosien_matka/8127155</a>
Graphene for PV surface	<a href="http://aabgu.org/bgu-makes-significant-advance-in-graphene-generation/">http://aabgu.org/bgu-makes-significant-advance-in-graphene-generation/</a>
Organic PV 13% efficiency	<a href="http://www.electronics-eetimes.com/en/heliatek-claims-opv-world-record-efficiency-of-13.2-percent.html?cmp_id=7&amp;news_id=222927415">http://www.electronics-eetimes.com/en/heliatek-claims-opv-world-record-efficiency-of-13.2-percent.html?cmp_id=7&amp;news_id=222927415</a>
Micrometre-thin solar panel	<a href="http://www.sciencedirect.com/science/article/pii/S1566119916300222">http://www.sciencedirect.com/science/article/pii/S1566119916300222</a>
CdTe solar cells are evolving	<a href="http://www.nature.com/articles/nenergy201615">http://www.nature.com/articles/nenergy201615</a>

### **Artificial leaf and synthetic fuel from the sun light and carbon dioxide (2.84) \***

Over 20% efficiency has been reached in the conversion of solar energy into hydrogen. Hydrogen has been produced from electricity at over 80% efficiency, and in methane production, efficiency has exceeded 50%. Ethanol production through electrocatalysis is also being continuously developed, and over 50% Faraday efficiency has been achieved. All of these are substances that can easily be used in fuel cells. Investments in development are increasing, as methods for long-time storage of energy are becoming important. This is a result of increasing price fluctuations in the electricity market, induced by the use of solar and wind power. This domain is already developing fast. Recommendation: change the heading to Synthetic fuels

Technology links after September 2013	
Cheap catalyst for hydrogen production	<a href="http://nextbigfuture.com/2015/09/carbon-fiber-with-molybdenum-disulfide.html">http://nextbigfuture.com/2015/09/carbon-fiber-with-molybdenum-disulfide.html</a>
22% of solar energy captured as hydrogen	<a href="http://www.techtimes.com/articles/77142/20150818/this-artificial-leaf-could-be-humanitys-lifeline-when-fossil-fuels-are-out.htm">http://www.techtimes.com/articles/77142/20150818/this-artificial-leaf-could-be-humanitys-lifeline-when-fossil-fuels-are-out.htm</a>
Methane from electricity 50%	<a href="http://www.rdmag.com/news/2015/08/milestone-achieved-hybrid-artificial-photosynthesis">http://www.rdmag.com/news/2015/08/milestone-achieved-hybrid-artificial-photosynthesis</a>
Artificial photosynthesis	<a href="http://phys.org/news/2015-10-ten-fold-efficiency-carbon-dioxide-fuel.html">http://phys.org/news/2015-10-ten-fold-efficiency-carbon-dioxide-fuel.html</a>
Methanol from methane with manganese catalyst	<a href="http://www.eurekalert.org/pub_releases/2016-01/uosd-hto012816.php">http://www.eurekalert.org/pub_releases/2016-01/uosd-hto012816.php</a>
Hydrogen from light	<a href="http://www.kurzweilai.net/making-hydrogen-fuel-from-water-and-visible-light-at-100-times-higher-efficiency">http://www.kurzweilai.net/making-hydrogen-fuel-from-water-and-visible-light-at-100-times-higher-efficiency</a>
Diesel fuel from water and carbon dioxide	<a href="http://www.sciencealert.com/audi-have-successfully-made-diesel-fuel-from-air-and-water">http://www.sciencealert.com/audi-have-successfully-made-diesel-fuel-from-air-and-water</a>
Ethanol from CO <sub>2</sub> at room temperature	<a href="http://news.stanford.edu/news/2014/april/ethanol-without-plants-040914.html">http://news.stanford.edu/news/2014/april/ethanol-without-plants-040914.html</a>
Hydrogen from water at over 80% efficiency	<a href="http://news.stanford.edu/news/2015/june/water-splitter-catalyst-062315.html">http://news.stanford.edu/news/2015/june/water-splitter-catalyst-062315.html</a>
Electricity produces aviation fuel from sea water	<a href="http://www.hindustantimes.com/world-news/us-navy-plane-flies-on-sea-water/article1-1206789.aspx">http://www.hindustantimes.com/world-news/us-navy-plane-flies-on-sea-water/article1-1206789.aspx</a>
Diesel fuel from air	<a href="http://www.bbc.com/news/business-34064072">http://www.bbc.com/news/business-34064072</a>
Low-cost hydrogen production	<a href="http://www.geek.com/science/stanford-discovers-cheap-way-to-produce-hydrogen-247-1626195/">http://www.geek.com/science/stanford-discovers-cheap-way-to-produce-hydrogen-247-1626195/</a>
Graphene produces hydrogen from air	<a href="http://phys.org/news/2014-11-protons-fuel-graphene-prospects.html">http://phys.org/news/2014-11-protons-fuel-graphene-prospects.html</a>
Cheap hydrogen electrolysis	<a href="http://spectrum.ieee.org/nanoclast/green-tech/fuel-cells/nanoscale-material-enables-cheap-emissionfree-hydrogen-production">http://spectrum.ieee.org/nanoclast/green-tech/fuel-cells/nanoscale-material-enables-cheap-emissionfree-hydrogen-production</a>
Hydrogen production	<a href="http://www.kurzweilai.net/making-hydrogen-fuel-from-water-and-visible-light-at-100-times-higher-efficiency">http://www.kurzweilai.net/making-hydrogen-fuel-from-water-and-visible-light-at-100-times-higher-efficiency</a>
Fuel from CO <sub>2</sub> &H <sub>2</sub> O using sunlight and heat	<a href="http://www.eurekalert.org/pub_releases/2016-02/uota-pop022216.php">http://www.eurekalert.org/pub_releases/2016-02/uota-pop022216.php</a>

### Production of biofuels using enzymes, bacteria or algae (2.85) \*\*

A method has been found for propane production using genetically modified bacteria. Algae population has been induced to produce electricity. Recommendation: incorporate in item 2.84.

Technology links after September 2013	
Synthetic propane	<a href="http://www.mtv.fi/uutiset/kotimaa/artikkeli/suomalaistutkijat-kehittavat-uusiutuvaa-propania/4383382">http://www.mtv.fi/uutiset/kotimaa/artikkeli/suomalaistutkijat-kehittavat-uusiutuvaa-propania/4383382</a>
E.coli produces propane (Finland), etc.	<a href="http://www.utu.fi/fi/Ajankohtaista/Uutiset/Sivut/Mikrobit-saatiin-tuottamaan-propania.aspx">http://www.utu.fi/fi/Ajankohtaista/Uutiset/Sivut/Mikrobit-saatiin-tuottamaan-propania.aspx</a>

Technology links after September 2013	
Hydrogen production	<a href="http://www.eurekalert.org/pub_releases/2015-04/vt-dbv040215.php">http://www.eurekalert.org/pub_releases/2015-04/vt-dbv040215.php</a>
Algae become a source of electricity	<a href="http://www.eurekalert.org/pub_releases/2015-10/ws-mpp100215.php">http://www.eurekalert.org/pub_releases/2015-10/ws-mpp100215.php</a>
GMO E.coli produces propane	<a href="http://www.theguardian.com/environment/2014/sep/02/propane-renewable-sources-ecoli-genes">http://www.theguardian.com/environment/2014/sep/02/propane-renewable-sources-ecoli-genes</a>

### Flying wind power and other new ways to produce wind energy (2.86) \*\*

Wind spirals have continued to develop further. Kite energy has been developed applying a number of different principles. Google's Makani has started testing a 600kW kite and is recruiting more employees at a fast pace. The principle of the convection power plant has been introduced. Recommendation: expand the category to include wave power plants and other kinetic energy.

Technology links after September 2013	
Kite energy	<a href="http://www.awelabs.com/awelabs-awecs-proposal/">http://www.awelabs.com/awelabs-awecs-proposal/</a>
Ship sails on wind power	<a href="http://www.tekniikkatalous.fi/Liikenne/rahtialus+liikkuu+tuulen+voimala++automaattiohjaus+loytaa+energiapiheimman+purjehdusreitina/1043105">http://www.tekniikkatalous.fi/Liikenne/rahtialus+liikkuu+tuulen+voimala++automaattiohjaus+loytaa+energiapiheimman+purjehdusreitina/1043105</a>
Wind power without blades	<a href="http://www.wired.com/2015/05/future-wind-turbines-no-blades/">http://www.wired.com/2015/05/future-wind-turbines-no-blades/</a>
Quadcopter kite energy	<a href="http://www.skywindpower.com/">http://www.skywindpower.com/</a>
Vertical wind power	<a href="https://www.facebook.com/EarthTheOperatorsManual.Page/">https://www.facebook.com/EarthTheOperatorsManual.Page/</a>
Windside wind spiral 100 m	<a href="http://yle.fi/uutiset/windside_virittelee_sadan_metrin_tuuliruuvia_valkeakoskelle/7989676">http://yle.fi/uutiset/windside_virittelee_sadan_metrin_tuuliruuvia_valkeakoskelle/7989676</a>
Convection power plant	<a href="http://www.fastcoexist.com/3030110/this-giant-tower-in-the-desert-could-generate-as-much-power-as-the-hoover-dam">http://www.fastcoexist.com/3030110/this-giant-tower-in-the-desert-could-generate-as-much-power-as-the-hoover-dam</a>
Wave power plant test	<a href="http://yle.fi/uutiset/suomalaisen_aaltovoimalan_testituloksia_julki_erittain_rohkaisevaa/7073948">http://yle.fi/uutiset/suomalaisen_aaltovoimalan_testituloksia_julki_erittain_rohkaisevaa/7073948</a>
Electricity from flowing salt water	<a href="http://arstechnica.com/science/2014/04/flowing-salt-water-over-graphene-generates-electricity/">http://arstechnica.com/science/2014/04/flowing-salt-water-over-graphene-generates-electricity/</a>

### Piezoelectrical energy sources, harvesting of kinetic energy (2.87) \*\*

Ricoh has launched a rubber-like material that converts kinetic energy into electricity. Galfenol, an alloy of gallium and iron, can convert 70% of kinetic energy into electricity. Recommendation: incorporate in item 2.86, due to similarity.

Technology links after September 2013	
Mechanical energy converted into electricity	<a href="http://nextbigfuture.com/2015/09/galfenol-can-convert-70-percent-of.html">http://nextbigfuture.com/2015/09/galfenol-can-convert-70-percent-of.html</a>
Rubber generates electricity from movement (Ricoh)	<a href="http://ricoh.com/release/2015/0518_1.html">http://ricoh.com/release/2015/0518_1.html</a>

## Serial production of small nuclear reactors, fission and fusion (2.88) \*

Fusion energy is being developed in many important, well-funded projects. New projects aim for small reactors, and their development cycle is estimated to be substantially faster compared with the development of large nuclear power plants. The scientific foundation of small fusion reactors has strengthened. Interest in thorium reactors has increased. LENR (cold fusion) keeps stirring discussion and the results of many independent groups are promising, but they do not meet the scientific criteria in terms of independence and transparency. Recommendation: retain.

Technology links after September 2013	
Small nuclear reactors	<a href="http://www.gu.se/omuniversitetet/aktuellt/nyheter/detalj//s maskalig-karnfusion-kan-bli-ny-energikalla.cid1323710">http://www.gu.se/omuniversitetet/aktuellt/nyheter/detalj//s maskalig-karnfusion-kan-bli-ny-energikalla.cid1323710</a>
Molten salt reactor	<a href="http://www.extremetech.com/extreme/150551-the-500mw-molten-salt-nuclear-reactor-safe-half-the-price-of-light-water-and-shipped-to-order-.VkAmRxyeBUc.facebook">http://www.extremetech.com/extreme/150551-the-500mw-molten-salt-nuclear-reactor-safe-half-the-price-of-light-water-and-shipped-to-order-.VkAmRxyeBUc.facebook</a>
LENR critics	<a href="https://medium.com/starts-with-a-bang/the-e-cat-cold-fusion-or-scientific-fraud-624f15676f96">https://medium.com/starts-with-a-bang/the-e-cat-cold-fusion-or-scientific-fraud-624f15676f96</a>
Small reactor PRISM	<a href="http://en.wikipedia.org/wiki/PRISM_%28reactor%29">http://en.wikipedia.org/wiki/PRISM_%28reactor%29</a>
Small Tokamak	<a href="http://physicsworld.com/cws/article/news/2015/feb/16/small-er-fusion-reactors-could-deliver-big-gains">http://physicsworld.com/cws/article/news/2015/feb/16/small-er-fusion-reactors-could-deliver-big-gains</a>
TWR reactor	<a href="http://nextbigfuture.com/2015/09/bill-gates-terrapower-and-china.html">http://nextbigfuture.com/2015/09/bill-gates-terrapower-and-china.html</a>
Cyclone LENR recruitment	<a href="http://pesn.com/2013/12/04/9602399_Nuclear-Engingeer-joins-Cyclone-to-pursue-LENR-Applications/">http://pesn.com/2013/12/04/9602399_Nuclear-Engingeer-joins-Cyclone-to-pursue-LENR-Applications/</a>
Thorium reactor	<a href="http://www.ithero.org/articles/world%E2%80%99s-first-thorium-reactor-designed">http://www.ithero.org/articles/world%E2%80%99s-first-thorium-reactor-designed</a>
LENR Parkhomov	<a href="https://www.facebook.com/MartinFleischmannMemorialProject/photos/a.587293604634676.1073741827.466698113360893/941079882589378/?type=3&amp;fref=nf">https://www.facebook.com/MartinFleischmannMemorialProject/photos/a.587293604634676.1073741827.466698113360893/941079882589378/?type=3&amp;fref=nf</a>
Fusion power W-7-X in operation	<a href="http://www.ipp.mpg.de/3984226/12_15">http://www.ipp.mpg.de/3984226/12_15</a>
LENR hypothesis	<a href="http://animpossibleinvention.com/2015/10/15/swedish-scientists-claim-lenr-explanation-break-through/">http://animpossibleinvention.com/2015/10/15/swedish-scientists-claim-lenr-explanation-break-through/</a>
Molten salt reactor review	<a href="http://nextbigfuture.com/2015/09/molten-salt-nuclear-reactor-review-and.html">http://nextbigfuture.com/2015/09/molten-salt-nuclear-reactor-review-and.html</a>
Small Tokamak	<a href="http://news.mit.edu/2015/small-modular-efficient-fusion-plant-0810">http://news.mit.edu/2015/small-modular-efficient-fusion-plant-0810</a>
Review of nuclear power development	<a href="http://thirdway.org/report/advanced-nuclear-101">http://thirdway.org/report/advanced-nuclear-101</a>

Technology links after September 2013	
LENR patent	<a href="http://fcnp.com/2015/08/27/the-peak-oil-crisis-cold-fusion-gets-a-u-s-patent/">http://fcnp.com/2015/08/27/the-peak-oil-crisis-cold-fusion-gets-a-u-s-patent/</a>
Lockheed fusion	<a href="http://www.theguardian.com/environment/2014/oct/15/lockheed-breakthrough-nuclear-fusion-energy">http://www.theguardian.com/environment/2014/oct/15/lockheed-breakthrough-nuclear-fusion-energy</a>
Small fusion reactor	<a href="http://motherboard.vice.com/read/an-alternative-approach-to-nuclear-fusion-think-smaller">http://motherboard.vice.com/read/an-alternative-approach-to-nuclear-fusion-think-smaller</a>
LENR aircraft	<a href="http://nari.arc.nasa.gov/sites/default/files/Wells_TM2014-218283%20Low%20Energy%20Nuclear%20Reaction%20Aircraft.pdf">http://nari.arc.nasa.gov/sites/default/files/Wells_TM2014-218283%20Low%20Energy%20Nuclear%20Reaction%20Aircraft.pdf</a>
Thorium reactor	<a href="http://youtu.be/N2vzotsvkvw">http://youtu.be/N2vzotsvkvw</a>
Fusion reactor (High-Beta)	<a href="http://www.washington.edu/news/2014/10/08/uw-fusion-reactor-concept-could-be-cheaper-than-coal/">http://www.washington.edu/news/2014/10/08/uw-fusion-reactor-concept-could-be-cheaper-than-coal/</a>
LENR E-Cat testing report	<a href="http://pressly.it/piXb">http://pressly.it/piXb</a>
Fusion energy	<a href="http://news.sciencemag.org/physics/2015/06/mystery-company-blazes-trail-fusion-energy">http://news.sciencemag.org/physics/2015/06/mystery-company-blazes-trail-fusion-energy</a>
Thorium reactor	<a href="http://www.youtube.com/watch?v=uK367T7h6ZY">http://www.youtube.com/watch?v=uK367T7h6ZY</a>

### Rapidly charging light batteries and supercapacitors (2.89) \*\*\*\*

Battery technology has developed relatively fast, and researchers have published a lot of results of progress on a number of alternative paths of development. Researchers have developed many methods that can significantly improve the energy density, charging speed and durability of lithium ion batteries. A lithium-air battery is under development, and its power/weight ratio is estimated to equal that of liquid fuels. The development is still in an early stage. The energy density of a lithium-sulphur battery is tenfold compared with current LI batteries. So far, however, researchers have only been able to develop a version that can be charged 50 times. Supercapacitors are being developed out of cellulose and graphene. Their capacity is approaching that of current batteries, but the charging speed and number of recharges are higher by orders of magnitude. Recommendation: retain.

Technology links after September 2013	
Graphene-based supercapacitors	<a href="http://www.iflscience.com/technology/graphene-based-supercapacitors-could-eliminate-batteries-electric-cars-within-5-years">http://www.iflscience.com/technology/graphene-based-supercapacitors-could-eliminate-batteries-electric-cars-within-5-years</a>
Supercapacitor made with graphene	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/3d-hybrid-supercapacitor-made-with-graphene">http://spectrum.ieee.org/nanoclast/semiconductors/materials/3d-hybrid-supercapacitor-made-with-graphene</a>
High energy density in lithium-sulphur battery	<a href="http://www.extremetech.com/extreme/200255-glass-coated-sulfur-particles-could-improve-battery-life-1000-percent">http://www.extremetech.com/extreme/200255-glass-coated-sulfur-particles-could-improve-battery-life-1000-percent</a>
Supercapacitors made with cellulose	<a href="http://www.nanotech-now.com/news.cgi?story_id=49290">http://www.nanotech-now.com/news.cgi?story_id=49290</a>
Graphene capacitor charger keeps devices powered on the go	<a href="http://androidcommunity.com/zapgo-graphene-supercapacitor-charger-charges-in-five-minutes-20141111/">http://androidcommunity.com/zapgo-graphene-supercapacitor-charger-charges-in-five-minutes-20141111/</a>
Nano-sandwich material	<a href="http://www.eurekalert.org/pub_releases/2015-08/du-de081415.php">http://www.eurekalert.org/pub_releases/2015-08/du-de081415.php</a>

Technology links after September 2013	
Samsung LI battery improves by 50–80%	<a href="http://www.neowin.net/news/samsung-doubles-lithium-battery-capacity-with-graphene-and-silicon">http://www.neowin.net/news/samsung-doubles-lithium-battery-capacity-with-graphene-and-silicon</a>
LI battery keeps itself warm in cold weather	<a href="http://www.gizmag.com/all-climate-lithium-battery/41429/">http://www.gizmag.com/all-climate-lithium-battery/41429/</a>
Quickly recharged battery	<a href="http://www.msn.com/en-us/news/it-insider/an-mit-battery-breakthrough-could-charge-your-smartphone-in-6-minutes/ar-BBlGwuY?ocid=wispr">http://www.msn.com/en-us/news/it-insider/an-mit-battery-breakthrough-could-charge-your-smartphone-in-6-minutes/ar-BBlGwuY?ocid=wispr</a>
Plastic supercapacitor using LIG process	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/laserinduced-graphene-looks-to-dipplace-batteries-with-supercapacitors">http://spectrum.ieee.org/nanoclast/semiconductors/materials/laserinduced-graphene-looks-to-dipplace-batteries-with-supercapacitors</a>
Feasible sodium batteries	<a href="http://phys.org/news/2015-09-cathode-material-possibilities-sodium-ion-batteries.html">http://phys.org/news/2015-09-cathode-material-possibilities-sodium-ion-batteries.html</a>
Lithium-air battery	<a href="http://phys.org/news/2015-10-path-ultimate-battery.html-jCp">http://phys.org/news/2015-10-path-ultimate-battery.html-jCp</a>
400 Wh/kg battery Bosch	<a href="http://nextbigfuture.com/2015/09/bosch-claims-they-will-commercialize.html">http://nextbigfuture.com/2015/09/bosch-claims-they-will-commercialize.html</a>
Carbon nanotube supercapacitor	<a href="http://cleantechnica.com/2014/05/12/new-graphene-carbon-nanotube-supercapacitor/">http://cleantechnica.com/2014/05/12/new-graphene-carbon-nanotube-supercapacitor/</a>
Flexible conductor of boron nitride	<a href="http://www.eurekalert.org/pub_releases/2015-08/ps-fdp080615.php-.VcY_8kTWhuo.facebook">http://www.eurekalert.org/pub_releases/2015-08/ps-fdp080615.php-.VcY_8kTWhuo.facebook</a>
Supercapacitors made with cellulose	<a href="http://www.sciencedaily.com/releases/2015/12/151203111337.htm">http://www.sciencedaily.com/releases/2015/12/151203111337.htm</a>
Supercapacitor made with graphene	<a href="http://www.extremetech.com/computing/163071-graphene-supercapacitors-created-with-traditional-paper-making-process-rivals-lead-acid-battery-capacity">http://www.extremetech.com/computing/163071-graphene-supercapacitors-created-with-traditional-paper-making-process-rivals-lead-acid-battery-capacity</a>
Long-lasting built-in batteries	<a href="http://www.kurzweilai.net/rechargeable-batteries-with-almost-indefinite-lifetimes-coming-say-mit-samsung-engineers">http://www.kurzweilai.net/rechargeable-batteries-with-almost-indefinite-lifetimes-coming-say-mit-samsung-engineers</a>
Quickly recharged battery	<a href="http://www.bbc.com/news/technology-30708945">http://www.bbc.com/news/technology-30708945</a>
Higher energy density in lithium battery	<a href="http://www.technologyreview.com/news/533541/a-prototype-battery-could-double-the-range-of-electric-cars/">http://www.technologyreview.com/news/533541/a-prototype-battery-could-double-the-range-of-electric-cars/</a>
Efficient sodium battery	<a href="http://www.broadbit.com/">http://www.broadbit.com/</a>
\$54/kWh polymer battery in the pipeline	<a href="http://cleantechnica.com/2016/02/26/new-energy-storage-solution-could-hit-magic-54-mark/">http://cleantechnica.com/2016/02/26/new-energy-storage-solution-could-hit-magic-54-mark/</a>
Lithium-air battery under development	<a href="http://spectrum.ieee.org/transportation/advanced-cars/an-electric-car-battery-that-will-get-you-from-paris-to-brussels-and-back">http://spectrum.ieee.org/transportation/advanced-cars/an-electric-car-battery-that-will-get-you-from-paris-to-brussels-and-back</a>

## 2.90 Massive storage of energy in high capacity batteries (2.90) \*\*\*

A number of battery solutions for load balancing in buildings and the grid have been launched in the market. In many cases, the competitiveness of batteries has surpassed gas turbines in daily balancing. In addition to LI batteries, there are batteries in the market that are based on inexpensive materials, such as zinc and salts. Flow batteries with easily expandable capacity are being developed, as well as batteries based on aluminium, sugars, paper and hemp. Recommendation: retain.

Technology links after September 2013	
Metal powders for fuel	<a href="http://www.eurekalert.org/pub_releases/2015-12/mucmp120915.php">http://www.eurekalert.org/pub_releases/2015-12/mucmp120915.php</a>
Costs of energy storage down by 70% by 2030	<a href="https://www.worldenergy.org/publications/2016/e-storage-shifting-from-cost-to-value-2016/">https://www.worldenergy.org/publications/2016/e-storage-shifting-from-cost-to-value-2016/</a>
Energy storage in soil cylinder	<a href="http://www.heindl-energy.com/hydraulic-rock-storage/overview.html">http://www.heindl-energy.com/hydraulic-rock-storage/overview.html</a>
Low-cost battery material	<a href="http://www.gizmag.com/fools-gold-replace-lithium-batteries/40404/">http://www.gizmag.com/fools-gold-replace-lithium-batteries/40404/</a>
Low-cost battery material	<a href="http://pubs.acs.org/doi/abs/10.1021/acs.chemmater.5b03531?journalCode=cmater&amp;">http://pubs.acs.org/doi/abs/10.1021/acs.chemmater.5b03531?journalCode=cmater&amp;</a>
Flux capacitor	<a href="http://advances.sciencemag.org/content/advances/1/9/e1500605.full.pdf">http://advances.sciencemag.org/content/advances/1/9/e1500605.full.pdf</a>
Profitability of energy storage in the USA	<a href="http://www.greentechmedia.com/articles/read/battery-storage-pays-back-in-less-than-five-years-sc-finds">http://www.greentechmedia.com/articles/read/battery-storage-pays-back-in-less-than-five-years-sc-finds</a>
Tesla battery for houses	<a href="http://thenextweb.com/gadgets/2015/05/01/elontricity/">http://thenextweb.com/gadgets/2015/05/01/elontricity/</a>
Aquion salt water battery	<a href="http://www.aquionenergy.com/grid-scale-batteries">http://www.aquionenergy.com/grid-scale-batteries</a>
Flow battery	<a href="http://jes.ecsdl.org/content/161/9/A1371.full?sid=e4be8ba7-839f-4669-9a85-5b9c42d73289">http://jes.ecsdl.org/content/161/9/A1371.full?sid=e4be8ba7-839f-4669-9a85-5b9c42d73289</a>
Aluminium battery	<a href="https://energy.stanford.edu/news/aluminum-battery-stanford-offers-safe-alternative-conventional-batteries">https://energy.stanford.edu/news/aluminum-battery-stanford-offers-safe-alternative-conventional-batteries</a>
Market forecast for energy storage systems	<a href="http://cleantechnica.com/2014/06/09/solar-energy-storage-system-market-germany-approaching-boom/">http://cleantechnica.com/2014/06/09/solar-energy-storage-system-market-germany-approaching-boom/</a>
Undersea energy storage	<a href="http://dspace.mit.edu/handle/1721.1/78934">http://dspace.mit.edu/handle/1721.1/78934</a>
Flow battery for homes	<a href="http://www.eurekalert.org/pub_releases/2015-09/hugsf091715.php">http://www.eurekalert.org/pub_releases/2015-09/hugsf091715.php</a>
Hemp as battery material	<a href="http://www.acs.org/content/acs/en/pressroom/newsreleases/2014/august/could-hemp-nanosheets-topple-graphene-for-making-the-ideal-supercapacitor.html">http://www.acs.org/content/acs/en/pressroom/newsreleases/2014/august/could-hemp-nanosheets-topple-graphene-for-making-the-ideal-supercapacitor.html</a>
VTT's study on energy storage systems	<a href="http://www.vtt.fi/inf/pdf/tiedotteet/2003/T2199.pdf">http://www.vtt.fi/inf/pdf/tiedotteet/2003/T2199.pdf</a>
Flow battery EUR 240/kWh	<a href="https://cleantechnica.com/2014/12/01/us-navy-pushes-solar-energy-storage-solution/">https://cleantechnica.com/2014/12/01/us-navy-pushes-solar-energy-storage-solution/</a>
Tesla's Gigafactory \$5 billion	<a href="http://www.batterynews.org/2014/02/27/tesla-open-5-billion-battery-factory-electric-cars/">http://www.batterynews.org/2014/02/27/tesla-open-5-billion-battery-factory-electric-cars/</a>
Molten salt-based storage of energy	<a href="http://spectrum.ieee.org/green-tech/solar/a-tower-of-molten-salt-will-deliver-solar-power-after-sunset">http://spectrum.ieee.org/green-tech/solar/a-tower-of-molten-salt-will-deliver-solar-power-after-sunset</a>
Sugar battery	<a href="http://phys.org/news/2014-01-energy-dense-sugar-battery.html">http://phys.org/news/2014-01-energy-dense-sugar-battery.html</a>
Summary of energy storage systems	<a href="http://energystorage.org/system/files/resources/2014storageplanassessment-recs-for-doe-sep2014.pdf">http://energystorage.org/system/files/resources/2014storageplanassessment-recs-for-doe-sep2014.pdf</a>
EOS Aurora \$160/kWh	<a href="http://cleantechnica.com/2015/01/29/eos-energy-storage-a-aurora-battery-system-commercially-available-2016-160kwh/">http://cleantechnica.com/2015/01/29/eos-energy-storage-a-aurora-battery-system-commercially-available-2016-160kwh/</a>

### Solar heat and long-term storage of heat (2.91) \*\*\*

A number of Finnish products and product concepts have been introduced for the capture and storage of solar heat, such as Polarsol, Solixi and Ahood. A geothermal power plant is

under construction in Espoo. IBM has introduced a sunlight collector; it converts 80% of the collected radiation into electricity, heat and clean water. Storage of solar heat is being studied on the basis of phase change. Solar heat storage solutions are about to be launched on the market, and solutions are developing quite rapidly. Recommendation: retain.

Technology links after September 2013	
Heat capture AHOOD	<a href="http://koti.ts.fi/rakenna/aktiivivaippa-nappaa-ilmaislammontalteen">http://koti.ts.fi/rakenna/aktiivivaippa-nappaa-ilmaislammontalteen</a>
Geothermal heat from depths (ST1)	<a href="https://www.facebook.com/st1suomi/videos/1122831784394302/?fref=nf">https://www.facebook.com/st1suomi/videos/1122831784394302/?fref=nf</a>
Passive radiator for cooling	<a href="http://spectrum.ieee.org/tech-talk/green-tech/solar/passive-radiators-cool-by-sending-heat-straight-to-outer-space">http://spectrum.ieee.org/tech-talk/green-tech/solar/passive-radiators-cool-by-sending-heat-straight-to-outer-space</a>
Capture of district heat	<a href="http://www.tekniikkatalous.fi/tekniikka/suomalaisyrittys-kehitti-mullistavan-kaukolampoputken-siirron-hyotysuhde-100-prosenttiin-6064861">http://www.tekniikkatalous.fi/tekniikka/suomalaisyrittys-kehitti-mullistavan-kaukolampoputken-siirron-hyotysuhde-100-prosenttiin-6064861</a>
Storage of solar heat, phase change	<a href="http://www.google.com/patents/US8231804">http://www.google.com/patents/US8231804</a>
IBM 80% solar energy collector	<a href="http://www.theguardian.com/environment/2014/sep/28/solar-energy-sunflower-ibm-airlight-electricity">http://www.theguardian.com/environment/2014/sep/28/solar-energy-sunflower-ibm-airlight-electricity</a>
Solar heat Polarsol	<a href="http://www.polarsol.com/">http://www.polarsol.com/</a>
Solixi energy storage	<a href="http://www.solixi.com/index.cfm?sivu=176">http://www.solixi.com/index.cfm?sivu=176</a>
Geothermal power plant in Espoo	<a href="http://yle.fi/uutiset/espoossa_aletaan_nostaa_kaukolampoa_maasta_120_asteista_vetta_kilometrien_syvydesta/7657222">http://yle.fi/uutiset/espoossa_aletaan_nostaa_kaukolampoa_maasta_120_asteista_vetta_kilometrien_syvydesta/7657222</a>

### Inexpensive storage of hydrogen in nanostructures (2.92) \*

Storage of hydrogen is mainly developed in connection with hydrogen cars. Storage of hydrogen in nanostructures or chemical compounds is necessary for long-time storage of hydrogen, such as the storage of solar energy in summer to be used in winter. Progress has been made with combining hydrogen with hydrocarbons, such as toluenes and benzene. The opportunities provided for graphene for the storage of hydrogen are being actively studied in a number of products. So far, no breakthroughs have been reported. Recommendation: retain.

Technology links after September 2013	
Storage of hydrogen in benzene using solar energy	<a href="http://phys.org/news/2015-06-simple-hydrogen-storage-solution-powered.html">http://phys.org/news/2015-06-simple-hydrogen-storage-solution-powered.html</a>
Storage of hydrogen in toluene	<a href="http://www.chiyoda-corp.com/news/en/2013/post_77.html">http://www.chiyoda-corp.com/news/en/2013/post_77.html</a>
Transportation of hydrogen (in cars)	<a href="http://phys.org/news/2014-06-hydrogen-breakthrough-game-changer-future-car.html">http://phys.org/news/2014-06-hydrogen-breakthrough-game-changer-future-car.html</a>

**Wireless electricity transmission (magnetism) for electric cars and other electrical devices (2.93) \*\***

Ossia has demonstrated the Cota technology that charges 30 different devices at a distance of ten metres. An AA battery, for example, has been demonstrated as a receiving device to be charged. Many actors have launched induction-based short-distance chargers  
 Recommendation: retain, but extend the heading to Wireless power transmission.

Technology links after September 2013	
Cota wireless charging	<a href="http://www.digitaltrends.com/cool-tech/ossia-cota-wireless-charging/">http://www.digitaltrends.com/cool-tech/ossia-cota-wireless-charging/</a>
Wireless charging 10 m	<a href="http://www.gizmag.com/cota-ossia-wireless-charging-microwave-phased-array/29217/">http://www.gizmag.com/cota-ossia-wireless-charging-microwave-phased-array/29217/</a>
Wireless charging by infrared laser	<a href="http://spectrum.ieee.org/tech-talk/consumer-electronics/portable-devices/wicharge-promises-phone-charging-by-infrared-laser">http://spectrum.ieee.org/tech-talk/consumer-electronics/portable-devices/wicharge-promises-phone-charging-by-infrared-laser</a>
Wireless electricity transmission	<a href="http://www.scienceworldreport.com/articles/12112/20140110/wireless-power-transfer-range-vastly-extended-with-superlens.htm">http://www.scienceworldreport.com/articles/12112/20140110/wireless-power-transfer-range-vastly-extended-with-superlens.htm</a>
Wireless charging	<a href="http://spectrum.ieee.org/energywise/consumer-electronics/gadgets/ossias-cota-wireless-power-tech-promises-to-enable-the-internet-of-everything">http://spectrum.ieee.org/energywise/consumer-electronics/gadgets/ossias-cota-wireless-power-tech-promises-to-enable-the-internet-of-everything</a>
Wireless charging of cars	<a href="http://witricity.com/">http://witricity.com/</a>

**High-performance lasers, wireless power transfer, laser weapons (2.94) \***

Many news have been published on the deployment of high-performance lasers in military use for combatting UAVs. EMP cannons have also been developed for military use for destroying electronic devices. Microwave weapons have also been introduced for military use. Directed energy weapons are developing fast. Recommendation: retain, but incorporate wireless power transfer in item 2.93 and change the heading to High-performance lasers, directed energy weapons.

Technology links after September 2013	
Anti-UAV	<a href="http://www.theguardian.com/technology/2015/oct/07/drone-death-ray-device-liteye-auds?CMP=tw_t_a-technology_b-gdntech">http://www.theguardian.com/technology/2015/oct/07/drone-death-ray-device-liteye-auds?CMP=tw_t_a-technology_b-gdntech</a>
US Navy development projects	<a href="http://news.yahoo.com/blogs/power-players-abc-news/technologies-once-available-only-in-movies-are-now-a-reality-for-the-us-navy-225652354.html">http://news.yahoo.com/blogs/power-players-abc-news/technologies-once-available-only-in-movies-are-now-a-reality-for-the-us-navy-225652354.html</a>
Antidrone weapons	<a href="http://petapixel.com/2015/07/23/anti-drone-systems-are-starting-to-take-off/ - more-173279">http://petapixel.com/2015/07/23/anti-drone-systems-are-starting-to-take-off/ - more-173279</a>
UAV combatting	<a href="http://yle.fi/uutiset/7825746">http://yle.fi/uutiset/7825746</a>

Technology links after September 2013	
Bofors HMP directed energy weapon	<a href="http://www.miltechmag.com/2014/03/todays-directed-energy-weapons-meeting.html">http://www.miltechmag.com/2014/03/todays-directed-energy-weapons-meeting.html</a>
Laser weapon stops car	<a href="http://www.engadget.com/2015/03/04/lockheed-martin-laser-athena-test/?ncid=rss_truncated">http://www.engadget.com/2015/03/04/lockheed-martin-laser-athena-test/?ncid=rss_truncated</a>
Laser weapon in use (USA)	<a href="http://www.uusisuomi.fi/teknologia/75325-usan-armeija-otti-juuri-kayttoon-1-laseraseen-047-eu-laukaus">http://www.uusisuomi.fi/teknologia/75325-usan-armeija-otti-juuri-kayttoon-1-laseraseen-047-eu-laukaus</a>
EMP cannon	<a href="http://yle.fi/uutiset/venaja_esittelee_mikroaaltokanunan__tu_hoaa_lentokoneiden_ja_lennokkien_elektroniikan/8075687">http://yle.fi/uutiset/venaja_esittelee_mikroaaltokanunan__tu_hoaa_lentokoneiden_ja_lennokkien_elektroniikan/8075687</a>

## (new) Inexpensive small fuel cell (2.102)

The fuel cell market has increased tenfold many times since the turn of the millennium. The development has been fast. Fuel cells are developed for the use of hydrogen, methane, alcohol, sugar, etc., as energy sources. Fuel cells produce electricity and heat. GE estimates achieving up to 95% energy efficiency in combined electricity and heat production. The natural gas fueled Redox Cube is a 25 kW device with a size of one cubic metre that promises over 54% efficiency in power generation and over 80% efficiency in combined power and heat generation. Toyota has made available thousands of fuel cell patent applications. The efficiency of fuel cells clearly exceeds diesel aggregates without taking heat generation into account. If the development continues as expected, fuel cells together with solar panels enable financially feasible withdrawal from the grid and better energy security for many households. Recommendation: new category.

Technology links after September 2013	
Fuel cells 95% S+L	<a href="http://spectrum.ieee.org/energywise/green-tech/fuel-cells/ge-claims-fuel-cell-breakthrough-starts-pilot-production">http://spectrum.ieee.org/energywise/green-tech/fuel-cells/ge-claims-fuel-cell-breakthrough-starts-pilot-production</a>
Fuel cell (commercial)	<a href="http://www.powercell.se/products/fuel-cell/">http://www.powercell.se/products/fuel-cell/</a>
Over 80% efficiency in household fuel cell	<a href="http://www.viessmann-us.com/content/dam/internet-global/pdf_documents/com/brochures_english/ppr-fuel_cell_boiler.pdf">http://www.viessmann-us.com/content/dam/internet-global/pdf_documents/com/brochures_english/ppr-fuel_cell_boiler.pdf</a>
5,000 fuel cell patents made available (Toyota)	<a href="http://www.geekwire.com/2015/toyota-gives-away-patents-build-game-changing-car-future/">http://www.geekwire.com/2015/toyota-gives-away-patents-build-game-changing-car-future/</a>
Fuel cell review	<a href="https://www.iea.org/publications/freepublications/publication/TechnologyRoadmapHydrogenandFuelCells.pdf">https://www.iea.org/publications/freepublications/publication/TechnologyRoadmapHydrogenandFuelCells.pdf</a>
Nickel to replace platinum in fuel cells	<a href="http://www.eurekalert.org/pub_releases/2016-01/uod-fca011416.php">http://www.eurekalert.org/pub_releases/2016-01/uod-fca011416.php</a>
Electricity from methane	<a href="http://phys.org/news/2015-10-microorganisms-sea-power-nanowire-cables.html">http://phys.org/news/2015-10-microorganisms-sea-power-nanowire-cables.html</a>
Small fuel cells	<a href="http://www.redoxpowersystems.com/products/">http://www.redoxpowersystems.com/products/</a>
Sugar fuel cell	<a href="https://www.facebook.com/download/915787981841799/P020141125389402985500.pdf">https://www.facebook.com/download/915787981841799/P020141125389402985500.pdf</a>
Microbial fuel cell	<a href="https://en.wikipedia.org/wiki/Microbial_fuel_cell">https://en.wikipedia.org/wiki/Microbial_fuel_cell</a>
Toyota gives away fuel cell patents	<a href="http://www.geekwire.com/2015/toyota-gives-away-patents-build-game-changing-car-future/">http://www.geekwire.com/2015/toyota-gives-away-patents-build-game-changing-car-future/</a>

## (new) CO2 recovery (2.105)

The warming of the climate has induced global measures, ranging from emission restrictions to carbon dioxide tax and emissions trading. Methods for the removal of carbon dioxide from process fuel gases, the atmosphere and sea water are developed continuously. The most promising of these are methods that produce useful materials of carbon dioxide and methods involving a process that is not energy intensive. Biological methods for carbon dioxide removal include genetically engineered bacteria and plants and synthetic photosynthesis, which is now being developed by many laboratories. Liquid fuels and methane are produced from carbon dioxide with promising new methods. The purpose is to use extra solar and wind power for the production of synthetic fuels and bind carbon dioxide at the same time. One of the most interesting radical technologies is pumping air through molten salt and live catalyst in a process that uses very little electricity and ties carbon from carbon dioxide in air into useful and valuable nanocarbon. This process will reduce the production cost of nanocarbons at least by one order of magnitude compared with other nanocarbons of similar quality. At least in theory, this method could be scalable into purifying the entire atmosphere of extra carbon dioxide in a manner that would be financially profitable. Recommendation: new category

Technology links after September 2013	
Hydrogen and graphite from methane	<a href="https://youtu.be/SuSi5HEwtEM">https://youtu.be/SuSi5HEwtEM</a>
CO2 capture from sea water	<a href="http://www.jacobsschool.ucsd.edu/news/news_releases/release.sfe?id=1817">http://www.jacobsschool.ucsd.edu/news/news_releases/release.sfe?id=1817</a>
Summary of radical technologies in the electricity market	<a href="http://energia.fi/sites/default/files/dokumentit/energiategollisuus/Tutkimus/ST-pooli/lu_risto_linturi.pdf">http://energia.fi/sites/default/files/dokumentit/energiategollisuus/Tutkimus/ST-pooli/lu_risto_linturi.pdf</a>
Fast-growing GMO tree	<a href="http://www.manchester.ac.uk/discover/news/article/?id=14313">http://www.manchester.ac.uk/discover/news/article/?id=14313</a>
CO2 capture	<a href="http://www.eurekalert.org/pub_releases/2015-10/uof-dbc_1102215.php">http://www.eurekalert.org/pub_releases/2015-10/uof-dbc_1102215.php</a>
CO2 converted into fuel with great efficiency	<a href="http://www.sciencelert.com/new-material-converts-co2-into-clean-fuel-with-unprecedented-efficiency">http://www.sciencelert.com/new-material-converts-co2-into-clean-fuel-with-unprecedented-efficiency</a>
Laser ignition improves engine efficiency	<a href="http://spectrum.ieee.org/energywise/energy/fossil-fuels/lasers-could-boost-engine-efficiency-by-27">http://spectrum.ieee.org/energywise/energy/fossil-fuels/lasers-could-boost-engine-efficiency-by-27</a>
Renewables provide 95% of energy in Uruguay	<a href="http://gu.com/p/4ekpc/sfb">http://gu.com/p/4ekpc/sfb</a>
Nanocarbons without CO2	<a href="http://www.bbc.com/news/science-environment-33998697">http://www.bbc.com/news/science-environment-33998697</a>
Carbon and energy from natural gas	<a href="http://www.kit.edu/kit/pi_2015_139_crack-it-fossile-energie-ohne-klimagase.php">http://www.kit.edu/kit/pi_2015_139_crack-it-fossile-energie-ohne-klimagase.php</a>
Carbon dioxide captured from air converted into methanol	<a href="http://phys.org/news/2016-01-carbon-dioxide-captured-air-methanol.html">http://phys.org/news/2016-01-carbon-dioxide-captured-air-methanol.html</a>
CO2 capture	<a href="http://decarboni.se/news/search-cheaper-carbon-capture-system-goes-using-common-materials">http://decarboni.se/news/search-cheaper-carbon-capture-system-goes-using-common-materials</a>
Review of new energy technologies	<a href="http://www.businessinsider.com/17-emerging-energy-technologies-2014-4?">http://www.businessinsider.com/17-emerging-energy-technologies-2014-4?</a>
Satellite laser to fight global warming	<a href="http://motherboard.vice.com/read/scientists-propose-using-lasers-to-fight-global-warming-from-space">http://motherboard.vice.com/read/scientists-propose-using-lasers-to-fight-global-warming-from-space</a>

Technology links after September 2013	
Driverless electric cars to reduce CO2 emissions by 90%	<a href="http://www.popsci.com/green-argument-driverless-cars">http://www.popsci.com/green-argument-driverless-cars</a>
IEA 2050 vision	<a href="http://www.iea.org/etp/explore/">http://www.iea.org/etp/explore/</a>
Synthetic photosynthesis, CO2 capture	<a href="http://pubs.acs.org/doi/abs/10.1021/acs.nanolett.5b01254?journalCode=nalefd">http://pubs.acs.org/doi/abs/10.1021/acs.nanolett.5b01254?journalCode=nalefd</a>
Review of funding of the fight against global warming	<a href="https://www.facebook.com/download/1508362316135159/CE RES_BNEF_MTG_Overview_Deck_27January.pdf">https://www.facebook.com/download/1508362316135159/CE RES_BNEF_MTG_Overview_Deck_27January.pdf</a>
CO2 capture	<a href="http://www.nature.com/nature/journal/v519/n7543/full/nature14327.html">http://www.nature.com/nature/journal/v519/n7543/full/nature14327.html</a>

### (new) Off Grid and Micro Grid solutions (2.110)

A number of separate solutions enable a technically easier and financially more sensible withdrawal from the grid, independent food production and goods manufacturing. Apartment- and community-level solutions have been demonstrated. In Australia, for example, it has been estimated that by 2020, it would be financially profitable for up to 50% of households to withdraw from the national grid. Ecocapsule is a prototype of an easily movable home. It produces the energy it needs, collects and purifies rainwater for household use and treats sewage. Recommendation: new category.

Technology links after September 2013	
Local grid	<a href="http://cleantechnica.com/2015/10/14/the-future-of-energy-in-australia-may-be-renewable-micro-grids/">http://cleantechnica.com/2015/10/14/the-future-of-energy-in-australia-may-be-renewable-micro-grids/</a>
Off Grid housing – Ecocapsule	<a href="http://www.huffingtonpost.com/2015/05/26/tiny-house_n_7443744.html">http://www.huffingtonpost.com/2015/05/26/tiny-house_n_7443744.html</a>
P2P electricity trading	<a href="http://www.technologyreview.com/news/544471/renewable-energy-trading-launched-in-germany/">http://www.technologyreview.com/news/544471/renewable-energy-trading-launched-in-germany/</a>

## 7.9 Digital crowdsourcing platforms and platform companies

Uberisation of work is a topic of increasingly serious discussion around the world. With the use of software and a global information network, the interface to job opportunities, quality assurance of work, trust, assignments and payment transactions can be automated. This decreases administrative costs and enables very dynamic and flexible organisations. Typically, the person doing the work owns the resources used or provided, and there is no permanent employment contract. Platform companies provide a channel for an economy of sharing, in which your apartment, car or any goods you no longer need are used by others, temporarily or permanently. As regards crowdsourcing, we can also talk about funding, collection of data conducted during use, or other use of time that involves people giving others access to their funds or expertise through a shared platform. The platform may be owned by a company or the third sector.

The impact of crowdsourcing platforms and platform companies on the reorganisation of work is becoming increasingly strong. The platforms reduce the number of layers in organisations and convert some of the previously paid jobs into voluntary activities. Wikipedia is a good example of this phenomenon that may considerably reduce or even completely replace business in some areas and, despite this, provide users with superb quality and availability compared with services previously provided by companies. A platform company may employ a considerably high number of people. For example, the six-year old Uber employs more than a million drivers in 64 countries, offering their services further. In practice, a platform company has total control over the way in which the platform operates. As platforms operate as cloud services, any changes have an immediate effect on the services.

Technological development after the publication of the TuV9/2013 report and needs for improvement related to reporting:

**Freely organising remote work and organisations that form on the internet (2.13)**

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In a few years, a multitude of services have emerged for the organisation of work and service on the internet. Uber and Airbnb are the financially most important of the newcomers. Linux and Wikipedia have the most extensive effects and are mostly based on voluntary work. Examples of recent development include the Be My Eyes service, the online doctor service organised by Google, Wikihouse, Opendesk and Flipboard. Transformation of advertising media, or AdTech business, peer collaboration networks, Darknet operating outside the reach of law and other anonymous internet, web-of-trust platforms, open-source code communities and workforce on demand platforms are some examples of the new growing trends. Radical ideas have been developed relating to machine-to-machine economy, platform co-operatives, a sharing economy in which the marginal cost approaches zero, and organisations becoming more dynamic networks. Organisations without leaders, such as Boorzorg, consumerisation of health care devices and organisation of peer groups, open-source code pancreas or the concept of an Uber of the seas show that this development will probably not leave many fields of business untouched. The development has been very fast. Recommendation: split the domain into 2-4 categories, for example: a) Platform companies that provide services and goods; b) Voluntary consolidation of user data and voluntary work platforms; c) Decentralised, professional production of content (subject to a charge or sponsored); d) Darknet and other anonymous internet.

Technology links after September 2013	
Googling online doctors	<a href="http://gizmodo.com/google-tests-connecting-doctors-with-online-patients-1645412934">http://gizmodo.com/google-tests-connecting-doctors-with-online-patients-1645412934</a>
Machine-to-machine economy	<a href="http://www.impactlab.net/2014/09/19/micro-payments-between-connected-devices-could-enable-a-new-layer-of-the-economy/">http://www.impactlab.net/2014/09/19/micro-payments-between-connected-devices-could-enable-a-new-layer-of-the-economy/</a>

Technology links after September 2013	
Darknet/anonymous internet	<a href="http://apps.washingtonpost.com/g/page/world/nsa-research-report-on-the-tor-encryption-program/501/">http://apps.washingtonpost.com/g/page/world/nsa-research-report-on-the-tor-encryption-program/501/</a>
Web-of-trust platform	<a href="https://www.ethereum.org/">https://www.ethereum.org/</a>
Driverless cars owning themselves	<a href="http://www.bbc.com/news/technology-30998361">http://www.bbc.com/news/technology-30998361</a>
AdTech business – transformation of advertising media, several links	<a href="http://www.macrumors.com/2016/01/13/apple-automated-iad-platform/">http://www.macrumors.com/2016/01/13/apple-automated-iad-platform/</a>
Zero Marginal Cost society	<a href="http://www.amazon.com/Zero-Marginal-Cost-Society-Collaborative/dp/1137278463">http://www.amazon.com/Zero-Marginal-Cost-Society-Collaborative/dp/1137278463</a>
Be My Eyes app	<a href="https://vimeo.com/113872517">https://vimeo.com/113872517</a>
Workforce on demand (Deloitte)	<a href="http://dupress.com/periodical/trends/human-capital-trends-2015/?id=us%3A2el%3A3dc%3Adu%3A1179%3Aeng%3Acons%3Aht15">http://dupress.com/periodical/trends/human-capital-trends-2015/?id=us%3A2el%3A3dc%3Adu%3A1179%3Aeng%3Acons%3Aht15</a>
Writers Cafe peer collaboration	<a href="http://www.kboards.com/index.php?board=60.0">http://www.kboards.com/index.php?board=60.0</a>
Review of the open source code market	<a href="http://techcrunch.com/2015/12/15/the-golden-age-of-open-source-has-arrived/">http://techcrunch.com/2015/12/15/the-golden-age-of-open-source-has-arrived/</a>
Boorzorg digital organisation	<a href="http://www.buurtzorgnederland.com/">http://www.buurtzorgnederland.com/</a>
Flipboard curation	<a href="https://about.flipboard.com/magmaker/flipboardchat-summary-how-to-curate-news-magazines/">https://about.flipboard.com/magmaker/flipboardchat-summary-how-to-curate-news-magazines/</a>
Opendesk global furniture design	<a href="https://www.opendesk.cc/">https://www.opendesk.cc/</a>
Wikihouse – open source building design	<a href="http://www.wikihouse.cc/">http://www.wikihouse.cc/</a>
Uber of seas (and inland waters)	<a href="http://businesssturku.fi/bt/fi/cms.nsf/PFBD/0E99FB3FEE58387EC2257F1500292715">http://businesssturku.fi/bt/fi/cms.nsf/PFBD/0E99FB3FEE58387EC2257F1500292715</a>
Zero Marginal Cost Society	<a href="https://www.youtube.com/watch?v=5-iDUcETjvo">https://www.youtube.com/watch?v=5-iDUcETjvo</a>
Crowdsourcing in translation/studying	<a href="http://www.theguardian.com/education/2012/feb/14/web-translation-fails-learners">http://www.theguardian.com/education/2012/feb/14/web-translation-fails-learners</a>
Organisations without leaders	<a href="http://www.washingtonpost.com/blogs/on-leadership/wp/2014/01/03/zappos-gets-rid-of-all-managers/">http://www.washingtonpost.com/blogs/on-leadership/wp/2014/01/03/zappos-gets-rid-of-all-managers/</a>
Open source code pancreas	<a href="http://openaps.org/">http://openaps.org/</a>
Platform co-ops	<a href="http://www.shareable.net/blog/how-platform-coops-can-beat-death-stars-like-uber-to-create-a-real-sharing-economy">http://www.shareable.net/blog/how-platform-coops-can-beat-death-stars-like-uber-to-create-a-real-sharing-economy</a>
Uber business model and examples for group 9	<a href="http://www.nytimes.com/2015/01/29/technology/personaltech/uber-a-rising-business-model.html">http://www.nytimes.com/2015/01/29/technology/personaltech/uber-a-rising-business-model.html</a>
From organisations to networks	<a href="http://interactioninstitute.org/blog/2013/07/31/why-networks-for-social-change/">http://interactioninstitute.org/blog/2013/07/31/why-networks-for-social-change/</a>
Work above and below the algorithm	<a href="http://www.druckerforum.org/blog/?p=1097">http://www.druckerforum.org/blog/?p=1097</a>

## Crowd funding and micro finance (2.18) \*\*

A simple invention related to beekeeping raised over 12 million dollars through Indiegogo's crowdfunding. Projects of Indiegogo and Kickstarter have received increasing amounts of funding, and the platforms have been established as significant early funding and marketing channel for new product ideas. Indiegogo is planning to start providing services also for medium-sized and large companies. In Finland, crowdfunding is taking its first steps. With regard to legislation, the situation is still confusing, due to attempts to restrict the structures of self-organisation with regulative measures. This is very harmful for Finnish actors and does not protect Finnish customers, who are increasingly

participating in crowdfunding campaigns of foreign actors. The significance of crowdfunding for the transformation of economy and as a means for bypassing rigid structures has probably only started to emerge, and fast development will continue. Recommendation: retain.

Technology links after September 2013	
Linda Liukas' kickstarter project	<a href="http://www.theguardian.com/technology/2014/jan/27/hello-ruby-kids-coding-book-kickstarter">http://www.theguardian.com/technology/2014/jan/27/hello-ruby-kids-coding-book-kickstarter</a>
Digital crowdsourcing platforms for larger businesses	<a href="http://www.fastcompany.com/3055223/fast-feed/indiegogo-courts-big-businesses-with-enterprise-crowdfunding">http://www.fastcompany.com/3055223/fast-feed/indiegogo-courts-big-businesses-with-enterprise-crowdfunding</a>
Crowdfunding example, \$12 million to fund a honey harvesting system	<a href="https://www.indiegogo.com/projects/flow-hive-honey-on-tap-directly-from-your-beehive">https://www.indiegogo.com/projects/flow-hive-honey-on-tap-directly-from-your-beehive</a>

### Open data and Big data (2.19) \*\*\*\*

In the first report, Open data and Big data were combined into one technology basket, as it seemed that only openly available Big data was significant. The rapid development of the industrial internet and internet of things, as well as the extensive amount of data available through cloud services, have quickly changed the situation. Industry and service organisations have more and more data available even in closed systems. On the other hand, the idea of open data has made such a quick breakthrough that, instead of the openness of data, the lack of interface standards can be seen as a problem. Thus, despite openness, the use of data is too complicated. Numerous examples of Big Data have been published recently. For example, you can figure out earthquakes from mobile phone data in real-time, in addition to countless other things. Big Data is too large a concept and it only keeps growing. From the perspective of applying Big Data, the main problem is no longer the availability of data but the algorithms and artificial intelligence needed to combine data into useful conclusions. Even though the category has continued to progress very fast at the application level, removal of this category is recommended. As regards Big Data, matters should be addressed in more detail as part of artificial intelligence and algorithmic deduction, and open data should be addressed as part of interfaces and digital crowdsourcing platforms.

Technology links after September 2013	
Earthquake information from mobile phones	<a href="https://www.facebook.com/RichardDawkinsFoundation/photos/a.496176595154.294030.8798180154/10151871457060155/?type=3&amp;fref=nf">https://www.facebook.com/RichardDawkinsFoundation/photos/a.496176595154.294030.8798180154/10151871457060155/?type=3&amp;fref=nf</a>
DR Watson, general description	<a href="http://www.businessinsider.com/ibms-watson-may-soon-be-the-best-doctor-in-the-world-2014-4?IR=T">http://www.businessinsider.com/ibms-watson-may-soon-be-the-best-doctor-in-the-world-2014-4?IR=T</a>
Smartphone app gives earthquake warning	<a href="http://advances.sciencemag.org/content/2/2/e1501055.full">http://advances.sciencemag.org/content/2/2/e1501055.full</a>

## Gamification (2.20) \*\*\*\*

Gamification has clearly progressed in the trust-promoting structures of platform companies, such as Uber. However, as an independent category, news in media is not detected and the area is not subject to significant research. Nevertheless, the concepts related to gamification have been clarified. The most extensive progress has been seen in the area of online learning. As the progress is clearly noticeable and has a strong impact on self-management and platform activities, it is recommended to continue monitoring this category: retain.

Technology links after September 2013	
Ideology of gamification matures	<a href="https://en.wikipedia.org/wiki/Gamification">https://en.wikipedia.org/wiki/Gamification</a>

## Electronic money, time banks (2.99) \*\*\*\*

Paypal and Bitcoin played a significant role during the worst time of the euro crisis in Greece. Bitcoin has doubled its turnover every year. In the latter part of 2015, the value was one billion dollars. Subcutaneous bitcoin wallets have been implanted in humans and a protocol to distribute Bitcoin via radio is under development. Bitcoin is also increasingly called a pyramid scheme. Its basic weaknesses are pointed out and its successor predicted. The number of Paypal users is growing steadily. At the end of 2015, there were approximately 180 million active users. Mobile payment has made electronic money very important in Africa. Transferring money between accounts using handy smartphone apps is banks' response to bit money. Time banks have not made significant progress. Recommendation: retain, but change the category to Electronic money and incorporate the content related to time banks as part of freely organisable work. On the other hand, Bitcoin could also be included as part of the proposed new 2.112 Blockchain category.

Technology links after September 2013	
Blockchain money for Tunisia's post office	<a href="http://goo.gl/qwGDTH">http://goo.gl/qwGDTH</a>
Subcutaneous Bitcoin wallet	<a href="http://www.slideshare.net/PekkoVehvilinen/worlds-first-bitcoin-transfer-into-a-human-this-is-how-we-did-it">http://www.slideshare.net/PekkoVehvilinen/worlds-first-bitcoin-transfer-into-a-human-this-is-how-we-did-it</a>
Bitcoin via radio	<a href="http://kryptoradio.koodilehto.fi/">http://kryptoradio.koodilehto.fi/</a>
Paypal/Bitcoin during the euro crisis	<a href="https://www.cryptocoinsnews.com/paypal-shuts-greece-bitcoin-still-operates/">https://www.cryptocoinsnews.com/paypal-shuts-greece-bitcoin-still-operates/</a>
Bitcoin critics	<a href="https://www.washingtonpost.com/news/innovations/wp/2016/01/19/r-i-p-bitcoin-its-time-to-move-on/">https://www.washingtonpost.com/news/innovations/wp/2016/01/19/r-i-p-bitcoin-its-time-to-move-on/</a>

## 7.10 Globalising technology component interfaces

Microsoft, Apple and Google, among others, have demonstrated what power technological products can have when they become industrial standards. When products include interfaces for their programming and use, new ecosystems and complete socio-economic systems that use the technology are born, relying on the interfaces. The technologies may enable practices that are in conflict with the way in which an individual country would like to attend to matters. However, it is difficult for an individual country to demand changes to global interfaces or, due to the detected issues, to keep out of these ecosystems.

Increasingly often, technology interfaces set the framework for social, political, financial and even military interaction. The interfaces discussed in this section benefit from and, when they become more common, produce economies of scale, connectivity and expanding ecosystems related to them. The interfaces are clearly stable and any modifications to them without losing their user base are possible only by expanding their functionality.

Evolving IOT, robotisation, artificial intelligence, virtual reality and biotechnology each expand the significance of technology interfaces and create new, even more significant interfaces. Anticipation of these is important but challenging.

Technological development after the publication of the TuV9/2013 report and needs for improvement related to reporting:

### Cloud computing (2.28) \*\*\*\*

Cloud services have rapidly become mainstream. Storage space and computing capacity can conveniently be leased according to need. This requires that the applications are compatible with the interfaces of virtualised servers and workstations. Cloud services are also increasingly produced at the application level. More and more devices come with functional features that are based on cloud services. According to the most dramatic expert forecast, the annual cost of storage space used in cloud services will drop to one thirtieth from 2015 to 2020. The estimate is based on increasing adoption of new memory technology. Recommendation: split in two sections to be monitored, in accordance with virtual computers offered through cloud services and storage-related SAAS services.

Technology links after September 2013	
Solu cloud computing terminal	<a href="https://www.kickstarter.com/projects/676993694/solu-a-new-breed-of-computing?ref=thanks_share">https://www.kickstarter.com/projects/676993694/solu-a-new-breed-of-computing?ref=thanks_share</a>
Optical GST memory circuit	<a href="http://www.kurzweilai.net/first-all-optical-chip-memory">http://www.kurzweilai.net/first-all-optical-chip-memory</a>
Decreased price of Nand Flash memory promotes cloud services	<a href="http://www.zdnet.com/article/enterprise-storage-trends-and-predictions/">http://www.zdnet.com/article/enterprise-storage-trends-and-predictions/</a>

### Grid computing (2.29) \*\*\*

As a result of the rapid progress of cloud computing, decentralisation of processing capacity through the processing of workstations has not emerged more strongly as a phenomenon. Its significance can be expected to decrease along with the advancing of cloud computing. Recommendation: remove.

### Modular robotics (2.53) \*\*\*\*

The development of robotics is quickly becoming modular. The price of robot control electronics is decreasing from tens of euros to less than ten. Hands, sensors and software platforms for robots are sold and developed in separate projects that are based on compatible interfaces. The strongest modularisation is seen around Arduino and Raspberry Pi. Quadcopters and the extrusion technology of 3D printers are the most distinct representatives of modularity. Modular robotics are clearly connected to the development of IOT and AI, within which many new parallel interfaces and platforms are being created. These will possibly create separate ecosystems that each involve modularity. However, it will probably be challenging to combine modules intended for different ecosystems. Dominant design will develop before long. Recommendation: retain, change the name to Modular robotics, robotic ecosystems.

Technology links after September 2013	
IOT adapters	<a href="http://ruuvi.com/blog/ruuvi-goes-bt-42.html">http://ruuvi.com/blog/ruuvi-goes-bt-42.html</a>
Arduino/Raspberry Pi comparison	<a href="http://readwrite.com/2014/05/07/arduino-vs-raspberry-pi-projects-diy-platform">http://readwrite.com/2014/05/07/arduino-vs-raspberry-pi-projects-diy-platform</a>
Inexpensive robotic hand Katia with 5 degrees of freedom	<a href="http://techcrunch.com/2016/01/06/this-robotic-arm-can-do-everything-from-3d-printing-to-laser-cutting-to-cake-decorating/">http://techcrunch.com/2016/01/06/this-robotic-arm-can-do-everything-from-3d-printing-to-laser-cutting-to-cake-decorating/</a>
Open hardware	<a href="http://www.open-electronics.org/open-hardware-summit-2014-rome-from-making-open-to-open-manufacturing/">http://www.open-electronics.org/open-hardware-summit-2014-rome-from-making-open-to-open-manufacturing/</a>
EUR 134 robotic hand	<a href="http://www.wired.com/design/2014/03/kickstarter-robot-arm-ufactory/">http://www.wired.com/design/2014/03/kickstarter-robot-arm-ufactory/</a>
Raspberry Pi2 \$35	<a href="http://www.bbc.com/news/technology-31088908">http://www.bbc.com/news/technology-31088908</a>
RaspBerry Pi Zero \$5	<a href="http://www.engadget.com/2015/11/28/raspberry-pi-eric-schmidt/">http://www.engadget.com/2015/11/28/raspberry-pi-eric-schmidt/</a>
\$9 computer, wifi, linux, etc.	<a href="http://postscapes.com/9-single-board-computer-chip">http://postscapes.com/9-single-board-computer-chip</a>

### Internet for robots (2.100) \*\*

Car manufacturers have started developing joint procedures for communication between cars. The development of 5G networks particularly pays attention to the explosively increasing need for communication by wireless sensors, resulting from the development of the IOT, and the need of many robots for low latency. Controlling of terrestrial robots from satellites and an internet protocol operating in space have also been developed.

Mutual sharing of information between learning robots has been developed further. This trend can be expected to increase rapidly as AI platforms evolve and their interfaces mature. Recommendation: split into two, a) competence and control services for robots, b) 5G network and telecommunications services for robots.

Technology links after September 2013	
Internet for robots	<a href="http://www.bbc.co.uk/news/technology-25727110">http://www.bbc.co.uk/news/technology-25727110</a>
5G, IOT situation in 2016	<a href="http://www.techweekeurope.co.uk/networks/voip/mobile-telecoms-predictions-2016-182776">http://www.techweekeurope.co.uk/networks/voip/mobile-telecoms-predictions-2016-182776</a>
Internet of space	<a href="https://tools.ietf.org/html/rfc4838">https://tools.ietf.org/html/rfc4838</a>
Internet for robots	<a href="http://www.fastcoexist.com/3024972/robots-can-now-teach-other-robots-thanks-to-the-robo-internet">http://www.fastcoexist.com/3024972/robots-can-now-teach-other-robots-thanks-to-the-robo-internet</a>
Google's Skybender 5G plan uses millimetre waves	<a href="http://indianexpress.com/article/technology/tech-news-technology/google-project-skybender-5g-internet-planes/">http://indianexpress.com/article/technology/tech-news-technology/google-project-skybender-5g-internet-planes/</a>
Car-to-car communication	<a href="http://spectrum.ieee.org/cars-that-think/transportation/infrastructure/cars-talk-to-cars-on-the-autobahn">http://spectrum.ieee.org/cars-that-think/transportation/infrastructure/cars-talk-to-cars-on-the-autobahn</a>
5G networks	<a href="http://www.tut.fi/fi/tietoa-yliopistosta/uutiset-ja-tapahtumat/5g-tarvitsee-digitaalista-signaalinkasittelya-x123729c2">http://www.tut.fi/fi/tietoa-yliopistosta/uutiset-ja-tapahtumat/5g-tarvitsee-digitaalista-signaalinkasittelya-x123729c2</a>
5G networks	<a href="https://www.facebook.com/ZTECorp/photos/pcb.755127304567731/755126827901112/?type=3">https://www.facebook.com/ZTECorp/photos/pcb.755127304567731/755126827901112/?type=3</a>
Nokia 5G White-Paper	<a href="http://nsn.com/file/28771/nsn-5g-white-paper?download">http://nsn.com/file/28771/nsn-5g-white-paper?download</a>

### (new) MyData (2.111)

MyData is a trend and international open development project for the creation of shared interfaces, so that citizens could possess and manage such information of themselves that different organisations have collected about them in their person registers. The development of MyData may have significant value for the national economy. In addition, its significance for people's daily life can be considerable by making it smoother and by promoting the feeling of management and fairness. Recommendation: new category.

Technology links after September 2013	
MyData	<a href="http://www.hs.fi/paakirjoitukset/a1402548692688?jako=95b0ef985b6f760000529c9bb30bf7da">http://www.hs.fi/paakirjoitukset/a1402548692688?jako=95b0ef985b6f760000529c9bb30bf7da</a>
MyData in government platform	<a href="http://fi.okfn.org/2015/05/29/mydata-mukana-strategisessa-hallitusohjelmassa/">http://fi.okfn.org/2015/05/29/mydata-mukana-strategisessa-hallitusohjelmassa/</a>
MyData's value for the national economy	<a href="http://www.libertyglobal.com/PDF/public-policy/The-Value-of-Our-Digital-Identity.pdf">http://www.libertyglobal.com/PDF/public-policy/The-Value-of-Our-Digital-Identity.pdf</a>
Ecosystem of traffic data	<a href="http://www2.liikennevirasto.fi/julkaisut/pdf8/Its_2014-42_liikennetiedon_visiot_web.pdf">http://www2.liikennevirasto.fi/julkaisut/pdf8/Its_2014-42_liikennetiedon_visiot_web.pdf</a>

## (new) Blockchain and other p2p solutions (2.112)

Blockchain has grown together with Bitcoin. However, there are many actors who are using Blockchain to develop various types of systems that can be very different from the original application. In a digital city project in China, for example, Blockchain is used for assigning user rights and conducting operation control. There are also plans to use Blockchain for share trading and other trading in securities and the securing of log data of telephone discussions. IBM supports Linux Foundation's project to develop an open source Blockchain platform. The domain is expanding very fast, and it has a great impact on the rationalisation of administration and bypassing of traditional power and control structures. Recommendation: new category.

Technology links after September 2013	
Blockchain development opportunities	<a href="https://www.youtube.com/watch?v=Pu4PAMFPo5Y">https://www.youtube.com/watch?v=Pu4PAMFPo5Y</a>
Bitcoin/Blockchain impacts	<a href="http://www.telegraph.co.uk/technology/news/10881213/The-coming-digital-anarchy.html?fb">http://www.telegraph.co.uk/technology/news/10881213/The-coming-digital-anarchy.html?fb</a>
Blockchain-based structures of trust, several links	<a href="http://www.ibtimes.co.uk/factom-signs-smart-city-deal-roll-out-blockchain-verification-across-china-1542059">http://www.ibtimes.co.uk/factom-signs-smart-city-deal-roll-out-blockchain-verification-across-china-1542059</a>
Blockchain for a logistics solution	<a href="http://www.kinno.fi/article/teknologiajatti-ibm-ja-kouvola-innovation-yhteistyohon-kehitteilla-teollisen-internetin">http://www.kinno.fi/article/teknologiajatti-ibm-ja-kouvola-innovation-yhteistyohon-kehitteilla-teollisen-internetin</a>
Blockchain applications, several links	<a href="http://www.blockchaintechnologies.com/blockchain-applications">http://www.blockchaintechnologies.com/blockchain-applications</a>

## (new) Digital art, digital experiences (2.700)

Digitalisation, artificial intelligence and robotisation enable new ways for producing experiences and art and delivering them to people. The new opportunities enable completely new forms of art and entertainment, but also easy copying and virtually experiencing already existing works of art. This development will create new, global technological interfaces between distribution, applications, recordings and terminal devices. Recommendation: new category.

Technology links after September 2013	
Significance of design	<a href="https://www.facebook.com/NowThisNews/videos/752323541524439/?fref=nf">https://www.facebook.com/NowThisNews/videos/752323541524439/?fref=nf</a>
Future of music	<a href="http://www.hs.fi/kulttuuri/a1390984545889">http://www.hs.fi/kulttuuri/a1390984545889</a>
Quadcopters replace fireworks	<a href="https://www.facebook.com/thisinsider/videos/1506168603023866/?fref=nf">https://www.facebook.com/thisinsider/videos/1506168603023866/?fref=nf</a>
3D printed kinetic art	<a href="http://www.uusisuomi.fi/kulttuuri/76636-3d-tulostuksella-luotiin-huimaava-naky-avaa-isoksi-ja-nauti">http://www.uusisuomi.fi/kulttuuri/76636-3d-tulostuksella-luotiin-huimaava-naky-avaa-isoksi-ja-nauti</a>
Robots on stage	<a href="https://www.youtube.com/watch?v=EFEqTgIXvf8">https://www.youtube.com/watch?v=EFEqTgIXvf8</a>

## 7.11 Unclassified innovations (2.200)

This list includes news about technological and scientific innovations that have breakthrough potential but have not yet been categorised. They were found through crowdsourcing but require consideration and assessment to be placed in a category, if they are found to be part of some significant phenomenon.

Technology links after September 2013	
Hypersonic passenger plane	<a href="http://nextbigfuture.com/2015/11/skreemr-hypersonic-passenger-plane.html">http://nextbigfuture.com/2015/11/skreemr-hypersonic-passenger-plane.html</a>
Zeno phenomenon	<a href="http://phys.org/news/2015-10-zeno-effect-verifiedatoms-wont.html">http://phys.org/news/2015-10-zeno-effect-verifiedatoms-wont.html</a>
Energy links NEO2015	<a href="http://www.bloomberg.com/company/new-energy-outlook/">http://www.bloomberg.com/company/new-energy-outlook/</a>
Circular economy	<a href="http://www.maaseuduntulevaisuus.fi/ymp%C3%A4rist%C3%B6/sitra-kotimaista-h%C3%A4rk%C3%A4papua-tuontisoijan-tilalle-1.126302">http://www.maaseuduntulevaisuus.fi/ymp%C3%A4rist%C3%B6/sitra-kotimaista-h%C3%A4rk%C3%A4papua-tuontisoijan-tilalle-1.126302</a>
Weyl fermion	<a href="http://www.sciencealert.com/scientists-have-finally-discovered-massless-particles-and-they-could-radically-speed-up-electronics">http://www.sciencealert.com/scientists-have-finally-discovered-massless-particles-and-they-could-radically-speed-up-electronics</a>
Remote audio sensors, HD phone call	<a href="http://spectrum.ieee.org/telecom/standards/full-hd-voice-will-soon-give-your-phone-an-audio-upgrade">http://spectrum.ieee.org/telecom/standards/full-hd-voice-will-soon-give-your-phone-an-audio-upgrade</a>
Thing2Data – individual identity of goods	<a href="https://www.facebook.com/notes/risto-linturi/esineiden-internet-hankkeen-thing2datan-hanke-esite-t%C3%A4m%C3%A4nkaltaista-kai-hallituso/10153385399454602">https://www.facebook.com/notes/risto-linturi/esineiden-internet-hankkeen-thing2datan-hanke-esite-t%C3%A4m%C3%A4nkaltaista-kai-hallituso/10153385399454602</a>
Express building	<a href="https://www.youtube.com/watch?v=rwvmru5JmXk">https://www.youtube.com/watch?v=rwvmru5JmXk</a>
Spherical robot in military tests	<a href="http://www.iflscience.com/technology/meet-guardbot-spherical-amphibious-robot">http://www.iflscience.com/technology/meet-guardbot-spherical-amphibious-robot</a>
Data security through quantum entanglement	<a href="http://phys.org/news/2014-12-fraud-proof-credit-cards-quantum-physics.html">http://phys.org/news/2014-12-fraud-proof-credit-cards-quantum-physics.html</a>
Privatisation of health care services in Finland	<a href="http://yle.fi/uutiset/terveyspalvelut_yksityistyvät_nopeasti/7623506">http://yle.fi/uutiset/terveyspalvelut_yksityistyvät_nopeasti/7623506</a>
Encryption with camera cell	<a href="http://www.uusisuomi.fi/tiede-ja-ymparisto/72056-tieteellinen-lapimurto-nokia-n9n-kameralla-maailmankaikkeuden-ika-ei-riita">http://www.uusisuomi.fi/tiede-ja-ymparisto/72056-tieteellinen-lapimurto-nokia-n9n-kameralla-maailmankaikkeuden-ika-ei-riita</a>
Hubless wheel	<a href="https://www.youtube.com/watch?v=cPsY2NfPjtw">https://www.youtube.com/watch?v=cPsY2NfPjtw</a>
Virtual windows	<a href="http://www.virgin.com/richard-branson/virgin-launches-glass-bottomed-plane">http://www.virgin.com/richard-branson/virgin-launches-glass-bottomed-plane</a>
DNA programming language	<a href="http://www.washington.edu/news/2013/09/30/uw-engineers-invent-programming-language-to-build-synthetic-dna/">http://www.washington.edu/news/2013/09/30/uw-engineers-invent-programming-language-to-build-synthetic-dna/</a>
Public transport solution on the road	<a href="https://www.youtube.com/watch?v=t1gTzc7-lbQ">https://www.youtube.com/watch?v=t1gTzc7-lbQ</a>
GHz antenna on a chip has been questioned	<a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/new-theory-leading-to-gigahertz-antenna-on-a-chip-is-questioned">http://spectrum.ieee.org/tech-talk/biomedical/devices/new-theory-leading-to-gigahertz-antenna-on-a-chip-is-questioned</a>
Waste paper turned into new paper in the office	<a href="https://www.facebook.com/ScienceNaturePage/videos/765132843618976/">https://www.facebook.com/ScienceNaturePage/videos/765132843618976/</a>
Quick encryption (MS)	<a href="http://www.theregister.co.uk/2016/02/09/researchers_break_homomorphic_encryption/">http://www.theregister.co.uk/2016/02/09/researchers_break_homomorphic_encryption/</a>

Technology links after September 2013	
Communication network made of fungi	<a href="http://www.bbc.com/earth/story/20141111-plants-have-a-hidden-internet">http://www.bbc.com/earth/story/20141111-plants-have-a-hidden-internet</a>
Passive WiFi (almost without power)	<a href="http://www.eurekalert.org/pub_releases/2016-02/uow-uea022316.php">http://www.eurekalert.org/pub_releases/2016-02/uow-uea022316.php</a>

## 7.12 Discussions related to technology news

Nearly all of the approximately thousand science and technology news included in the tables of this chapter were discussed by the crowdsourcing group. Very often, the discussion brought up excellent viewpoints, critics and links to parallel research data, original scientific publications and tangential topics. Thus, the thousand links presented here are just a representative sample and summary of the more detailed material produced through crowdsourcing. Appendix 2 is a file that, in addition to these links, includes the name of the person posting the link and a link to the discussion on the topic, as well as the classification information of the links and assessment of the progress of the technology baskets. To be able to open the link to a discussion requires membership in that Facebook group. This is due to a privacy-related technical reason. Membership has been automatically granted to all Finnish citizens who have requested it.

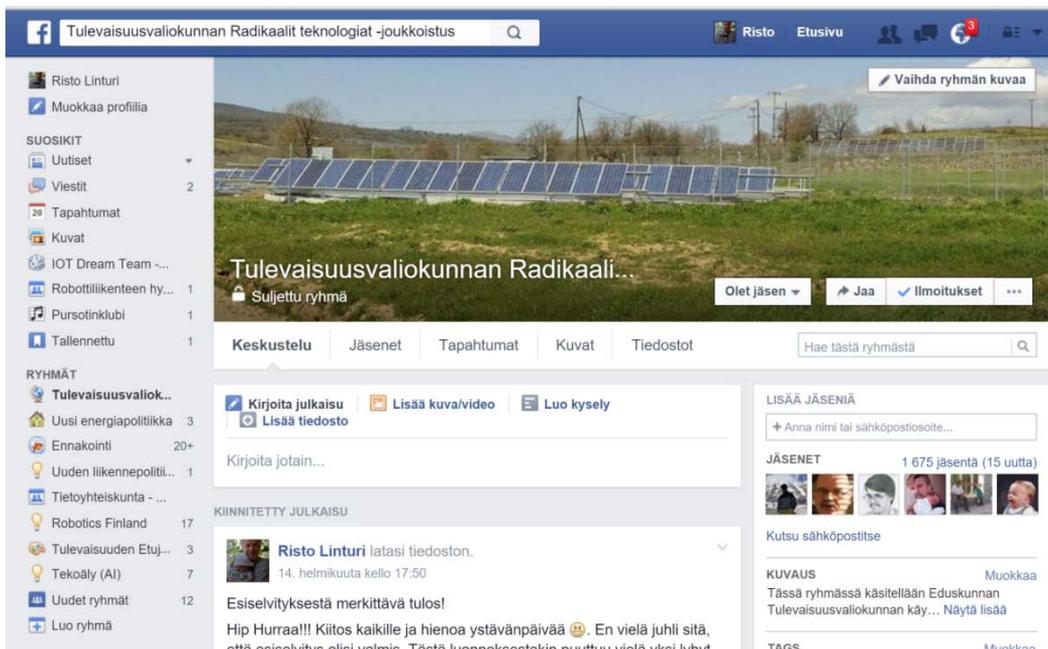


Figure: Extensive crowdsourcing through social media continued for years

## 8 Appendixes

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### Appendix 1 Preliminary description of the radical technologies database

A Hundred New Opportunities for Finland: Radical Technological Solutions  
Preliminary description of database in accordance with the four-level model:

Table1: Value-producing network

Fields: AVID, main heading of network, subheading, general description, additional value of the network including scope of influence, network dynamics and actors, technological threats to the network, technological opportunities related to the network, the socio-technical regime controlling the network and inertial forces.

Table2: Technology basket

Fields: TKID, TKRID, heading of technology basket, general description, readiness for the market, domestic expertise, export channels, scientific research background, R&D background, AVID1-20, VIKD1-N (scoring values)

Table3: Export channel

Fields: VKID, TKID, description of export channel, scope of export channel

Table4: Technology news

Fields: TKUID, TKID, heading describing the technology news, news classification, importance as news, date, person posting/TID, link to news, link to discussion.

Table5: Technology group

Fields: TKRID, technology group

Table6: Application

Fields: SID, AVID, TKID, description of application, weight

Table7: State

Fields: VID, weight of value-producing network 1–20

Table8: Area

Fields: AID, description of area

Table9: Organisation

Fields: OID, AIR, name of organisation, description, weight of organisation in the value-producing network 1-20, need in technology baskets 1-100, offering in technology baskets 1-100.

Table10: Person with knowledge

Fields: TID, name, contact details, description, expertise, postings, TKUID 1-n

**Appendix2: collection of links to technologies developed after the publication of the report**

Technology basket	Brief description of link	www link	Group	Posted by	FB discussion in TuVRad group	Priority 1-5
1	DNA sequencer Minion in use	<a href="http://www.nature.com/news/pint-sized-dna-sequencer-impresses-first-users-1.17483">http://www.nature.com/news/pint-sized-dna-sequencer-impresses-first-users-1.17483</a>		1 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/764761043641504/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/764761043641504/</a>	0
1	DNA sequencing	<a href="http://phys.org/news/2015-03-atomic-chicken-wire-key-faster-dna.html">http://phys.org/news/2015-03-atomic-chicken-wire-key-faster-dna.html</a>		1 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/744518305665778/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/744518305665778/</a>	0
1	USA to analyse DNA from a million Americans	<a href="http://www.reuters.com/article/2015/01/30/us-usa-obama-precisionmedicine-idUSKBN0L313R20150130">http://www.reuters.com/article/2015/01/30/us-usa-obama-precisionmedicine-idUSKBN0L313R20150130</a>		7 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/712425368875072/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/712425368875072/</a>	0
1	Fast DNA sequencing	<a href="http://spectrum.ieee.org/at-work/start-ups/startups-t2-biosystems">http://spectrum.ieee.org/at-work/start-ups/startups-t2-biosystems</a>		1 Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/709814245802851/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/709814245802851/</a>	0
1	DNA sequencer – test results (USB)	<a href="http://arstechnica.com/science/2014/12/usb-sized-dna-sequencer-is-error-prone-but-still-useful/">http://arstechnica.com/science/2014/12/usb-sized-dna-sequencer-is-error-prone-but-still-useful/</a>		1 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/681070998677176/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/681070998677176/</a>	0
1	DNA sequencing using graphene	<a href="http://phys.org/news/2014-11-unique-graphene-nanopores-optical-antennas.html">http://phys.org/news/2014-11-unique-graphene-nanopores-optical-antennas.html</a>		1 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/663339447116998/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/663339447116998/</a>	0
1	Minion USB DNA sequencer comes to market	<a href="http://minion-usb-stick-gene-sequencer-finally-comes-to-market">minion-usb-stick-gene-sequencer-finally-comes-to-market</a>		1 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/637403689710574/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/637403689710574/</a>	0
1	Handheld PCR DNA sequencer	<a href="http://gizmodo.com/the-worlds-first-handheld-dna-sequencer-is-a-genetics-l-1626992774">http://gizmodo.com/the-worlds-first-handheld-dna-sequencer-is-a-genetics-l-1626992774</a>		1 Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/622319614552315/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/622319614552315/</a>	0
1	Routine and complete DNA sequencing			2014 Report by the Committee for the Future		5
1	\$1,000 whole genome (Illumina 2015)	<a href="http://www.illumina.com/systems/hiseq-x-sequencing-system.html">http://www.illumina.com/systems/hiseq-x-sequencing-system.html</a>		2014 Report by the Committee for the Future		0
1	Genome sequencing for \$300	<a href="http://nextbigfuture.com/2016/01/whole-genome-sequencing-for-330.html">http://nextbigfuture.com/2016/01/whole-genome-sequencing-for-330.html</a>		1 Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875938709190403/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875938709190403/</a>	0
1	Simulated DNA sequencing, 66 billion bases/second	<a href="http://phys.org/news/2016-01-nist-simulates-fast-accurate-dna.html">http://phys.org/news/2016-01-nist-simulates-fast-accurate-dna.html</a>		1 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/882764361841171/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/882764361841171/</a>	0
1	Plan on human GMO embryo at the Karolinska Institutet (Crip-Cas9)	<a href="https://www.facebook.com/groups/TuVRadikaalit/permalink/891992770918330/">https://www.facebook.com/groups/TuVRadikaalit/permalink/891992770918330/</a> <a href="https://www.washingtonpost.com/news/speaking-of-science/wp/2016/01/27/scientists-open-the-black-box-of-schizophrenia-with-dramatic-genetic-finding/">https://www.washingtonpost.com/news/speaking-of-science/wp/2016/01/27/scientists-open-the-black-box-of-schizophrenia-with-dramatic-genetic-finding/</a>		1 Pekka Neva	<a href="http://www.nyteknik.se/nyheter/innovati-on/forskning_utveckling/article3959440.ece">http://www.nyteknik.se/nyheter/innovati-on/forskning_utveckling/article3959440.ece</a>	0
1	Genetics of schizophrenia further clarified	<a href="http://spectrum.ieee.org/biomedical/diagnostics/software-helps-gene-editing-tool-crispr-live-up-to-its-hype">http://spectrum.ieee.org/biomedical/diagnostics/software-helps-gene-editing-tool-crispr-live-up-to-its-hype</a>		1 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/888990441218563/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/888990441218563/</a>	0
1	Quick DNA information search and combination			1 Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/894805903970350/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/894805903970350/</a>	0
1	Quick insertion of DNA into cells	<a href="http://www.eurekalert.org/pub_releases/2016-02/miot-ndm021816.php">http://www.eurekalert.org/pub_releases/2016-02/miot-ndm021816.php</a>		1 Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/894805903970350/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/894805903970350/</a>	0
1	Open-source code synthetic biology	<a href="http://radar.oreilly.com/2015/10/open-source-lessons-for-synthetic-biology.html">http://radar.oreilly.com/2015/10/open-source-lessons-for-synthetic-biology.html</a>		1 Jarmo Salmela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/894030710714536/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/894030710714536/</a>	0
1	Optimisation of vectors improves the accuracy of CRISPR	<a href="http://futurism.com/new-technique-makes-crispr-gene-editing-easy-point-click/">http://futurism.com/new-technique-makes-crispr-gene-editing-easy-point-click/</a>		1 Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/904156969701910/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/904156969701910/</a>	0
1	Repair of DNA errors, Chem. Nobel	<a href="http://medicalxpress.com/news/2015-10-chemistry-nobel-dna-foundation-ways.html">http://medicalxpress.com/news/2015-10-chemistry-nobel-dna-foundation-ways.html</a>		7 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/838447569606184/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/838447569606184/</a>	0
1	Crispr-Cas9 DNA modification	<a href="http://m.phys.org/news/2015-09-scientists-human-genome.html">http://m.phys.org/news/2015-09-scientists-human-genome.html</a>		7 Jouni Tuomela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832994730151468/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832994730151468/</a>	0
1	Gene editing	<a href="http://io9.com/researchers-have-just-found-a-better-way-to-edit-dna-1652828550">http://io9.com/researchers-have-just-found-a-better-way-to-edit-dna-1652828550</a> <a href="https://www.washingtonpost.com/news/speaking-of-science/wp/2015/12/01/historic-summit-on-gene-editing-and-designer-babies-convenes-in-">https://www.washingtonpost.com/news/speaking-of-science/wp/2015/12/01/historic-summit-on-gene-editing-and-designer-babies-convenes-in-</a>		7 Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/660048347446108/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/660048347446108/</a>	0
1	Crispr-Cas9 & genome editing & regulation	<a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/flexible-sensors-measure-blood-flow-under-the-skin">http://spectrum.ieee.org/tech-talk/biomedical/devices/flexible-sensors-measure-blood-flow-under-the-skin</a>		7 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859726964144911/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859726964144911/</a>	0
2	Blood flow sensor	<a href="http://www.kauppaletti.fi/uutiset/suomalainen-innovaatio-lyytaa-nobelin-osoittaman-vian/h9EcFaw6">http://www.kauppaletti.fi/uutiset/suomalainen-innovaatio-lyytaa-nobelin-osoittaman-vian/h9EcFaw6</a>		1 Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/84688638762077/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/84688638762077/</a>	0
2	Recognition of predisposition to cancer	<a href="http://www.upi.com/Health_News/2015/09/29/New-test-detects-all-the-viruses-that-infect-people-animals/7991443551878/">http://www.upi.com/Health_News/2015/09/29/New-test-detects-all-the-viruses-that-infect-people-animals/7991443551878/</a>		2 Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/840749179376023/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/840749179376023/</a>	0
2	Universal virus test			1 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/835126779938263/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/835126779938263/</a>	0
2	Cancer diagnosis from breath	<a href="http://www.rdmag.com/news/2015/09/sniffing-out-cancer">http://www.rdmag.com/news/2015/09/sniffing-out-cancer</a>		1 Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834823886635219/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834823886635219/</a>	0
2	Suicide risk blood test	<a href="http://tinyurl.com/suicidal-blood-sample">http://tinyurl.com/suicidal-blood-sample</a>		2 Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/818438464940428/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/818438464940428/</a>	0
2	Accurate graphene biosensor	<a href="http://phys.org/news/2015-06-graphene-biosensors.html">http://phys.org/news/2015-06-graphene-biosensors.html</a>		1 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/788040624646879/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/788040624646879/</a>	0
2	GMO bacterium to find cancer	<a href="http://www.aamulehti.fi/Ulkomaat/1194983145603/artikkeli/elavasta+bakteerista+ohjelmoitiin+syovan+etapesakkeita+elimistosta+etsiva+biosensori.html?ut">http://www.aamulehti.fi/Ulkomaat/1194983145603/artikkeli/elavasta+bakteerista+ohjelmoitiin+syovan+etapesakkeita+elimistosta+etsiva+biosensori.html?ut</a>		7 Tarja Ollas	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/773645532753055/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/773645532753055/</a>	0
2	VTT's drug test printed on paper	<a href="http://www.eurekalert.org/pub_releases/2015-04/vtrc-vpa041315.php">http://www.eurekalert.org/pub_releases/2015-04/vtrc-vpa041315.php</a>		1 Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/752114781572797/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/752114781572797/</a>	0

2	Antenna on a chip	<a href="http://www.eurekalert.org/pub_releases/2015-04/uoc-nuo040715.php">http://www.eurekalert.org/pub_releases/2015-04/uoc-nuo040715.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/750024805115128/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/750024805115128/</a>	0
2	DNA analyser (gene-specific)	<a href="http://www.quantumdx.com/devices.html">http://www.quantumdx.com/devices.html</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751070178343924/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751070178343924/</a>	0
2	Self-recharging sensors	<a href="http://www.tivi.fi/kaikki_uutiset/asioiden+internet+kasvaa+itsestaan+latautuvilla+antureilla/a1038634">http://www.tivi.fi/kaikki_uutiset/asioiden+internet+kasvaa+itsestaan+latautuvilla+antureilla/a1038634</a> <a href="http://www.computerworld.com/article/2854003/software-can-now-identify-dna-from-viruses-and-speed-up-diagnoses.html">http://www.computerworld.com/article/2854003/software-can-now-identify-dna-from-viruses-and-speed-up-diagnoses.html</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/688675817916694/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/688675817916694/</a>	0
2	DNA identification software	<a href="http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm">http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm</a>	1	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/677513325699610/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/677513325699610/</a>	0
2	Biochips and biosensors able to diagnose cheaply diseases, physiological states and		1	2014 Report by the Committee for the Future		5
2	Testing a large number of proteins with a handheld device	<a href="http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm">http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm</a>	1	2014 Report by the Committee for the Future		0
2	Hand-held biosensor	<a href="http://www.eurekalert.org/pub_releases/2016-02/uon-nrf021816.php">http://www.eurekalert.org/pub_releases/2016-02/uon-nrf021816.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/900874046696869/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/900874046696869/</a>	0
3	Small portable magnetic resonance imaging scanner		1	2014 Report by the Committee for the Future		2
3	Portable 2D MRI scanner	<a href="http://onlinelibrary.wiley.com/doi/10.1002/mrm.25147/abstract">http://onlinelibrary.wiley.com/doi/10.1002/mrm.25147/abstract</a>	1	2014 Report by the Committee for the Future		0
4	Cancer-killing virus	<a href="http://www.wired.com/2015/10/fda-approves-first-virus-will-kill-cancer-cells">http://www.wired.com/2015/10/fda-approves-first-virus-will-kill-cancer-cells</a>	7	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/846492628801678/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/846492628801678/</a>	0
4	Gene therapy to treat cancer	<a href="http://www.cell.com/cell/fulltext/S0092-8674%2815%2900623-6">http://www.cell.com/cell/fulltext/S0092-8674%2815%2900623-6</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/786699704780971/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/786699704780971/</a>	0
4	Stem cell treatment for Parkinson's disease	<a href="http://www.bbc.com/news/health-29935449">http://www.bbc.com/news/health-29935449</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/663974963720113/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/663974963720113/</a>	0
4	Six-letter DNA replicated	<a href="http://www.cbsnews.com/news/artificial-dna-breakthrough-could-lead-to-new-drugs-treatments/">http://www.cbsnews.com/news/artificial-dna-breakthrough-could-lead-to-new-drugs-treatments/</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/563277443789866/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/563277443789866/</a>	0
4	Universal solution for the treatment of different cancers	<a href="http://www.sciencecodex.com/new_general_concept_for_the_treatment_of_cancer-131015">http://www.sciencecodex.com/new_general_concept_for_the_treatment_of_cancer-131015</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/54651048879895/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/54651048879895/</a>	0
4	HIV gene therapy	<a href="http://www.nejm.org/doi/full/10.1056/NEJMoa1300662">http://www.nejm.org/doi/full/10.1056/NEJMoa1300662</a> <a href="http://www.scienceworldreport.com/articles/9855/20131001/scientists-uncover-hidden-feature-genetic-code-control-protein-production.htm">http://www.scienceworldreport.com/articles/9855/20131001/scientists-uncover-hidden-feature-genetic-code-control-protein-production.htm</a>	7	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/533173163466961/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/533173163466961/</a>	0
4	Programming of bacteria	<a href="http://www.nejm.org/doi/full/10.1056/NEJMoa1300662">http://www.nejm.org/doi/full/10.1056/NEJMoa1300662</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/449894565128155/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/449894565128155/</a>	0
4	Generic flu vaccine	<a href="http://www.bbc.co.uk/news/health-24175030">http://www.bbc.co.uk/news/health-24175030</a> <a href="http://www.gosh.nhs.uk/news/press-releases/2015-press-release-archive/world-first-use-gene-edited-immune-cells-treat-incurable-leukaemia">http://www.gosh.nhs.uk/news/press-releases/2015-press-release-archive/world-first-use-gene-edited-immune-cells-treat-incurable-leukaemia</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/447308968720048/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/447308968720048/</a>	0
4	GMO immune cell cured leukaemia	<a href="http://www.gosh.nhs.uk/news/press-releases/2015-press-release-archive/world-first-use-gene-edited-immune-cells-treat-incurable-leukaemia">http://www.gosh.nhs.uk/news/press-releases/2015-press-release-archive/world-first-use-gene-edited-immune-cells-treat-incurable-leukaemia</a>	7	Teemu Peltonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/866100773507530/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/866100773507530/</a>	0
4	Drugs based on genetically modified organisms		7	2014 Report by the Committee for the Future		5
4	Anti-CD47 cancer treatment to begin human testing	<a href="http://blog.planprescriber.com/2014/03/28/anti-cd47-cancer-drug/">http://blog.planprescriber.com/2014/03/28/anti-cd47-cancer-drug/</a>	7	2014 Report by the Committee for the Future		0
4	HIV gene therapy CCR5	<a href="http://www.nejm.org/doi/full/10.1056/NEJMoa1300662">http://www.nejm.org/doi/full/10.1056/NEJMoa1300662</a>	7	2014 Report by the Committee for the Future		0
4	Six-letter DNA	<a href="http://www.cbsnews.com/news/artificial-dna-breakthrough-could-lead-to-new-drugs-treatments/">http://www.cbsnews.com/news/artificial-dna-breakthrough-could-lead-to-new-drugs-treatments/</a>	7	2014 Report by the Committee for the Future		0
4	Virus-based treatment for Ebola	<a href="http://www.eurekalert.org/pub_releases/2016-02/uop-nsh021216.php">http://www.eurekalert.org/pub_releases/2016-02/uop-nsh021216.php</a> <a href="http://singularityhub.com/2015/10/12/ray-kurzweils-wildest-prediction-nanobots-will-plug-our-brains-into-the-web-by-the-2030s/">http://singularityhub.com/2015/10/12/ray-kurzweils-wildest-prediction-nanobots-will-plug-our-brains-into-the-web-by-the-2030s/</a> <a href="http://www.rdmag.com/news/2015/10/halloysite-finally-promising-natural-nanomaterial?et_cid=4898946">http://www.rdmag.com/news/2015/10/halloysite-finally-promising-natural-nanomaterial?et_cid=4898946</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/898646933586247/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/898646933586247/</a>	0
5	Nanobots in the body	<a href="http://singularityhub.com/2015/10/12/ray-kurzweils-wildest-prediction-nanobots-will-plug-our-brains-into-the-web-by-the-2030s/">http://singularityhub.com/2015/10/12/ray-kurzweils-wildest-prediction-nanobots-will-plug-our-brains-into-the-web-by-the-2030s/</a> <a href="http://www.rdmag.com/news/2015/10/halloysite-finally-promising-natural-nanomaterial?et_cid=4898946">http://www.rdmag.com/news/2015/10/halloysite-finally-promising-natural-nanomaterial?et_cid=4898946</a>	1	Seppo Nikkilä	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/852042848246656/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/852042848246656/</a>	0
5	Nanolevel medicine administration	<a href="http://www.rdmag.com/news/2015/10/halloysite-finally-promising-natural-nanomaterial?et_cid=4898946">http://www.rdmag.com/news/2015/10/halloysite-finally-promising-natural-nanomaterial?et_cid=4898946</a>	7	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845197878931153/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845197878931153/</a>	0
5	Nanobots for the treatment of leukaemia	<a href="http://nextbigfuture.com/2015/03/ido-bachelet-dna-nanobots-summary-with.html">http://nextbigfuture.com/2015/03/ido-bachelet-dna-nanobots-summary-with.html</a> <a href="https://www.facebook.com/curiositydotcom/photos/a.293459797348511.88330.206936646000827/1003795746314909/?type=3">https://www.facebook.com/curiositydotcom/photos/a.293459797348511.88330.206936646000827/1003795746314909/?type=3</a>	7	Teemu Peltonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/736431523141123/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/736431523141123/</a>	0
5	Pill camera, Smithsonian	<a href="https://www.facebook.com/photo.php?fbid=10152824561419909&amp;set=gm.672970076153935&amp;type=3">https://www.facebook.com/photo.php?fbid=10152824561419909&amp;set=gm.672970076153935&amp;type=3</a>	1	Laura Tiilikainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/718457091605233/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/718457091605233/</a>	0
5	Biodegradable implant	<a href="https://www.facebook.com/photo.php?fbid=10152824561419909&amp;set=gm.672970076153935&amp;type=3">https://www.facebook.com/photo.php?fbid=10152824561419909&amp;set=gm.672970076153935&amp;type=3</a>	7	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/672970076153935/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/672970076153935/</a>	0
5	Nanosensors for the body	<a href="http://www.engadget.com/2014/11/19/mit-polymer-medicine-nanotech/">http://www.engadget.com/2014/11/19/mit-polymer-medicine-nanotech/</a> <a href="http://www.theverge.com/2014/10/28/7085023/google-wants-to-flood-your-body-with-tiny-magnets-to-search-for">http://www.theverge.com/2014/10/28/7085023/google-wants-to-flood-your-body-with-tiny-magnets-to-search-for</a>	1	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/672415662876043/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/672415662876043/</a>	0
5	Controlling nanobots in the body with magnets	<a href="http://www.theverge.com/2014/10/28/7085023/google-wants-to-flood-your-body-with-tiny-magnets-to-search-for">http://www.theverge.com/2014/10/28/7085023/google-wants-to-flood-your-body-with-tiny-magnets-to-search-for</a>	1	Jouni Laveri	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/659575900826686/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/659575900826686/</a>	0
5	Remote-controlled medicine implant	<a href="http://www.technologyreview.com/news/528121/a-contraceptive-implant-with-remote-control/">http://www.technologyreview.com/news/528121/a-contraceptive-implant-with-remote-control/</a>	1	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/598363973614546/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/598363973614546/</a>	0

5	Programmable subcutaneous medicine chip	<a href="http://www.cnet.com/news/remote-controlled-chip-implant-could-be-the-future-of-contraceptives/">http://www.cnet.com/news/remote-controlled-chip-implant-could-be-the-future-of-contraceptives/</a>	7	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/595729813877962/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/595729813877962/</a>	0
5	DNA-programmable nanobots	<a href="http://www.popsci.com/article/science/nano-robots-compute-dna-installed-living-cockroach">http://www.popsci.com/article/science/nano-robots-compute-dna-installed-living-cockroach</a> <a href="http://spectrum.ieee.org/nanoclast/biomedical/devices/graphenebased-microbattery-ushers-in-new-age-for-biotelemetry">http://spectrum.ieee.org/nanoclast/biomedical/devices/graphenebased-microbattery-ushers-in-new-age-for-biotelemetry</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/577122525738691/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/577122525738691/</a>	0
5	Rice grain-sized microbattery for biotelemetry	<a href="http://www.scienceworldreport.com/articles/12786/20140210/first-nanomotors-ever-controlled-inside-living-cells.htm">http://www.scienceworldreport.com/articles/12786/20140210/first-nanomotors-ever-controlled-inside-living-cells.htm</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/52484289429988/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/52484289429988/</a>	0
5	Robotic dive into the cell	<a href="http://www.scientificamerican.com/video.cfm?id=south-korea-develops-worlds-first-c2014-01-05">http://www.scientificamerican.com/video.cfm?id=south-korea-develops-worlds-first-c2014-01-05</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/519040931546851/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/519040931546851/</a>	0
5	Nanorobot looking for cancer	<a href="http://www.spectrumspectrum.com/story/nst-awards-16m-researchers-developing-implants-reanimate-paralyzed-limbs/2016-01-04">http://www.spectrumspectrum.com/story/nst-awards-16m-researchers-developing-implants-reanimate-paralyzed-limbs/2016-01-04</a> <a href="http://www.theguardian.com/science/2015/aug/04/can-we-reverse-ageing-process-young-blood-older-people">http://www.theguardian.com/science/2015/aug/04/can-we-reverse-ageing-process-young-blood-older-people</a>	1	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/497843533666591/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/497843533666591/</a>	0
5	Subcutaneous antenna & electronics of graphene	<a href="http://phys.org/news/2015-12-graphene-wearable-devices.html">http://phys.org/news/2015-12-graphene-wearable-devices.html</a> <a href="http://spectrum.ieee.org/tech-talk/energy/environment/a-blast-of-plasma-makes-plants-grow-faster">http://spectrum.ieee.org/tech-talk/energy/environment/a-blast-of-plasma-makes-plants-grow-faster</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/867272913390316/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/867272913390316/</a>	0
5	Faster growth through radiation		7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859598974157710/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859598974157710/</a>	0
5	Nanorobots (nanobots) in the health promotion		7	2014 Report by the Committee for the Future		5
5	Nanobot micromotors deliver medicine into the body of mice	<a href="http://www.gizmag.com/nanobot-micromotors-deliver-nanoparticles-living-creature/35700/">http://www.gizmag.com/nanobot-micromotors-deliver-nanoparticles-living-creature/35700/</a>	1	Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/886198048164669/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/886198048164669/</a>	0
5	Rice grain-sized biodegradable sensor for the brain	<a href="http://arstechnica.com/science/2016/01/in-a-brain-dissolvable-electronics-monitor-health-then-vanish/">http://arstechnica.com/science/2016/01/in-a-brain-dissolvable-electronics-monitor-health-then-vanish/</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/884886218295652/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/884886218295652/</a>	0
5	Chip powered by cellular energy	<a href="http://www.ecnmag.com/news/2015/12/columbia-engineers-build-biologically-powered-chip">http://www.ecnmag.com/news/2015/12/columbia-engineers-build-biologically-powered-chip</a> <a href="http://www.fiercemedicaldevices.com/story/nst-awards-16m-researchers-developing-implants-reanimate-paralyzed-limbs/2016-01-04">http://www.fiercemedicaldevices.com/story/nst-awards-16m-researchers-developing-implants-reanimate-paralyzed-limbs/2016-01-04</a>	1	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/862762771714663/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/862762771714663/</a>	0
5	Activation of paralysed limb with neuroimplants	<a href="http://www.theguardian.com/science/2015/aug/04/can-we-reverse-ageing-process-young-blood-older-people">http://www.theguardian.com/science/2015/aug/04/can-we-reverse-ageing-process-young-blood-older-people</a>	7	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/877140185736922/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/877140185736922/</a>	0
6	Reversal of aging process with blood		7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/850528068398134/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/850528068398134/</a>	0
6	Promotion of longevity	<a href="http://www.pnas.org/content/early/2015/07/16/1505451112">http://www.pnas.org/content/early/2015/07/16/1505451112</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/800711190046489/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/800711190046489/</a>	0
6	Promotion of longevity	<a href="http://io9.com/do-these-startling-animal-studies-mean-your-lifespan-co-486041314">http://io9.com/do-these-startling-animal-studies-mean-your-lifespan-co-486041314</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751417244975884/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751417244975884/</a>	0
6	Slowing down aging	<a href="http://onlinelibrary.wiley.com/doi/10.1111/accel.12344/abstract">http://onlinelibrary.wiley.com/doi/10.1111/accel.12344/abstract</a>	7	Olli Pitkänen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/733977516719857/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/733977516719857/</a>	0
6	Prevention of aging (skin)	<a href="http://www.geek.com/science/scientists-accidentally-stop-skin-aging-in-mice-1611888/">http://www.geek.com/science/scientists-accidentally-stop-skin-aging-in-mice-1611888/</a> <a href="http://www.iflscience.com/health-and-medicine/preliminary-results-early-human-trials-anti-aging-formulas-reveal-no-adverse">http://www.iflscience.com/health-and-medicine/preliminary-results-early-human-trials-anti-aging-formulas-reveal-no-adverse</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/686643181453291/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/686643181453291/</a>	0
6	Anti-aging drug trial begins		7	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/663035527147390/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/663035527147390/</a>	0
6	On/off switch in telomerase	<a href="http://www.sciencealert.com.au/news/20142409-26223.html">http://www.sciencealert.com.au/news/20142409-26223.html</a>	7	Antti Tulonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/641272992656977/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/641272992656977/</a>	0
6	Young blood rejuvenates old mouse	<a href="http://www.nature.com/news/young-blood-anti-ageing-mechanism-called-into-question-1.17583">http://www.nature.com/news/young-blood-anti-ageing-mechanism-called-into-question-1.17583</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/561415253976085/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/561415253976085/</a>	0
6	HLI Human Longevity Inc	<a href="http://www.humanlongevity.com/">http://www.humanlongevity.com/</a>	7	Harri Vartiainen, Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/531494683634809/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/531494683634809/</a>	0
6	Muscle cells rejuvenated	<a href="http://www.bbc.co.uk/news/health-25445748">http://www.bbc.co.uk/news/health-25445748</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/489434844507460/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/489434844507460/</a>	0
6	Google to research extension of lifespan	<a href="http://www.usatoday.com/story/tech/2013/09/18/google-calico-health-aging/2833675/">http://www.usatoday.com/story/tech/2013/09/18/google-calico-health-aging/2833675/</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/443485902435688/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/443485902435688/</a>	0
6	Prevention of aging	<a href="http://cmns.umd.edu/news-events/features/3352">http://cmns.umd.edu/news-events/features/3352</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/866921283425479/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/866921283425479/</a>	0
6	Genetics of aging	<a href="http://www.sciencedaily.com/releases/2015/12/151201113917.htm">http://www.sciencedaily.com/releases/2015/12/151201113917.htm</a>	7	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859673407483600/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859673407483600/</a>	0
6	Longer lifetime and slower aging processes		7	2014 Report by the Committee for the Future		4
6	Sirt1 prevents metabolic stress, aging	<a href="http://phys.org/news/2014-01-protein-sirt1.html">http://phys.org/news/2014-01-protein-sirt1.html</a>	7	2014 Report by the Committee for the Future		0
6	Young blood rejuvenates the brain of old mice	<a href="http://news.sciencemag.org/biology/2014/05/young-blood-renews-old-mice">http://news.sciencemag.org/biology/2014/05/young-blood-renews-old-mice</a>	7	2014 Report by the Committee for the Future		0
6	Human Longevity Inc Mitochondrial manipulation to slow down the aging of hepatic cells	<a href="http://www.humanlongevity.com/">http://www.humanlongevity.com/</a> <a href="http://emboj.emboipress.org/content/early/2016/02/02/emboj.201592862">http://emboj.emboipress.org/content/early/2016/02/02/emboj.201592862</a>	7	2014 Report by the Committee for the Future		0
6			7	Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893501910767416/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893501910767416/</a>	0
7	Blood count (low-cost)	<a href="http://www.eurekalert.org/pub_releases/2015-10/epfd-mcb102215.php">http://www.eurekalert.org/pub_releases/2015-10/epfd-mcb102215.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/843749032409371/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/843749032409371/</a>	0

7	Devices for self-diagnosis	<a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/5-materials-innovations-that-will-make-new-medical-devices">http://spectrum.ieee.org/tech-talk/biomedical/devices/5-materials-innovations-that-will-make-new-medical-devices</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/783932981724310/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/783932981724310/</a>	0
7	Microwave stethoscopy	<a href="http://spectrum.ieee.org/biomedical/diagnostics/microwave-stethoscope-lets-physicians-peer-into-the-lungs">http://spectrum.ieee.org/biomedical/diagnostics/microwave-stethoscope-lets-physicians-peer-into-the-lungs</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/748452795272329/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/748452795272329/</a>	0
7	Personal diagnosis gadget	<a href="http://www.bloomberg.com/news/videos/2015-04-02/the-star-trek-like-gadget-to-diagnose-your-health">http://www.bloomberg.com/news/videos/2015-04-02/the-star-trek-like-gadget-to-diagnose-your-health</a>	1	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/746630825454526/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/746630825454526/</a>	0
7	Dozens of blood tests with a small gadget	<a href="http://spectrum.ieee.org/tech-talk/biomedical/diagnostics/winning-xprize-medical-gadget-could-run-hundreds-of-lab-tests-on-a-single">http://spectrum.ieee.org/tech-talk/biomedical/diagnostics/winning-xprize-medical-gadget-could-run-hundreds-of-lab-tests-on-a-single</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/735233876594221/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/735233876594221/</a>	0
7	\$34 HIV&Syphilis test accessory for smartphone	<a href="http://www.extremetech.com/extreme/198945-34-accessory-detects-hiv-syphilis-and-works-with-any-smartphone">http://www.extremetech.com/extreme/198945-34-accessory-detects-hiv-syphilis-and-works-with-any-smartphone</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/717073295076946/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/717073295076946/</a>	0
7	Ear infection imaging at home	<a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/diagnosing-ear-infections-with-a-new-smartphone-gadget">http://spectrum.ieee.org/tech-talk/biomedical/devices/diagnosing-ear-infections-with-a-new-smartphone-gadget</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/711575988960010/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/711575988960010/</a>	0
7	Glucose sensor for the skin	<a href="http://news.bioscholar.com/2015/01/engineers-create-temporary-tattoo-painless-sugar-monitoring.html">http://news.bioscholar.com/2015/01/engineers-create-temporary-tattoo-painless-sugar-monitoring.html</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706990402751902/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706990402751902/</a>	0
7	Subcutaneous chip	<a href="http://www.helsinginuitset.fi/artikkeli/257297-teknikka-tulee-ihon-alle-mieheen-asennettiin-siru-helsingissa">http://www.helsinginuitset.fi/artikkeli/257297-teknikka-tulee-ihon-alle-mieheen-asennettiin-siru-helsingissa</a>	1	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/694585823992360/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/694585823992360/</a>	0
7	Body implants top 10	<a href="https://wtvox.com/2014/10/top-10-implantable-wearables-soon-body/">https://wtvox.com/2014/10/top-10-implantable-wearables-soon-body/</a>	1	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/687719898012286/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/687719898012286/</a>	0
7	Quantified self test	<a href="http://www.slideshare.net/PekkoVehvilinen/pekko-vehvilinen-suomen-mitatuin-mies-radio-nova-14122014">http://www.slideshare.net/PekkoVehvilinen/pekko-vehvilinen-suomen-mitatuin-mies-radio-nova-14122014</a>	7	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/683557685095174/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/683557685095174/</a>	0
7	Needle-free blood test at pharmacy	<a href="http://www.engadget.com/2014/11/18/walgreens-blood-tests/">http://www.engadget.com/2014/11/18/walgreens-blood-tests/</a>	1	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/672414989542777/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/672414989542777/</a>	0
7	Dialysis belt (5 kg)	<a href="http://io9.com/this-medical-device-is-a-major-gamechanger-for-kidney-p-1658564050">http://io9.com/this-medical-device-is-a-major-gamechanger-for-kidney-p-1658564050</a>	7	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/670671846383758/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/670671846383758/</a>	0
7	Tricorder X-Prize finals	<a href="http://tricorder.xprize.org/teams">http://tricorder.xprize.org/teams</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/657065327744410/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/657065327744410/</a>	0
7	Apple Healthkit	<a href="http://www.patentlyapple.com/patently-apple/2014/09/stanford-duke-prepare-major-trials-with-apples-healthkit.html">http://www.patentlyapple.com/patently-apple/2014/09/stanford-duke-prepare-major-trials-with-apples-healthkit.html</a>	10	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/634645613319715/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/634645613319715/</a>	0
7	iPhone & Apple Watch digital health review	<a href="http://digiterveys.blogspot.fi/2014/09/apple-watch-ja-iphone-6.html">http://digiterveys.blogspot.fi/2014/09/apple-watch-ja-iphone-6.html</a>	1	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/631962933587983/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/631962933587983/</a>	0
7	Haemoglobin level from a selfie of the eyelid	<a href="http://www.evenaemia.com/">http://www.evenaemia.com/</a>	1	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/608831645901112/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/608831645901112/</a>	0
7	Diagnosis wristband&API	<a href="http://www.cnet.com/products/samsung-simband/">http://www.cnet.com/products/samsung-simband/</a>	1	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/573823062735304/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/573823062735304/</a>	0
7	Contact lens for glucose level measurement	<a href="http://www.engadget.com/2014/01/16/google-smart-contact-lens/">http://www.engadget.com/2014/01/16/google-smart-contact-lens/</a>	1	Antti Tulonen, Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/503949636389314/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/503949636389314/</a>	0
7	Continuously monitored personal health		1	2014 Report by the Committee for the Future		5
7	Bio processor from Samsung for the monitoring of physiological metrics	<a href="http://motherboard.vice.com/read/with-samsungs-bio-processor-wearable-health-tech-is-about-to-get-weird">http://motherboard.vice.com/read/with-samsungs-bio-processor-wearable-health-tech-is-about-to-get-weird</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/876403242477283/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/876403242477283/</a>	0
7	Smart spoon for Parkinson's sufferers	<a href="http://thescienceexplorer.com/brain-and-body/smart-spoon-could-change-lives-parkinson-s-sufferers">http://thescienceexplorer.com/brain-and-body/smart-spoon-could-change-lives-parkinson-s-sufferers</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/87353215915725/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/87353215915725/</a>	0
7	A review of smartphones for personal body measurement	<a href="http://www.eurekalert.org/pub_releases/2016-02/scp-sfs020316.php">http://www.eurekalert.org/pub_releases/2016-02/scp-sfs020316.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893861927398081/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893861927398081/</a>	0
7	Stethoscope connected to smartphone diagnoses lung conditions	<a href="http://www.eurekalert.org/pub_releases/2016-02/hu-nes022316.php">http://www.eurekalert.org/pub_releases/2016-02/hu-nes022316.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/903742026410071/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/903742026410071/</a>	0
8	Nanobots for the body	<a href="https://www.linkedin.com/pulse/rays-wildest-prediction-peter-diamandis">https://www.linkedin.com/pulse/rays-wildest-prediction-peter-diamandis</a>	1	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/841579969292944/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/841579969292944/</a>	0
8	Brain implants	<a href="http://www.eurekalert.org/pub_releases/2015-07/nion-fbp071615.php">http://www.eurekalert.org/pub_releases/2015-07/nion-fbp071615.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/798433896940885/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/798433896940885/</a>	0
8	Biocompatible artificial neuron	<a href="http://www.ecnmag.com/news/2015/06/artificial-neuron-mimicks-function-human-cells?et_cid=4641606">http://www.ecnmag.com/news/2015/06/artificial-neuron-mimicks-function-human-cells?et_cid=4641606</a>	1	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/788019671315641/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/788019671315641/</a>	0
8	Connection between the brain and the immune system	<a href="http://www.sciencedaily.com/releases/2015/06/15061122445.htm">http://www.sciencedaily.com/releases/2015/06/15061122445.htm</a>	7	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/777829842334624/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/777829842334624/</a>	0
8	Eye implant – 60 pixels	<a href="http://www.medicalnewstoday.com/articles/289863.php">http://www.medicalnewstoday.com/articles/289863.php</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/724882087629400/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/724882087629400/</a>	0
8	Retinal prosthesis	<a href="http://www.medicalnewstoday.com/articles/286352.php">http://www.medicalnewstoday.com/articles/286352.php</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/677666245684318/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/677666245684318/</a>	0
8	Artificial eye implanted in human	<a href="http://bionicvision.org.au/eye">http://bionicvision.org.au/eye</a>	7	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/650010851783191/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/650010851783191/</a>	0
8	Memory coding and memory implants	<a href="http://www.technologyreview.com/featuredstory/513681/memory-implants/">http://www.technologyreview.com/featuredstory/513681/memory-implants/</a>	3	Jari Kaivo-oja	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/557427627708181/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/557427627708181/</a>	0

8	Spinal cord implant restores gait	<a href="http://gizmodo.com/watch-this-spinal-cord-implant-&lt;br/&gt;revive-the-legs-of-a-par-1560697896">http://gizmodo.com/watch-this-spinal-cord-implant- revive-the-legs-of-a-par-1560697896</a>	7	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/54794838865105/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/54794838865105/</a>	0
8	Brain implants that restore or develop brain functions		7	2014 Report by the Committee for the Future		4
8	A review of brain implants – neuroprostheses	<a href="http://www.businessinsider.com/brain-implants-will-&lt;br/&gt;give-us-superpowers-2014-4?IR=T">http://www.businessinsider.com/brain-implants-will- give-us-superpowers-2014-4?IR=T</a>	1	2014 Report by the Committee for the Future		0
8	Neuroprostheses repair neurological disorders	<a href="http://www.npr.org/sections/health-&lt;br/&gt;shots/2014/05/27/316129491/military-plans-to-test-&lt;br/&gt;brain-implants-to-fight-mental-disorders">http://www.npr.org/sections/health- shots/2014/05/27/316129491/military-plans-to-test- brain-implants-to-fight-mental-disorders</a>	7	2014 Report by the Committee for the Future		0
8	Brain implant detects infrared light	<a href="http://www.telegraph.co.uk/news/science/science-&lt;br/&gt;news/9875931/Scientists-create-sixth-sense-brain-&lt;br/&gt;implant-to-detect-infrared-light.html">http://www.telegraph.co.uk/news/science/science- news/9875931/Scientists-create-sixth-sense-brain- implant-to-detect-infrared-light.html</a>	1	2014 Report by the Committee for the Future		0
9	70% of Alzheimer's cases in mice were cured	<a href="http://www.sciencealert.com/new-alzheimer-s-&lt;br/&gt;treatment-fully-restores-memory-function">http://www.sciencealert.com/new-alzheimer-s- treatment-fully-restores-memory-function</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/738016688649273/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/738016688649273/</a>	0
9	Susceptibility to dementia KLOTHO	<a href="https://www.ucsf.edu/news/2015/01/122761/brain-&lt;br/&gt;region-vulnerable-aging-larger-those-longevity-gene-&lt;br/&gt;variant">https://www.ucsf.edu/news/2015/01/122761/brain- region-vulnerable-aging-larger-those-longevity-gene- variant</a>	2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/712968922154050/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/712968922154050/</a>	0
9	Gene protects against Alzheimer's	<a href="http://www.ucsf.edu/news/2014/05/114196/better-&lt;br/&gt;cognition-seen-gene-variant">http://www.ucsf.edu/news/2014/05/114196/better- cognition-seen-gene-variant</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/564237473693863/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/564237473693863/</a>	0
9	Alzheimer's research tau vs. amyloid	<a href="http://www.scienceworldreport.com/articles/23679/&lt;br/&gt;20150325/tau-protein-not-amyloid-now-thought-to-&lt;br/&gt;be-responsible-for-alzheimers.htm">http://www.scienceworldreport.com/articles/23679/ 20150325/tau-protein-not-amyloid-now-thought-to- be-responsible-for-alzheimers.htm</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/742146399236302/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/742146399236302/</a>	0
9	Alzheimer's research	<a href="http://www.nature.com/ncomms/2015/151127/nco-&lt;br/&gt;mms9836/full/ncomms9836.html">http://www.nature.com/ncomms/2015/151127/nco- mms9836/full/ncomms9836.html</a>	7	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/742146399236302/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/742146399236302/</a>	0
9	Drugs that prevent dementia KLOTHO gene protects against		7	2014 Report by the Committee for the Future		3
9	Alzheimer's and improves intelligence	<a href="https://www.ucsf.edu/news/2014/05/114196/better-&lt;br/&gt;cognition-seen-gene-variant">https://www.ucsf.edu/news/2014/05/114196/better- cognition-seen-gene-variant</a>	7	2014 Report by the Committee for the Future		0
9	Review of Alzheimer's research	<a href="http://www.alz.org/research/science/alzheimers_tre-&lt;br/&gt;atment_horizon.asp">http://www.alz.org/research/science/alzheimers_tre- atment_horizon.asp</a>	7	2014 Report by the Committee for the Future		0
10	Dental stem cell implants	<a href="http://worldtruth.tv/stem-cell-dental-implants-grow-&lt;br/&gt;new-teeth-in-your-mouth/">http://worldtruth.tv/stem-cell-dental-implants-grow- new-teeth-in-your-mouth/</a>	7	Seppo Nikkilä	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/851351498315791/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/851351498315791/</a>	0
10	Cell cultivation (blood)	<a href="http://medicalxpress.com/news/2015-10-gene-lab-&lt;br/&gt;based-red-blood-cell.html">http://medicalxpress.com/news/2015-10-gene-lab- based-red-blood-cell.html</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/843936215723986/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/843936215723986/</a>	0
10	GMO organ transplantions	<a href="http://www.ilsience.com/health-and-&lt;br/&gt;medicine/scientists-break-gene-editing-record-create-&lt;br/&gt;animal-organs-human-transplantation">http://www.ilsience.com/health-and- medicine/scientists-break-gene-editing-record-create- animal-organs-human-transplantation</a>	7	Merja Penttilä	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/840272466090361/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/840272466090361/</a>	0
10	Lab-grown kidney	<a href="http://www.sciencealert.com/lab-grown-kidneys-&lt;br/&gt;shown-to-be-fully-functional-in-animal-recipients">http://www.sciencealert.com/lab-grown-kidneys- shown-to-be-fully-functional-in-animal-recipients</a>	7	Vilho Ahola	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/832976383486636/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/832976383486636/</a>	0
10	The body is independently destroying cancer	<a href="http://yle.fi/uutiset/syopahoito_on_mullistumassa&lt;br/&gt;elimisto_voi_itse_tuhotua_syopakasvaimia/8321028">http://yle.fi/uutiset/syopahoito_on_mullistumassa elimisto_voi_itse_tuhotua_syopakasvaimia/8321028</a>	7	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/832212686896339/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/832212686896339/</a>	0
10	Regeneration of the nervous system	<a href="http://factor-tech.com/3d-printing/19785-complex-&lt;br/&gt;damaged-nerve-re-grown-for-first-time-using-3d-&lt;br/&gt;printed-guide/">http://factor-tech.com/3d-printing/19785-complex- damaged-nerve-re-grown-for-first-time-using-3d- printed-guide/</a>	7	Petja Jäppinen	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/831395853644689/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/831395853644689/</a>	0
10	Cultivated cardiac cells	<a href="http://www.sciencedaily.com/releases/2015/07/150-&lt;br/&gt;714124129.htm">http://www.sciencedaily.com/releases/2015/07/150- 714124129.htm</a>	7	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/802372459880362/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/802372459880362/</a>	0
10	Healing dressing	<a href="http://www.tekniikkatalous.fi/innovaatiot/mullistus-&lt;br/&gt;vaikkeiden-haavojen-hoitoon-tulee-suomesta-startup-&lt;br/&gt;esitteli-hopeaa-hyodyntavan-haavataitokensa-">http://www.tekniikkatalous.fi/innovaatiot/mullistus- vaikkeiden-haavojen-hoitoon-tulee-suomesta-startup- esitteli-hopeaa-hyodyntavan-haavataitokensa-</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/800988190018789/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/800988190018789/</a>	0
10	'Training' the immune system Large quantities of insulin-producing cells have been cultivated	<a href="http://www.sciencedaily.com/releases/2014/09/140-&lt;br/&gt;925100929.htm">http://www.sciencedaily.com/releases/2014/09/140- 925100929.htm</a>	7	Sulka Haro	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/742153792568896/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/742153792568896/</a>	0
10	Artificial blood from factories	<a href="http://www.webmd.com/diabetes/news/20141009/s-&lt;br/&gt;tem-cell-success-raises-hopes-of-type-1-diabetes-&lt;br/&gt;cure">http://www.webmd.com/diabetes/news/20141009/s- tem-cell-success-raises-hopes-of-type-1-diabetes- cure</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/649375921846684/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/649375921846684/</a>	0
10	Obstacles for human spare parts in Finland	<a href="http://www.telegraph.co.uk/health/healthnews/107-&lt;br/&gt;65132/Artificial-blood-will-be-manufactured-in-&lt;br/&gt;factories.html">http://www.telegraph.co.uk/health/healthnews/107- 65132/Artificial-blood-will-be-manufactured-in- factories.html</a>	7	Tatu Lund and Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/556598611124416/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/556598611124416/</a>	0
10	Cardiac booster Repairing and regrowing human organs, (stem) cell cultivation	<a href="http://yle.fi/uutiset/tutkijat_selvittavat_ihmisen_var-&lt;br/&gt;aosateollisuuden_synnyn_esteita_suomessa/714429-&lt;br/&gt;3">http://yle.fi/uutiset/tutkijat_selvittavat_ihmisen_var- aosateollisuuden_synnyn_esteita_suomessa/714429- 3</a>	7	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/538603646257246/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/538603646257246/</a>	0
10	Cardiac booster Repairing and regrowing human organs, (stem) cell cultivation	<a href="http://www.independent.co.uk/news/science/3dprin-&lt;br/&gt;ted-electronic-glove-could-help-keep-your-heart-&lt;br/&gt;beating-for-ever-9166004.html">http://www.independent.co.uk/news/science/3dprin- ted-electronic-glove-could-help-keep-your-heart- beating-for-ever-9166004.html</a>	7	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/530553517062259/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/530553517062259/</a>	0
10	Review of growing of artificial organs		7	2014 Report by the Committee for the Future		5
10	Review of growing of artificial organs	<a href="http://discovermagazine.com/2014/jan-feb/05-stem-&lt;br/&gt;cell-future">http://discovermagazine.com/2014/jan-feb/05-stem- cell-future</a>	7	2014 Report by the Committee for the Future		0
10	Type 1 diabetes treated with cultivated stem cells	<a href="http://gizmodo.com/stem-cell-breakthrough-could-&lt;br/&gt;put-an-end-to-daily-insuli-1754981810">http://gizmodo.com/stem-cell-breakthrough-could- put-an-end-to-daily-insuli-1754981810</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/887686141348993/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/887686141348993/</a>	0
10	Modification of the immune system put 90% of terminally ill leukaemia patients into	<a href="http://www.bbc.com/news/health-35586834">http://www.bbc.com/news/health-35586834</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/899053470212260/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/899053470212260/</a>	0
10	DNA-guided 3D printing of cells DPAC	<a href="http://www.ucsf.edu/news/2015/08/131431/dna-&lt;br/&gt;guided-3-d-printing-human-tissue-unveiled">http://www.ucsf.edu/news/2015/08/131431/dna- guided-3-d-printing-human-tissue-unveiled</a>	7	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa&lt;br/&gt;dikaalit/permalink/832248466892761/">https://www.facebook.com/groups/TuVRa dikaalit/permalink/832248466892761/</a>	0

10	3D-printing of blood vessels	<a href="http://www.ifscience.com/health-and-medicine/scientists-use-3d-printing-produce-blood-vessels">http://www.ifscience.com/health-and-medicine/scientists-use-3d-printing-produce-blood-vessels</a>	7	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/576363285814615/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/576363285814615/</a>	0
10	Cancer tumour, cultivated & 3D printed	<a href="http://phys.org/news/2014-04-breakthrough-cancer-tumors-3d-printer.html">http://phys.org/news/2014-04-breakthrough-cancer-tumors-3d-printer.html</a>	7	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/556813261102951/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/556813261102951/</a>	0
11	3D printed cartilage	<a href="http://www.ifscience.com/health-and-medicine/made-order-cartilage-could-combat-osteoarthritis">http://www.ifscience.com/health-and-medicine/made-order-cartilage-could-combat-osteoarthritis</a>	7	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/558164830967794/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/558164830967794/</a>	0
11	Synthetic cartilage in human joints		7	2014 Report by the Committee for the Future		2
11	Artificial 3D printed cartilage	<a href="http://www.ifscience.com/health-and-medicine/made-order-cartilage-could-combat-osteoarthritis">http://www.ifscience.com/health-and-medicine/made-order-cartilage-could-combat-osteoarthritis</a>	7	2014 Report by the Committee for the Future		0
11	Synthetic cartilage tested in patients	<a href="http://www.foxnews.com/health/2015/03/12/artificial-cartilage-implants-may-reduce-need-for-knee-replacement-surgery.html">http://www.foxnews.com/health/2015/03/12/artificial-cartilage-implants-may-reduce-need-for-knee-replacement-surgery.html</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890934781024129/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890934781024129/</a>	0
12	Schools in the cloud		3	2014 Report by the Committee for the Future		2
12	Duolingo – free-of-charge courses of 23 languages	<a href="https://en.wikipedia.org/wiki/Duolingo">https://en.wikipedia.org/wiki/Duolingo</a>	3	Mari Heimala		0
12	MOOC trends	<a href="https://www.class-central.com/report/5-mooc-trends-of-2015/">https://www.class-central.com/report/5-mooc-trends-of-2015/</a>	9	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/884425235008417/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/884425235008417/</a>	0
12	Gamification platform for learning	<a href="http://www.seppo.io/">http://www.seppo.io/</a>	3	Laura Tiilikainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/895673690550238/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/895673690550238/</a>	0
12	Accurate neurostimulation improves the efficiency of learning	<a href="http://www.hrl.com/news/2016/0210/">http://www.hrl.com/news/2016/0210/</a>	3	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/906897119427895/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/906897119427895/</a>	0
13	Driverless cars owning themselves	<a href="http://www.bbc.com/news/technology-30998361">http://www.bbc.com/news/technology-30998361</a>	9	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/752538928197049/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/752538928197049/</a>	0
13	Open source code pancreas	<a href="http://openaps.org/">http://openaps.org/</a>	9	Sulka Haro	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/716423238475285/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/716423238475285/</a>	0
13	Be My Eyes app	<a href="https://vimeo.com/113872517">https://vimeo.com/113872517</a>	9	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/713428165441459/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/713428165441459/</a>	0
13	Web-of-trust platform	<a href="https://www.ethereum.org/">https://www.ethereum.org/</a>	9	Esa Heiskanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/681109772006632/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/681109772006632/</a>	0
13	Googling online doctors	<a href="http://gizmodo.com/google-tests-connecting-doctors-with-online-patients-1645412934">http://gizmodo.com/google-tests-connecting-doctors-with-online-patients-1645412934</a>	10	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/651164358334507/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/651164358334507/</a>	0
13	Machine-to-machine economy	<a href="http://www.impactlab.net/2014/09/19/micro-payments-between-connected-devices-could-enable-a-new-layer-of-the-economy/">http://www.impactlab.net/2014/09/19/micro-payments-between-connected-devices-could-enable-a-new-layer-of-the-economy/</a>	10	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/636970323087244/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/636970323087244/</a>	0
13	Zero Marginal Cost society	<a href="http://www.amazon.com/Zero-Marginal-Cost-Society-Collaborative/dp/1137278463">http://www.amazon.com/Zero-Marginal-Cost-Society-Collaborative/dp/1137278463</a>	9	Risto Linturi		0
13	Zero Marginal Cost Society	<a href="https://www.youtube.com/watch?v=5-iDUcETjvo">https://www.youtube.com/watch?v=5-iDUcETjvo</a>	9	Ilkka Kakko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/552906251493652/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/552906251493652/</a>	0
13	From organisations to networks	<a href="http://interactioninstitute.org/blog/2013/07/31/why-networks-for-social-change/">http://interactioninstitute.org/blog/2013/07/31/why-networks-for-social-change/</a>	9	Jesse Soininen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/541590955958515/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/541590955958515/</a>	0
13	Organisations without leaders	<a href="http://www.washingtonpost.com/blogs/on-leadership/wp/2014/01/03/zappos-gets-rid-of-all-managers/">http://www.washingtonpost.com/blogs/on-leadership/wp/2014/01/03/zappos-gets-rid-of-all-managers/</a>	9	Ilkka Kakko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/500446683406276/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/500446683406276/</a>	0
13	Darknet/anonymous internet	<a href="http://apps.washingtonpost.com/g/page/world/nsa-research-report-on-the-tor-encryption-program/501/">http://apps.washingtonpost.com/g/page/world/nsa-research-report-on-the-tor-encryption-program/501/</a>	9	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/450725218378423/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/450725218378423/</a>	0
13	Freely organising remote work and organisations that form on the Internet		9	2014 Report by the Committee for the Future		5
13	Work above and below the algorithm	<a href="http://www.druckerforum.org/blog/?p=1097">http://www.druckerforum.org/blog/?p=1097</a>	10	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875214215929519/?comment_id=876151209169153&amp;comment_">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875214215929519/?comment_id=876151209169153&amp;comment_</a>	0
13	Uber business model and examples for group 9	<a href="http://www.nytimes.com/2015/01/29/technology/personaltech/uber-a-rising-business-model.html">http://www.nytimes.com/2015/01/29/technology/personaltech/uber-a-rising-business-model.html</a>	9	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/873728136078127/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/873728136078127/</a>	0
13	Platform co-ops	<a href="http://www.shareable.net/blog/how-platform-coops-can-beat-death-stars-like-uber-to-create-a-real-sharing-economy">http://www.shareable.net/blog/how-platform-coops-can-beat-death-stars-like-uber-to-create-a-real-sharing-economy</a>	9	Esko Nuutila		0
13	Wikihouse – open source building design	<a href="http://www.wikihouse.cc/">http://www.wikihouse.cc/</a>	9	Mikko Mononen		0
13	Opendesk global furniture design	<a href="https://www.opendesk.cc/">https://www.opendesk.cc/</a>	9	Mikko Mononen		0
13	Flipboard curation	<a href="https://about.flipboard.com/magmaker/flipboardchat-summary-how-to-curate-news-magazines/">https://about.flipboard.com/magmaker/flipboardchat-summary-how-to-curate-news-magazines/</a>	9	Esa Turtiainen		0
13	Writers Café peer collaboration	<a href="http://www.kboards.com/index.php?board=60.0">http://www.kboards.com/index.php?board=60.0</a>	9	Mari Heimala		0
13	Crowdsourcing in translation/studying	<a href="http://www.theguardian.com/education/2012/feb/14/web-translation-fails-learners">http://www.theguardian.com/education/2012/feb/14/web-translation-fails-learners</a>	9	Mari Heimala		0

13	Workforce on demand (Deloitte)	<a href="http://dupress.com/periodical/trends/human-capital-trends-2015/?id=us%3A2el%3A3dc%3A3dup1179%3Aeng%3">http://dupress.com/periodical/trends/human-capital-trends-2015/?id=us%3A2el%3A3dc%3A3dup1179%3Aeng%3</a> <a href="http://techcrunch.com/2015/12/15/the-golden-age-of-open-source-has-arrived/?ncid=rss&amp;utm_source=feedburner&amp;utm_me">http://techcrunch.com/2015/12/15/the-golden-age-of-open-source-has-arrived/?ncid=rss&amp;utm_source=feedburner&amp;utm_me</a>	9	Tatu Lund		0
13	Review of the open source code market		9	Tatu Lund		0
13	Boorzorg digital organisation	<a href="http://www.buurtzorgnederland.com/">http://www.buurtzorgnederland.com/</a>	0	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/873728136078127/?comment_id=874273942690213&amp;comment_id=8744701726705908&amp;comment_id=8744701726705908&amp;comment_id=8744701726705908">https://www.facebook.com/groups/TuVRaDikaalit/permalink/873728136078127/?comment_id=874273942690213&amp;comment_id=8744701726705908&amp;comment_id=8744701726705908&amp;comment_id=8744701726705908</a>	0
13	Uber of seas (and inland waters)	<a href="http://business turku.fi/bt/fi/cms.nsf/PFBD/0E99FB3FE58387EC2257F1500292715">http://business turku.fi/bt/fi/cms.nsf/PFBD/0E99FB3FE58387EC2257F1500292715</a>	0	Veikko Hintsanen		0
13	AdTech business – transformation of advertising media, several links	<a href="http://www.macrumors.com/2016/01/13/apple-automated-iad-platform/">http://www.macrumors.com/2016/01/13/apple-automated-iad-platform/</a>	9	Nea Barman	<a href="https://www.facebook.com/pages/Helsinki/109595459060079">https://www.facebook.com/pages/Helsinki/109595459060079</a>	0
14	FB facial recognition improved	<a href="http://money.cnn.com/2014/04/04/technology/innovation/facebook-facial-recognition/">http://money.cnn.com/2014/04/04/technology/innovation/facebook-facial-recognition/</a> <a href="https://www.newscientist.com/article/mg22129613600-genetic-mugshot-recreates-faces-from-nothing-but-dna">https://www.newscientist.com/article/mg22129613600-genetic-mugshot-recreates-faces-from-nothing-but-dna</a>	2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/546789285438682/">https://www.facebook.com/groups/TuVRaDikaalit/permalink/546789285438682/</a>	0
14	Facial image from DNA		2	Jarmo Heimo, Tatu Lund	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/539863669464577/">https://www.facebook.com/groups/TuVRaDikaalit/permalink/539863669464577/</a>	0
14	Facial image from DNA, Venter	<a href="https://www.youtube.com/watch?v=4ywjThNbfYk">https://www.youtube.com/watch?v=4ywjThNbfYk</a>	2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/864386317012309/">https://www.facebook.com/groups/TuVRaDikaalit/permalink/864386317012309/</a>	0
14	Human recognition systems		2	2014 Report by the Committee for the Future		4
14	Facebook recognises facial photos from different angles	<a href="http://money.cnn.com/2014/04/04/technology/innovation/facebook-facial-recognition/">http://money.cnn.com/2014/04/04/technology/innovation/facebook-facial-recognition/</a> <a href="http://www.itscience.com/health-and-medicine/forensic-scientists-build-crude-3d-mugshots-dna">http://www.itscience.com/health-and-medicine/forensic-scientists-build-crude-3d-mugshots-dna</a>	2	2014 Report by the Committee for the Future		0
14	Facial recognition from DNA (Penn University)		2	2014 Report by the Committee for the Future		0
15	Machine that recognises emotions	<a href="http://nemohanke.blogspot.fi/2015/06/kone-tietaa-tunteesi.html">http://nemohanke.blogspot.fi/2015/06/kone-tietaa-tunteesi.html</a>	2	Aulikki Holma, Tatu Lund	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/786702858113989/">https://www.facebook.com/groups/TuVRaDikaalit/permalink/786702858113989/</a>	0
15	Android reads the news	<a href="https://www.youtube.com/watch?v=Wyl72Re5110">https://www.youtube.com/watch?v=Wyl72Re5110</a>	3	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/589279511189659/">https://www.facebook.com/groups/TuVRaDikaalit/permalink/589279511189659/</a>	0
15	Facial animation	<a href="http://www.indiegogo.com/projects/facerig">http://www.indiegogo.com/projects/facerig</a> <a href="http://www.universityherald.com/articles/26929/20151209/tom-hanks-face-the-subject-of-digital-puppet-technology.htm">http://www.universityherald.com/articles/26929/20151209/tom-hanks-face-the-subject-of-digital-puppet-technology.htm</a>	2	Antti Tulonen	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/492643100853301/">https://www.facebook.com/groups/TuVRaDikaalit/permalink/492643100853301/</a>	0
15	Realistic facial animation Emotion management in robots and automatic recognition of emotions		2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/863506133766994/">https://www.facebook.com/groups/TuVRaDikaalit/permalink/863506133766994/</a>	0
15	Pepper, the robot that recognises emotions	<a href="http://edition.cnn.com/2014/06/06/tech/innovation/pepper-robot-emotions/">http://edition.cnn.com/2014/06/06/tech/innovation/pepper-robot-emotions/</a>	2	2014 Report by the Committee for the Future		0
16	Capturing and content searching of personal life		1	2014 Report by the Committee for the Future		2
17	Simultaneous interpretation in Skype	<a href="http://www.theverge.com/2014/12/15/7393665/skype-translator-features">http://www.theverge.com/2014/12/15/7393665/skype-translator-features</a>	2	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/684578681659741/">https://www.facebook.com/groups/TuVRaDikaalit/permalink/684578681659741/</a>	0
17	Automatic speech recognition and translation		2	2014 Report by the Committee for the Future		3
17	Speech recognition top ten 2016	<a href="http://voice-recognition-software-review.toptenreviews.com/">http://voice-recognition-software-review.toptenreviews.com/</a> <a href="http://www.dailymail.co.uk/sciencetech/article-2641653/Dont-bother-learning-foreign-language-Skype-soon-let-translate-spoken-foreign-words-real.html">http://www.dailymail.co.uk/sciencetech/article-2641653/Dont-bother-learning-foreign-language-Skype-soon-let-translate-spoken-foreign-words-real.html</a>	2	2014 Report by the Committee for the Future		0
17	Simultaneous interpretation in Skype		2	2014 Report by the Committee for the Future		0
17	Robotised telephone service Nuance	<a href="http://www.nuance.com/for-business/customer-service-solutions/loquendo-small-business-bundle/index.htm">http://www.nuance.com/for-business/customer-service-solutions/loquendo-small-business-bundle/index.htm</a>	2	2014 Report by the Committee for the Future		0
18	Example of crowdfunding	<a href="https://www.indiegogo.com/projects/flow-hive-honey-on-tap-directly-from-your-beehive">https://www.indiegogo.com/projects/flow-hive-honey-on-tap-directly-from-your-beehive</a>	9	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/751472181637057/">https://www.facebook.com/groups/TuVRaDikaalit/permalink/751472181637057/</a>	0
18	Linda Liukas' Kickstarter project	<a href="http://www.theguardian.com/technology/2014/jan/27/hello-ruby-kids-coding-book-kickstarter">http://www.theguardian.com/technology/2014/jan/27/hello-ruby-kids-coding-book-kickstarter</a>	9	Eetu Simpanen	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/509977149119896/">https://www.facebook.com/groups/TuVRaDikaalit/permalink/509977149119896/</a>	0
18	Crowdfunding and micro finance		9	2014 Report by the Committee for the Future		3
18	Digital crowdsourcing platforms for larger businesses	<a href="http://www.fastcompany.com/3055223/fast-feed/indiegogo-courts-big-businesses-with-enterprise-crowdfunding">http://www.fastcompany.com/3055223/fast-feed/indiegogo-courts-big-businesses-with-enterprise-crowdfunding</a> <a href="https://www.facebook.com/RichardDawkinsFoundation/photos/a.496176595154.294030.8798180154/10151871457060155/?type=3&amp;fref=nf">https://www.facebook.com/RichardDawkinsFoundation/photos/a.496176595154.294030.8798180154/10151871457060155/?type=3&amp;fref=nf</a>	9	Pekka Salokannel	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/881340321983575/">https://www.facebook.com/groups/TuVRaDikaalit/permalink/881340321983575/</a>	0
19	Earthquake information from mobile phones		9	Micco Juvonen	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/449251635192448/">https://www.facebook.com/groups/TuVRaDikaalit/permalink/449251635192448/</a>	0
19	Open data and big data		9	2014 Report by the Committee for the Future		3
19	DR Watson, general description	<a href="http://www.businessinsider.com/ibms-watson-may-soon-be-the-best-doctor-in-the-world-2014-4?IR=T">http://www.businessinsider.com/ibms-watson-may-soon-be-the-best-doctor-in-the-world-2014-4?IR=T</a>	2	2014 Report by the Committee for the Future		0
19	Smartphone app gives earthquake warning	<a href="http://advances.sciencemag.org/content/2/2/e1501055.full">http://advances.sciencemag.org/content/2/2/e1501055.full</a>	9	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRaDikaalit/permalink/897833213667619/">https://www.facebook.com/groups/TuVRaDikaalit/permalink/897833213667619/</a>	0

20	Gamification			2014 Report by the Committee for the Future		2
20	Ideology of gamification matures	<a href="https://en.wikipedia.org/wiki/Gamification">https://en.wikipedia.org/wiki/Gamification</a>	9	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/892718550845752/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/892718550845752/</a>	0
21	Microradar user interface	<a href="http://m.youtube.com/watch?v=0QNiZfsPc0">http://m.youtube.com/watch?v=0QNiZfsPc0</a>	1	Pekka Ketola, Esa Heiskanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/77874709242899/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/77874709242899/</a>	0
21	Eye 'mouse'	<a href="http://www.theverge.com/2014/11/25/7279849/samsung-eyecan-plus-eye-mouse">http://www.theverge.com/2014/11/25/7279849/samsung-eyecan-plus-eye-mouse</a>	1	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/673086199475656/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/673086199475656/</a>	0
21	Gesture user interface with ultrasound	<a href="http://www.cnet.com/news/elliptic-labs-ultrasonic-gestures-could-revolutionize-smartphone-interaction-next-year/">http://www.cnet.com/news/elliptic-labs-ultrasonic-gestures-could-revolutionize-smartphone-interaction-next-year/</a>	1	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/652796761504600/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/652796761504600/</a>	0
21	Gesture user interface – Soli	<a href="https://www.facebook.com/Vocativ/videos/1015231405155761/?fref=nf">https://www.facebook.com/Vocativ/videos/1015231405155761/?fref=nf</a>	1	Severi Virolainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/872607036190237/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/872607036190237/</a>	0
21	Interfaces reacting on movements			2014 Report by the Committee for the Future		4
21	Myo movement control wristband	<a href="https://www.myo.com/">https://www.myo.com/</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/873610929423181/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/873610929423181/</a>	0
22	VTT's AR display	<a href="http://www.vtt.fi/medialle/uutiset/kännykkä-osaksitavallisia-silmälaseja">http://www.vtt.fi/medialle/uutiset/kännykkä-osaksitavallisia-silmälaseja</a>	3	Pekka Pasanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851733494944258/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851733494944258/</a>	0
22	Night vision glasses of graphene	<a href="http://www.sciencealert.com/graphene-can-create-super-powerful-night-vision-lenses-that-are-just-one-atom-thick">http://www.sciencealert.com/graphene-can-create-super-powerful-night-vision-lenses-that-are-just-one-atom-thick</a>	3	Janne Mähönen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851177498333191/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851177498333191/</a>	0
22	VR and AR \$150 billion in 2020	<a href="http://www.cnet.com/news/microsofts-hololens-priced-at-3000-for-developer-edition-shipping-early-next-year/">http://www.cnet.com/news/microsofts-hololens-priced-at-3000-for-developer-edition-shipping-early-next-year/</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/840343056083302/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/840343056083302/</a>	0
22	Hololens 1Q2016	<a href="http://www.pcworld.com/article/2986140/gadgets/samsungs-new-gearvr-virtual-reality-headset-only-costs-99.html">http://www.pcworld.com/article/2986140/gadgets/samsungs-new-gearvr-virtual-reality-headset-only-costs-99.html</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/838659262918348/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/838659262918348/</a>	0
22	Samsung GearVR		3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832609050190036/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832609050190036/</a>	0
22	Magic Leap AR patents	<a href="http://fortune.com/2015/09/01/magic-leap-patents-contact-lens/">http://fortune.com/2015/09/01/magic-leap-patents-contact-lens/</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/821666061284335/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/821666061284335/</a>	0
22	Hololens available to developers in 2016	<a href="http://uk.businessinsider.com/microsoft-hololens-augmented-reality-glasses-will-be-available-to-developers-within-a-year-2015-8?r=US&amp;IR=T">http://uk.businessinsider.com/microsoft-hololens-augmented-reality-glasses-will-be-available-to-developers-within-a-year-2015-8?r=US&amp;IR=T</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/806445762806365/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/806445762806365/</a>	0
22	Artificial (super) lens for the eye	<a href="http://www.collective-evolution.com/2015/06/19/the-8-minute-surgery-that-will-give-you-superhuman-vision-forever/">http://www.collective-evolution.com/2015/06/19/the-8-minute-surgery-that-will-give-you-superhuman-vision-forever/</a>	1	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/787376454713296/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/787376454713296/</a>	0
22	Infrared retina implant testing	<a href="http://spectrum.ieee.org/tech-talk/biomedical/bionics/blind-patients-will-soon-try-a-new-bionic-eye">http://spectrum.ieee.org/tech-talk/biomedical/bionics/blind-patients-will-soon-try-a-new-bionic-eye</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/787376454713296/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/787376454713296/</a>	0
22	AR Magic Leap development environment	<a href="http://techcrunch.com/2015/06/02/magic-leap-platform/">http://techcrunch.com/2015/06/02/magic-leap-platform/</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/777823672335241/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/777823672335241/</a>	0
22	AR-Magic Leap, just another day	<a href="https://www.youtube.com/watch?v=kPMHcang0xM">https://www.youtube.com/watch?v=kPMHcang0xM</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/739306786186930/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/739306786186930/</a>	0
22	Artificial eyes 2027	<a href="http://3dprint.com/52616/mhox-3d-printed-eyes/">http://3dprint.com/52616/mhox-3d-printed-eyes/</a>	7	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/739246629526279/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/739246629526279/</a>	0
22	AR Hololens demo	<a href="http://www.pcmag.com/article2/0,2817,2475581,00.asp">http://www.pcmag.com/article2/0,2817,2475581,00.asp</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/709093902541552/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/709093902541552/</a>	0
22	LEDs for contact lenses	<a href="http://www.cnet.com/news/bionic-eye-3d-printing-merges-contact-lens-and-qleds/">http://www.cnet.com/news/bionic-eye-3d-printing-merges-contact-lens-and-qleds/</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/682512145199728/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/682512145199728/</a>	0
22	Quadcopter flying with VR glasses	<a href="http://www.youtube.com/CharpuFPV">http://www.youtube.com/CharpuFPV</a>	3	Jouni Laveri	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/673757192741890/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/673757192741890/</a>	0
22	Google's Magic Leap investment	<a href="http://www.bloomberg.com/video/google-qualcomm-are-interested-in-augmented-reality-ZsOFtgy3RxWWXa3hmPmjNQ.html">http://www.bloomberg.com/video/google-qualcomm-are-interested-in-augmented-reality-ZsOFtgy3RxWWXa3hmPmjNQ.html</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/655175041266772/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/655175041266772/</a>	0
22	Oculus in remote control by drone	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/655699724547637/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/655699724547637/</a>	3	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/655699724547637/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/655699724547637/</a>	0
22	Google Glass in Dubai	<a href="http://nuviun.com/content/news/dubai-using-google-glass-beyond-healthcare">http://nuviun.com/content/news/dubai-using-google-glass-beyond-healthcare</a>	3	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/650022905115319/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/650022905115319/</a>	0
22	VR+Robotic examples		3	Antti Tulonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/642043132579963/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/642043132579963/</a>	0
22	Virtual (CT) autopsy	<a href="https://www.youtube.com/watch?v=9usf3kL7mc">https://www.youtube.com/watch?v=9usf3kL7mc</a>	3	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/597561367028140/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/597561367028140/</a>	0
22	Oculus VR in military use	<a href="http://www.itviikko.fi/uutiset/2014/05/06/panssarikuskit-suunnitavat-oculus-riftilla--vaikka-pahaa-tekisi/20146372/7">http://www.itviikko.fi/uutiset/2014/05/06/panssarikuskit-suunnitavat-oculus-riftilla--vaikka-pahaa-tekisi/20146372/7</a>	3	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/562978207153123/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/562978207153123/</a>	0
22	Patent for smart contact lenses	<a href="http://phys.org/news/2014-04-patent-google-sharpens-contact-lens.html">http://phys.org/news/2014-04-patent-google-sharpens-contact-lens.html</a>	3	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/551990368251907/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/551990368251907/</a>	0
22	Thermal camera for contact lens	<a href="http://www.extremetech.com/extreme/178593-graphene-smart-contact-lenses-could-give-you-thermal-infrared-and-uv-vision">http://www.extremetech.com/extreme/178593-graphene-smart-contact-lenses-could-give-you-thermal-infrared-and-uv-vision</a>	1	Risto Linturi, Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/537736513010626/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/537736513010626/</a>	0

22	Telescopic contact lens	<a href="https://www.facebook.com/RichardDawkinsFoundation/photos/a.496176595154.294030.8798180154/10151870994790155/?type=3&amp;fref=nf">https://www.facebook.com/RichardDawkinsFoundation/photos/a.496176595154.294030.8798180154/10151870994790155/?type=3&amp;fref=nf</a>	7	Micco Juvonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/449252005192411/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/449252005192411/</a>	0
22	Glasses of augmented reality		3	2014 Report by the Committee for the Future		5
22	Atheer, 2D AR glasses	<a href="http://atheerair.com/">http://atheerair.com/</a>	3	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/87896265221342/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/87896265221342/</a>	0
22	AR glasses (2D) from Kopin	<a href="http://venturebeat.com/2016/01/04/kopin-enables-augmented-reality-glasses-with-breakthroughs-in-display-speech-and-battery-tech/">http://venturebeat.com/2016/01/04/kopin-enables-augmented-reality-glasses-with-breakthroughs-in-display-speech-and-battery-tech/</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/876912942426313/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/876912942426313/</a>	0
22	Earbuds modifying the sound environment	<a href="http://gizmodo.com/what-its-like-to-wear-bionic-earbuds-1756802862">http://gizmodo.com/what-its-like-to-wear-bionic-earbuds-1756802862</a>	3	Jouni Laveri	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/892258674225073/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/892258674225073/</a>	0
22	Thinglink for AR and VR advertisement links	<a href="http://www.talouselama.fi/kasvuyritykset/ulla-estromin-thinglink-kerasi-miljoonasisoituksen-laajentaa-virtuaalitodellisuuteen-6303424">http://www.talouselama.fi/kasvuyritykset/ulla-estromin-thinglink-kerasi-miljoonasisoituksen-laajentaa-virtuaalitodellisuuteen-6303424</a>	3	Laura Tiilikainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/897304260387181/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/897304260387181/</a>	0
22	360-degree video Facebook/BBC	<a href="https://www.facebook.com/bbcearth/videos/1135051163195105/?fref=nf">https://www.facebook.com/bbcearth/videos/1135051163195105/?fref=nf</a>	3	Jarmo Salmela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/902728069844800/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/902728069844800/</a>	0
22	Evaluation of the AR/VR market segments in 2020 (150 billion)	<a href="http://www.valuewalk.com/2016/02/virtual-and-augmented-reality-the-players-and-the-game-infographic/">http://www.valuewalk.com/2016/02/virtual-and-augmented-reality-the-players-and-the-game-infographic/</a>	3	Jarmo Kuismanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/90387056397198/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/90387056397198/</a>	0
22	Hololens technology explained	<a href="https://www.youtube.com/watch?v=606oZKLa_s">https://www.youtube.com/watch?v=606oZKLa_s</a>	3	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/906833776100896/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/906833776100896/</a>	0
22	3D light dots projected in the air with laser	<a href="http://www.thiscolossal.com/2014/11/an-aerial-laser-display-capable-of-projecting-3d-objects-in-mid-air/">http://www.thiscolossal.com/2014/11/an-aerial-laser-display-capable-of-projecting-3d-objects-in-mid-air/</a>	3	Jussi Ruohonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/66543233574386/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/66543233574386/</a>	0
22	VR with projectors without glasses	<a href="http://www.fastcodesign.com/3036628/microsoft-can-now-turn-any-space-into-the-holodeck?partner=rss">http://www.fastcodesign.com/3036628/microsoft-can-now-turn-any-space-into-the-holodeck?partner=rss</a>	3	Juan Juha Seg	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/646743335443276/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/646743335443276/</a>	0
22	Virtual mask with laser in real-time	<a href="http://www.businessinsider.com/projection-mapping-like-digital-makeup-2014-8">http://www.businessinsider.com/projection-mapping-like-digital-makeup-2014-8</a>	3	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/618013044982972/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/618013044982972/</a>	0
22	Hologram projected in mid-air	<a href="http://www.bitrebels.com/technology/realview-mid-air-holography-station/">http://www.bitrebels.com/technology/realview-mid-air-holography-station/</a>	3	Harri Eela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/470448176406127/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/470448176406127/</a>	0
23	Touchable holograms with femtosecond laser	<a href="http://spectrum.ieee.org/tech-talk/consumer-electronics/audiovideo/femtosecond-lasers-create-3d-midair-plasma-displays-you-can-touch">http://spectrum.ieee.org/tech-talk/consumer-electronics/audiovideo/femtosecond-lasers-create-3d-midair-plasma-displays-you-can-touch</a>	3	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/795056960611912/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/795056960611912/</a>	0
23	Haptic interfaces with ultrasound (WV)	<a href="http://spectrum.ieee.org/tech-talk/consumer-electronics/gadgets/ces-2015-hands-on-with-ultrahaptics-ultrasonic-tactile-display">http://spectrum.ieee.org/tech-talk/consumer-electronics/gadgets/ces-2015-hands-on-with-ultrahaptics-ultrasonic-tactile-display</a>	3	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/71249222201720/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/71249222201720/</a>	0
23	Haptic interface in the air with ultrasound	<a href="http://www.youtube.com/watch?v=2QkbVr4J7CM">http://www.youtube.com/watch?v=2QkbVr4J7CM</a>	3	Jouni Laveri	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/471290336321911/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/471290336321911/</a>	0
23	Touchable holograms in mid-air	<a href="http://spectrum.ieee.org/tech-talk/consumer-electronics/audiovideo/femtosecond-lasers-create-3d-midair-plasma-displays-you-can-touch">http://spectrum.ieee.org/tech-talk/consumer-electronics/audiovideo/femtosecond-lasers-create-3d-midair-plasma-displays-you-can-touch</a>	3	Risto Linturi, Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/860140887436852/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/860140887436852/</a>	0
23	Interfaces based on feeling of touch		3	2014 Report by the Committee for the Future		2
23	Finnish developer of haptic technology	<a href="http://senseg.fi/">http://senseg.fi/</a>	3	2014 Report by the Committee for the Future		0
24	Large haptic screens		3	2014 Report by the Committee for the Future		3
25	Internal organs in digital mirror	<a href="http://m.medicaldaily.com/miracle-digital-mirror-reveals-your-internal-organs-using-kinect-camera-and-pet-scans-277348">http://m.medicaldaily.com/miracle-digital-mirror-reveals-your-internal-organs-using-kinect-camera-and-pet-scans-277348</a>	3	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/553281861456091/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/553281861456091/</a>	0
25	Digital mirror		3	2014 Report by the Committee for the Future		3
26	Brain to brain connection	<a href="http://www.iflscience.com/brain/first-brain-brain-interface-could-revolutionize-neuroscience">http://www.iflscience.com/brain/first-brain-brain-interface-could-revolutionize-neuroscience</a>	1	Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/796193420498266/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/796193420498266/</a>	0
26	Flexible, permanent EEG sensor	<a href="http://spectrum.ieee.org/tech-talk/biomedical/bionics/a-braincomputing-interface-that-lasts-for-weeks">http://spectrum.ieee.org/tech-talk/biomedical/bionics/a-braincomputing-interface-that-lasts-for-weeks</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/737900336327575/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/737900336327575/</a>	0
26	Direct control by the brain	<a href="http://defensetech.org/2015/03/02/this-woman-flew-an-f-35-simulator-with-her-mind/">http://defensetech.org/2015/03/02/this-woman-flew-an-f-35-simulator-with-her-mind/</a>	1	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/729067487210860/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/729067487210860/</a>	0
26	Direct brain connection	<a href="http://www.iflscience.com/brain/mind-meld-brains-cooperate-without-words">http://www.iflscience.com/brain/mind-meld-brains-cooperate-without-words</a>	1	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/664220880362188/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/664220880362188/</a>	0
26	Controlling of robot hand with thoughts	<a href="http://www.cnet.com/news/mind-controlled-prosthetic-arm-now-reality/">http://www.cnet.com/news/mind-controlled-prosthetic-arm-now-reality/</a>	1	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/648150655302544/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/648150655302544/</a>	0
26	Control by the brain	<a href="http://www.wired.com/2014/08/mind-controlled-robot">http://www.wired.com/2014/08/mind-controlled-robot</a>	1	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/619983658119244/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/619983658119244/</a>	0
26	Smart glasses controlled by thoughts	<a href="http://techcrunch.com/2014/07/09/torget-ok-glass-minddr-is-a-new-google-glass-app-that-you-control-with-your-">http://techcrunch.com/2014/07/09/torget-ok-glass-minddr-is-a-new-google-glass-app-that-you-control-with-your-</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/597406267043650/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/597406267043650/</a>	0
26	Thoughts monitored from brain and actions based on them		1	2014 Report by the Committee for the Future		4
26	Graphene implants in the brain	<a href="http://blog.hospitalclinic.org/en/2014/07/lidibaps-participa-en-el-proyecto-emblematic-graphene-flagship/">http://blog.hospitalclinic.org/en/2014/07/lidibaps-participa-en-el-proyecto-emblematic-graphene-flagship/</a>	1	2014 Report by the Committee for the Future		0

26	Brain control by laser	<a href="http://www.livescience.com/49568-thirst-switched-off-brain.html">http://www.livescience.com/49568-thirst-switched-off-brain.html</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/71097748235194/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/71097748235194/</a>	0
27	Flexible and transparent screens using cheap materials		3	2014 Report by the Committee for the Future		2
28	Solu cloud computing terminal	<a href="https://www.kickstarter.com/projects/676993694/solu-a-new-breed-of-computing?ref=thanks_share">https://www.kickstarter.com/projects/676993694/solu-a-new-breed-of-computing?ref=thanks_share</a>	10	Tero Kauppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/841100436007564/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/841100436007564/</a>	0
28	Optical GST memory circuit	<a href="http://www.kurzweilai.net/first-all-optical-chip-memory">http://www.kurzweilai.net/first-all-optical-chip-memory</a>	3	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832402910210650/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832402910210650/</a>	0
28	Cloud computing		10	2014 Report by the Committee for the Future		2
28	Decreased price of Nand Flash memory promotes cloud services	<a href="http://www.zdnet.com/article/enterprise-storage-trends-and-predictions/">http://www.zdnet.com/article/enterprise-storage-trends-and-predictions/</a>	10	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893051384145802/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893051384145802/</a>	0
29	Grid computing		10	2014 Report by the Committee for the Future		2
30	PV calculator from satellite image	<a href="http://www.iflscience.com/technology/should-you-get-solar-panels-ask-google">http://www.iflscience.com/technology/should-you-get-solar-panels-ask-google</a>	2	Aulikki Holma	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/816593051791636/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/816593051791636/</a>	0
30	Psychosis detection from speech	<a href="http://medicalxpress.com/news/2015-08-psychosis-automated-speech-analysis.html">http://medicalxpress.com/news/2015-08-psychosis-automated-speech-analysis.html</a>	2	Vilho Ahola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/818511204933154/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/818511204933154/</a>	0
30	Diagnostic mirror	<a href="http://www.smithsonianmag.com/innovation/look-into-this-smart-mirror-and-you-get-a-one-minute-medical-checkup-180956367/">http://www.smithsonianmag.com/innovation/look-into-this-smart-mirror-and-you-get-a-one-minute-medical-checkup-180956367/</a>	2	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/817589251692016/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/817589251692016/</a>	0
30	AI learning to play unfamiliar video games	<a href="http://www.bloomberg.com/news/articles/2015-02-25/google-s-computers-learn-to-play-video-games-by-themselves">http://www.bloomberg.com/news/articles/2015-02-25/google-s-computers-learn-to-play-video-games-by-themselves</a>	2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/726105067507102/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/726105067507102/</a>	0
30	Optical cancer detection	<a href="http://info.adimec.com/blogposts/interview-with-fabrice-harms-at-litech-about-high-full-well-capacity-camera-for-non-invasive-cancer-assessment-ffoct">http://info.adimec.com/blogposts/interview-with-fabrice-harms-at-litech-about-high-full-well-capacity-camera-for-non-invasive-cancer-assessment-ffoct</a>	1	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/724032641047678/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/724032641047678/</a>	0
30	Image recognition into text	<a href="http://deeplearning.cs.toronto.edu/i2t">http://deeplearning.cs.toronto.edu/i2t</a>	2	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/714970731953869/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/714970731953869/</a>	0
30	Stroke anticipation	<a href="http://www.cnet.com/news/samsung-prototypes-brainwave-reading-wearable-stroke-detector/">http://www.cnet.com/news/samsung-prototypes-brainwave-reading-wearable-stroke-detector/</a>	2	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/708724959245113/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/708724959245113/</a>	0
30	AI, Google deep learning	<a href="https://medium.com/backchannel/google-search-will-be-your-next-brain-5207c26e4523">https://medium.com/backchannel/google-search-will-be-your-next-brain-5207c26e4523</a>	2	Antti Halonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706393636144912/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706393636144912/</a>	0
30	AI learns to cook from video	<a href="http://www.hs.fi/tiede/a1305914088246?jako=df300339f3cd69f898d367d247fe73ac&amp;ref=fb-share">http://www.hs.fi/tiede/a1305914088246?jako=df300339f3cd69f898d367d247fe73ac&amp;ref=fb-share</a>	2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/702898653161077/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/702898653161077/</a>	0
30	Deep learning AI	<a href="http://www.ted.com/talks/jeremy_howard_the_wonderful_and_terrorifying_implications_of_computers_that_can_learn">http://www.ted.com/talks/jeremy_howard_the_wonderful_and_terrorifying_implications_of_computers_that_can_learn</a>	2	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/687337841383825/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/687337841383825/</a>	0
30	Words read from thoughts	<a href="http://www.newscientist.com/article/mg22429934.000-brain-decoder-can-eavesdrop-on-your-inner-voice.html">http://www.newscientist.com/article/mg22429934.000-brain-decoder-can-eavesdrop-on-your-inner-voice.html</a>	2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/660113720772904/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/660113720772904/</a>	0
30	Smartphone detects Parkinson's disease	<a href="http://www.ft.com/intl/cms/s/0/cb6ec31a-376b-11e4-971c-00144feabdc0.html">http://www.ft.com/intl/cms/s/0/cb6ec31a-376b-11e4-971c-00144feabdc0.html</a>	2	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/633506266766983/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/633506266766983/</a>	0
30	Breakthrough of machine vision	<a href="http://www.technologyreview.com/view/530561/the-revolutionary-technique-that-quietly-changed-machine-vision-forever/">http://www.technologyreview.com/view/530561/the-revolutionary-technique-that-quietly-changed-machine-vision-forever/</a>	2	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/632785863505690/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/632785863505690/</a>	0
30	DR Watson	<a href="http://www.businessinsider.com/ibms-watson-may-soon-be-the-best-doctor-in-the-world-2014-4">http://www.businessinsider.com/ibms-watson-may-soon-be-the-best-doctor-in-the-world-2014-4</a>	2	Marko Mikael Tenkanen	<a href="http://www.telegraph.co.uk/science/science-news/7987821/Mind-reading-machine-can-convert-thoughts-into-speech.html">http://www.telegraph.co.uk/science/science-news/7987821/Mind-reading-machine-can-convert-thoughts-into-speech.html</a>	0
30	Thoughts converted into words		2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/536563826461228/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/536563826461228/</a>	0
30	Deep learning models	<a href="http://papers.nips.cc/paper/5947-semi-supervised-learning-with-ladder-networks.pdf">http://papers.nips.cc/paper/5947-semi-supervised-learning-with-ladder-networks.pdf</a>	2	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/864623603655247/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/864623603655247/</a>	0
30	Pattern recognition and pattern search services		2	2014 Report by the Committee for the Future		3
30	Bioimage informatics	<a href="https://www.doria.fi/handle/10024/97260">https://www.doria.fi/handle/10024/97260</a>	2	2014 Report by the Committee for the Future		0
30	AI looks for hidden cancer links in patient records	<a href="https://www.newscientist.com/article/2078159-ai-reads-doctors-notes-to-find-hidden-links-in-cancer-cases/">https://www.newscientist.com/article/2078159-ai-reads-doctors-notes-to-find-hidden-links-in-cancer-cases/</a>	2	Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/903566023094338/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/903566023094338/</a>	0
31	Inexpensive 3D imaging	<a href="https://www.facebook.com/techcrunch/videos/10153485781482952/?fref=nf">https://www.facebook.com/techcrunch/videos/10153485781482952/?fref=nf</a>	3	Jouni Kari	<a href="http://spectrum.ieee.org/video/consumer-electronics/audiovideo/kinect-fusion-lets-you-build-3d-models-of-anything">http://spectrum.ieee.org/video/consumer-electronics/audiovideo/kinect-fusion-lets-you-build-3d-models-of-anything</a>	0
31	3D model using Kinect Fusion		3	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/707098346074441/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/707098346074441/</a>	0
31	More precise 3D imaging by exploiting polarisation	<a href="http://www.sciencedaily.com/releases/2015/12/151201141244.htm">http://www.sciencedaily.com/releases/2015/12/151201141244.htm</a>	1	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859722324145375/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859722324145375/</a>	0
31	Effortless 3D imaging of parts		3	2014 Report by the Committee for the Future		4
31	(ToF) 3D camera cell	<a href="http://image-sensors-world.blogspot.fi/2015/12/pmd-and-infineon-present-improved-tof.html">http://image-sensors-world.blogspot.fi/2015/12/pmd-and-infineon-present-improved-tof.html</a>	1	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/869566539827620/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/869566539827620/</a>	0

32	3D-filmed video	<a href="https://www.facebook.com/schrep/videos/10153738792764443/?hc_location=ufi">https://www.facebook.com/schrep/videos/10153738792764443/?hc_location=ufi</a>	3	Janne Mähönen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/852188738232067/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/852188738232067/</a>	0
32	Nokia OZO VR camera	<a href="http://www.engadget.com/2015/07/28/nokia-virtual-reality-camera/">http://www.engadget.com/2015/07/28/nokia-virtual-reality-camera/</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/804296233021318/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/804296233021318/</a>	0
32	Sound camera for development of mechanics	<a href="http://spectrum.ieee.org/tech-talk/at-work/test-and-measurement/zero-in-on-buzz-squeak-and-rattle">http://spectrum.ieee.org/tech-talk/at-work/test-and-measurement/zero-in-on-buzz-squeak-and-rattle</a> <a href="http://www.gsmarena.com/project_tango_developer_tablet_arrives_in_the_google_play_store-news-10208.php">http://www.gsmarena.com/project_tango_developer_tablet_arrives_in_the_google_play_store-news-10208.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/721404081310534/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/721404081310534/</a>	0
32	Google Tango 3D device	<a href="http://spectrum.ieee.org/automaton/robotics/aerial-robots/autonomous-quadrotor-flight-based-on-google-project-tango">http://spectrum.ieee.org/automaton/robotics/aerial-robots/autonomous-quadrotor-flight-based-on-google-project-tango</a>	3	Paul Godsmark	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/667485126702430/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/667485126702430/</a>	0
32	Google Tango (3D modelling) in quadcopter		3	Ilkka Nojonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/571487026302241/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/571487026302241/</a>	0
32	Google Tango	<a href="http://www.google.com/atap/projecttango/">http://www.google.com/atap/projecttango/</a>	3	Pekka Salokannel	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/525480197569591/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/525480197569591/</a>	0
32	Nokia OZO VR camera \$60K	<a href="http://www.pcmag.com/article2/0,2817,2495939,00,asp">http://www.pcmag.com/article2/0,2817,2495939,00,asp</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859714227479518/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859714227479518/</a>	0
32	Real time 3D-modelling of the environment		3	2014 Report by the Committee for the Future		5
32	360-modelling of sounds in the environment	<a href="https://theta360.com/en/">https://theta360.com/en/</a> <a href="http://www.avaruus.fi/uutiset/maa-ja-lahjavaruus/maapallosta-julkaistaan-nyt-aidonvarinen-kokonaiskuva-paivittain.html">http://www.avaruus.fi/uutiset/maa-ja-lahjavaruus/maapallosta-julkaistaan-nyt-aidonvarinen-kokonaiskuva-paivittain.html</a>	3	Pekka Ketola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/888997017884572/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/888997017884572/</a>	0
33	Daily global picture	<a href="http://www.uusisuomi.fi/tiede-ja-ymparisto/68522-tanskan-valtion-huieka-temppu-koko-maa-minecraftiin-11-koossa">http://www.uusisuomi.fi/tiede-ja-ymparisto/68522-tanskan-valtion-huieka-temppu-koko-maa-minecraftiin-11-koossa</a>	3	Esa Turtiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/842699759180965/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/842699759180965/</a>	0
33	All of Denmark in Minecraft		3	Laura Tiilikainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/556181464499464/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/556181464499464/</a>	0
33	Self organizing virtual world from the 3D data of the Internet		2	2014 Report by the Committee for the Future		2
34	AI creativity, self-organising data		2	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/784944531623155/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/784944531623155/</a>	0
34	Predictive analytics based on self-organising data		2	2014 Report by the Committee for the Future		2
35	Graphene memory circuit	<a href="http://news.stanford.edu/news/2015/october/graphene-memory-chips-102315.html">http://news.stanford.edu/news/2015/october/graphene-memory-chips-102315.html</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/844854455632162/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/844854455632162/</a>	0
35	Memristor processor	<a href="http://fortune.com/2015/09/03/memristor-brain-like-chips/">http://fortune.com/2015/09/03/memristor-brain-like-chips/</a> <a href="http://newsroom.intel.com/community/intel_newsroom/blog/2015/07/28/intel-and-micron-produce-breakthrough-memory-technology">http://newsroom.intel.com/community/intel_newsroom/blog/2015/07/28/intel-and-micron-produce-breakthrough-memory-technology</a>	3	Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/822327934551481/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/822327934551481/</a>	0
35	128 Gbit of fast memory on a circuit	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/graphene-becomes-magnetic-and-electric-at-same-time">http://spectrum.ieee.org/nanoclast/semiconductors/materials/graphene-becomes-magnetic-and-electric-at-same-time</a> <a href="http://www.technologyreview.com/news/533526/new-form-of-memory-could-advance-brain-inspired-computers/">http://www.technologyreview.com/news/533526/new-form-of-memory-could-advance-brain-inspired-computers/</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/804445276339747/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/804445276339747/</a>	0
35	Magnetic memory of graphene		6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/712332272217715/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/712332272217715/</a>	0
35	Associative circuit (IBM)		3	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/694228217361454/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/694228217361454/</a>	0
35	Million neurons on IBM circuit	<a href="http://www.bbc.com/news/science-environment-28688781">http://www.bbc.com/news/science-environment-28688781</a>	3	Vilho Ahola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/612282718889338/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/612282718889338/</a>	0
35	HP640TB cpu & memory unit?	<a href="http://bit.ly/1i3zSAI">http://bit.ly/1i3zSAI</a>	3	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/584558008328476/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/584558008328476/</a>	0
35	Memristor background	<a href="http://edition.cnn.com/2015/02/26/tech/mci-eth-memristor/index.html">http://edition.cnn.com/2015/02/26/tech/mci-eth-memristor/index.html</a>	3	Risto Linturi		0
35	Supermemory of a quartz crystal	<a href="http://bit.ly/1jswMm1">http://bit.ly/1jswMm1</a> <a href="http://www.natureworldnews.com/articles/6274/20140307/multiferroic-magnetic-materials-increase-power-efficiency-computers.htm">http://www.natureworldnews.com/articles/6274/20140307/multiferroic-magnetic-materials-increase-power-efficiency-computers.htm</a>	3	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/553272444790366/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/553272444790366/</a>	0
35	Spintronics improve energy efficiency of ICT	<a href="http://yle.fi/uutiset/suomessa_kehitettiin_ainutlaatua_painettua_alya_muistivastus_voidaan_tulostaa_vaikka_postipaketin_kylkeen/8494473">http://yle.fi/uutiset/suomessa_kehitettiin_ainutlaatua_painettua_alya_muistivastus_voidaan_tulostaa_vaikka_postipaketin_kylkeen/8494473</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/532936370157307/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/532936370157307/</a>	0
35	Memristor from Finland		3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/863039800480294/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/863039800480294/</a>	0
35	Universal memory based on new materials and solutions		3	2014 Report by the Committee for the Future		4
35	Racetrack memory making progress	<a href="http://www.electronicweekly.com/news/glasgow-and-leeds-researchers-move-towards-racetrack-memory-2015-12/">http://www.electronicweekly.com/news/glasgow-and-leeds-researchers-move-towards-racetrack-memory-2015-12/</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/873629659421308/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/873629659421308/</a>	0
35	360 TB memory crystal fabricated	<a href="http://phys.org/news/2016-02-eternal-5d-storage-history-humankind.html">http://phys.org/news/2016-02-eternal-5d-storage-history-humankind.html</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/898802310237376/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/898802310237376/</a>	0
36	Functional mechanism of memory	<a href="http://phys.org/news/2015-10-biochemists-uncover-cellular-memory-mechanism.html">http://phys.org/news/2015-10-biochemists-uncover-cellular-memory-mechanism.html</a> <a href="http://www.nytimes.com/2015/10/09/science/rat-brain-digital-reconstruction-human-brain-project.html?_r=0">http://www.nytimes.com/2015/10/09/science/rat-brain-digital-reconstruction-human-brain-project.html?_r=0</a>	7	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/840744116043196/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/840744116043196/</a>	0
36	Simulation of rat brain		2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/838437986273809/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/838437986273809/</a>	0
36	Modelling/printing of the brain	<a href="http://www.theguardian.com/science/neurophilosophy/2015/aug/12/3d-printed-brain-tissue">http://www.theguardian.com/science/neurophilosophy/2015/aug/12/3d-printed-brain-tissue</a>	2	Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/811410562309885/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/811410562309885/</a>	0

36	Talent from brain damage	<a href="http://www.hs.fi/ulkomaat/Baaritappelussa+mukiloidusta+miehest%C3%A4+tuli+nero++matkusti+tutkimuksiin+Suomeen/a1399515817870">http://www.hs.fi/ulkomaat/Baaritappelussa+mukiloidusta+miehest%C3%A4+tuli+nero++matkusti+tutkimuksiin+Suomeen/a1399515817870</a>	7	Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/563293490454928/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/563293490454928/</a>	0
36	Circuit imitates the brain	<a href="http://www.cnet.com.au/brain-inspired-circuit-board-9000-times-faster-than-an-average-pc-339347168.htm">http://www.cnet.com.au/brain-inspired-circuit-board-9000-times-faster-than-an-average-pc-339347168.htm</a>	2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/560016720782605/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/560016720782605/</a>	0
36	Emulation of brain (IBM)	<a href="http://www.youtube.com/watch?v=tqeINGOziZo">http://www.youtube.com/watch?v=tqeINGOziZo</a>	2	Antti Halonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/492467414204203/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/492467414204203/</a>	0
36	Neuroprocessors	<a href="http://readwrite.com/2013/10/25/neural-processing-unit">http://readwrite.com/2013/10/25/neural-processing-unit</a>	3	Antti Halonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/492447297539548/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/492447297539548/</a>	0
36	Simulation and mapping of the brain			2014 Report by the Committee for the Future		4
36	Digital neuron interface in the pipeline (DARPA)	<a href="http://www.darpa.mil/news-events/2015-01-19">http://www.darpa.mil/news-events/2015-01-19</a>	1	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885719308212343/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885719308212343/</a>	0
36	Revealing the memory structures of the brain	<a href="http://gizmodo.com/our-brains-can-store-10-times-more-information-than-we-1754255335">http://gizmodo.com/our-brains-can-store-10-times-more-information-than-we-1754255335</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885755434875397/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885755434875397/</a>	0
37	Quantum computer	<a href="http://www.sciencealert.com/australian-engineers-have-put-quantum-technology-in-a-silicon-chip-for-the-first-time">http://www.sciencealert.com/australian-engineers-have-put-quantum-technology-in-a-silicon-chip-for-the-first-time</a>	3	Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/836858139765127/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/836858139765127/</a>	0
37	Quantum computer on silicon	<a href="http://www.smh.com.au/technology/sci-tech/australian-researchers-make-quantum-computing-breakthrough-paving-way-for-worldfirst-">http://www.smh.com.au/technology/sci-tech/australian-researchers-make-quantum-computing-breakthrough-paving-way-for-worldfirst-</a>	3	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/839401902844084/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/839401902844084/</a>	0
37	Quantum computer-proof encryption	<a href="http://www.wired.com/2015/09/tricky-encryption-stump-quantum-computers/">http://www.wired.com/2015/09/tricky-encryption-stump-quantum-computers/</a>	3	Esa Turtiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/830543670396574/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/830543670396574/</a>	0
37	Multicore processors	<a href="http://spectrum.ieee.org/tech-talk/computing/hardware/tardis-memory-could-enable-huge-multicore-computer-chips">http://spectrum.ieee.org/tech-talk/computing/hardware/tardis-memory-could-enable-huge-multicore-computer-chips</a>	3	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/825935907524017/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/825935907524017/</a>	0
37	Development trends in computing performance	<a href="http://intelligence.org/2014/05/12/exponential-and-non-exponential/">http://intelligence.org/2014/05/12/exponential-and-non-exponential/</a>	3	Kaj Sotala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/565615920222685/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/565615920222685/</a>	0
37	Quantum computer – photon switch	<a href="http://www.extremetech.com/extreme/219160-gooles-quantum-computer-is-100-million-times-faster-than-a-conventional-system">http://www.extremetech.com/extreme/219160-gooles-quantum-computer-is-100-million-times-faster-than-a-conventional-system</a>	3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/548820641902213/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/548820641902213/</a>	0
37	Quantum computer (Google)		3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/863500493767558/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/863500493767558/</a>	0
37	Quantum computers			2014 Report by the Committee for the Future		4
38	Solid State LIDAR	<a href="http://nextbigfuture.com/2015/11/low-cost-compact-solid-state-lidar.html">http://nextbigfuture.com/2015/11/low-cost-compact-solid-state-lidar.html</a>	1	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/822888774495397/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/822888774495397/</a>	0
38	Low-cost Lidar for braking	<a href="http://spectrum.ieee.org/cars-that-think/transportation/sensors/cheap-lidar-for-automatic-braking">http://spectrum.ieee.org/cars-that-think/transportation/sensors/cheap-lidar-for-automatic-braking</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/778801952237413/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/778801952237413/</a>	0
38	OPAL lidar for difficult conditions	<a href="http://www.autonomoustuff.com/uploads/9/6/0/5/9605198/neptec_opal_whitepaper.pdf">http://www.autonomoustuff.com/uploads/9/6/0/5/9605198/neptec_opal_whitepaper.pdf</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/71180689270253/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/71180689270253/</a>	0
38	Lidar vs Radar	<a href="http://spectrum.ieee.org/tech-talk/aerospace/aviation/laser-makes-more-accurate-radar-system">http://spectrum.ieee.org/tech-talk/aerospace/aviation/laser-makes-more-accurate-radar-system</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/70828292262650/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/70828292262650/</a>	0
38	Low-cost Lidar	<a href="http://www.dragoninnovation.com/projects/32-lidar-lite-by-pulsedlight">http://www.dragoninnovation.com/projects/32-lidar-lite-by-pulsedlight</a>	1	Ilkka Nojonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/538945646223046/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/538945646223046/</a>	0
38	Low-cost Lidar	<a href="http://pulsedlight3d.com/">http://pulsedlight3d.com/</a>	1	Tuomas Santakallio	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859278367523104/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859278367523104/</a>	0
38	Cheap Lidar			2014 Report by the Committee for the Future		4
38	Low-cost \$250 'solid state' LIDAR	<a href="http://spectrum.ieee.org/cars-that-think/transportation/sensors/quanergy-solid-state-lidar">http://spectrum.ieee.org/cars-that-think/transportation/sensors/quanergy-solid-state-lidar</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/878938385557102/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/878938385557102/</a>	0
38	GPS tracking down to the centimeter	<a href="https://www.sciencedaily.com/releases/2016/02/160211111507.htm">https://www.sciencedaily.com/releases/2016/02/160211111507.htm</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/899120350205572/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/899120350205572/</a>	0
39	FlatCam lenseless imaging	<a href="http://arxiv.org/pdf/1509.00116v1.pdf">http://arxiv.org/pdf/1509.00116v1.pdf</a>	3	Pekka Pasanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/857075364410071/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/857075364410071/</a>	0
39	Lenseless imaging	<a href="http://www.osa.org/en-us/about_os/newsroom/news_releases/2015/pushing_the_limits_of_lensless_imaging/">http://www.osa.org/en-us/about_os/newsroom/news_releases/2015/pushing_the_limits_of_lensless_imaging/</a>	3	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832185740232367/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832185740232367/</a>	0
39	Computational imaging	<a href="http://www.nature.com/news/optics-super-vision-1.16877">http://www.nature.com/news/optics-super-vision-1.16877</a>	3	Kirmo Vartiavaara	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/719486144835661/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/719486144835661/</a>	0
39	Lenseless FlatCam	<a href="http://arxiv.org/pdf/1509.00116v1.pdf">http://arxiv.org/pdf/1509.00116v1.pdf</a>	1	Pekka Pasanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/857075364410071/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/857075364410071/</a>	0
39	Lenseless camera and image construction based on data analysis			2014 Report by the Committee for the Future		4
40	Hyperspectral camera	<a href="http://www.tiede.fi/artikkeli/uutiset/hyperspektrikamera_voi_kutistaa_kannykkakokoon">http://www.tiede.fi/artikkeli/uutiset/hyperspektrikamera_voi_kutistaa_kannykkakokoon</a>	1	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/841997472584527/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/841997472584527/</a>	0
40	Nanometer-level imaging	<a href="http://www.eurekalert.org/pub_releases/2015-09/aioip-msi092515.php">http://www.eurekalert.org/pub_releases/2015-09/aioip-msi092515.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834074640043477/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834074640043477/</a>	0

40	Nanospectroscopy	<a href="http://www.nature.com/nano/journal/voap/ncurrent/full/nano.2015.168.html">http://www.nature.com/nano/journal/voap/ncurrent/full/nano.2015.168.html</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/810386472412294/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/810386472412294/</a>	0
40	'Quick' NanoMRI	<a href="http://spectrum.ieee.org/nanoclast/biomedical/imaging/new-technique-brings-nanomri-a-step-closer-to-commercial-applications">http://spectrum.ieee.org/nanoclast/biomedical/imaging/new-technique-brings-nanomri-a-step-closer-to-commercial-applications</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/777072999076975/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/777072999076975/</a>	0
40	Nanoscale metamaterial lens	<a href="http://www.buffalo.edu/news/releases/2015/05/039.html">http://www.buffalo.edu/news/releases/2015/05/039.html</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/770735796377362/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/770735796377362/</a>	0
40	Material radar in Finland	<a href="http://www.tekniikkatalous.fi/innovaatiot/2015-01-09/Terrorismin-torjuntaan-lis%C3%A4%C3%A4-v%C3%A4lineit%C3%A4---jyv%C3%A4skyl%C3%A4n">http://www.tekniikkatalous.fi/innovaatiot/2015-01-09/Terrorismin-torjuntaan-lis%C3%A4%C3%A4-v%C3%A4lineit%C3%A4---jyv%C3%A4skyl%C3%A4n</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/708505602600382/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/708505602600382/</a>	0
40	Food scanner	<a href="https://www.indiegogo.com/projects/tellspec-what-s-in-your-food">https://www.indiegogo.com/projects/tellspec-what-s-in-your-food</a>	1	Antti Tulonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/620989368018673/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/620989368018673/</a>	0
40	Monitoring of humans (vital signs) through walls	<a href="http://newsoffice.mit.edu/2014/could-wireless-replace-wearables">http://newsoffice.mit.edu/2014/could-wireless-replace-wearables</a>	1	Kaj Sotala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/586124064838537/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/586124064838537/</a>	0
40	SCIO material radar	<a href="http://edition.cnn.com/2014/05/02/tech/innovation/molecular-sensor-fits-in-your-hand/">http://edition.cnn.com/2014/05/02/tech/innovation/molecular-sensor-fits-in-your-hand/</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/560588950725382/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/560588950725382/</a>	0
40	Comprehensive set of blood tests optically	<a href="http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm">http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/531415790309365/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/531415790309365/</a>	0
40	Near-real-time nanoscale 3D video	<a href="http://www.eurekalert.org/pub_releases/2015-12/miot-mcn121415.php">http://www.eurekalert.org/pub_releases/2015-12/miot-mcn121415.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/866795556771385/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/866795556771385/</a>	0
40	'Material Radar'		1	2014 Report by the Committee for the Future		5
40	Optical laboratory	<a href="http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm">http://www.scienceworldreport.com/articles/13249/20140303/complete-medical-check-up-chip.htm</a>	1	2014 Report by the Committee for the Future		0
41	Gas measurement	<a href="http://www.tekniikkatalous.fi/innovaatiot/huumeongelmaan-keksittiin-suomalainen-ratkaisu-kayttoon-2019-3481908">http://www.tekniikkatalous.fi/innovaatiot/huumeongelmaan-keksittiin-suomalainen-ratkaisu-kayttoon-2019-3481908</a>	1	Kari Vahtiala	<a href="http://www.tekniikkatalous.fi/innovaatiot/huumeongelmaan-keksittiin-suomalainen-ratkaisu-kayttoon-2019-3481908">http://www.tekniikkatalous.fi/innovaatiot/huumeongelmaan-keksittiin-suomalainen-ratkaisu-kayttoon-2019-3481908</a>	0
41	Gas sensors in clothes	<a href="http://www.smithsonianmag.com/innovation/thin-sensors-on-our-skin-in-our-clothes-may-warn-us-environmental-hazards-180956127">http://www.smithsonianmag.com/innovation/thin-sensors-on-our-skin-in-our-clothes-may-warn-us-environmental-hazards-180956127</a>	1	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/810619415722333/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/810619415722333/</a>	0
41	Recognition of mold spores	<a href="http://www.tekniikkatalous.fi/innovaatiot/tama+tuule+tarpeeseen+suomessa+kehitettiin+uusi+menetelm+a+homeaurioiden+tunnistamiseen/a1062992">http://www.tekniikkatalous.fi/innovaatiot/tama+tuule+tarpeeseen+suomessa+kehitettiin+uusi+menetelm+a+homeaurioiden+tunnistamiseen/a1062992</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/772242149560060/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/772242149560060/</a>	0
41	Small gas chromatograph	<a href="http://www.eurekalert.org/pub_releases/2015-04/vt-ntp041315.php">http://www.eurekalert.org/pub_releases/2015-04/vt-ntp041315.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/752143931569882/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/752143931569882/</a>	0
41	Smell digitalisation and printing	<a href="http://themindunleashed.org/2014/06/first-scent-message-transmitted-across-the-atlantic-via-the-internet.html">http://themindunleashed.org/2014/06/first-scent-message-transmitted-across-the-atlantic-via-the-internet.html</a>	1	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/586077328176544/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/586077328176544/</a>	0
41	Artificial nose smells cancer	<a href="http://utain.uta.fi/uutiset/keinonen%C3%A4-haistaisy%C3%B6v%C3%A4n-virtsasta">http://utain.uta.fi/uutiset/keinonen%C3%A4-haistaisy%C3%B6v%C3%A4n-virtsasta</a>	1	Antti Tulonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/49788933032678/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/49788933032678/</a>	0
41	Cheap gas sensors		1	2014 Report by the Committee for the Future		4
41	Scents digitalised and reproduced	<a href="http://themindunleashed.org/2014/06/first-scent-message-transmitted-across-the-atlantic-via-the-internet.html">http://themindunleashed.org/2014/06/first-scent-message-transmitted-across-the-atlantic-via-the-internet.html</a>	1	2014 Report by the Committee for the Future		0
41	Accurate NO2 detection with graphene oxid	<a href="http://pubs.rsc.org/en/Content/ArticleLanding/2014/NR/c4nr00332b">http://pubs.rsc.org/en/Content/ArticleLanding/2014/NR/c4nr00332b</a>	1	2014 Report by the Committee for the Future		0
42	Very sensitive camera sensors based on nanocarbons		1	2014 Report by the Committee for the Future		2
42	Image cells in quick development	<a href="http://www.eetimes.com/document.asp?doc_id=1325655">http://www.eetimes.com/document.asp?doc_id=1325655</a>	1	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/720109714773304/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/720109714773304/</a>	0
43	Inkjet-printed flexible electronics	<a href="http://www.eurekalert.org/pub_releases/2015-04/pu-ilm040815.php">http://www.eurekalert.org/pub_releases/2015-04/pu-ilm040815.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751619071622368/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751619071622368/</a>	0
43	Graphene biosensor	<a href="http://www.upenn.edu/pennnews/current/2015-01-15/latest-news/new-graphene-based-biosensor-triple-threat">http://www.upenn.edu/pennnews/current/2015-01-15/latest-news/new-graphene-based-biosensor-triple-threat</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/704908339626775/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/704908339626775/</a>	0
43	Printed cheap biosensors		1	2014 Report by the Committee for the Future		3
43	Roll-to-roll electronics evolve	<a href="http://spectrum.ieee.org/tech-talk/semiconductors/materials/roll-to-roll-electronics-manufacturing-rolls-on">http://spectrum.ieee.org/tech-talk/semiconductors/materials/roll-to-roll-electronics-manufacturing-rolls-on</a>	5	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/889533214497619/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/889533214497619/</a>	0
43	Microcircuit on nanocellulose paper	<a href="http://spectrum.ieee.org/tech-talk/consumer-electronics/portable-devices/green-microchips-created-on-cellulose-nanofibril-paper">http://spectrum.ieee.org/tech-talk/consumer-electronics/portable-devices/green-microchips-created-on-cellulose-nanofibril-paper</a>	3	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/777071225743819/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/777071225743819/</a>	0
44	Tunable nanolaser & THz	<a href="http://www.nature.com/ncomms/2015/150420/ncomms7939/full/ncomms7939.html">http://www.nature.com/ncomms/2015/150420/ncomms7939/full/ncomms7939.html</a>	1	Kari Vahtiala	<a href="http://www.nature.com/ncomms/2015/150420/ncomms7939/full/ncomms7939.html">http://www.nature.com/ncomms/2015/150420/ncomms7939/full/ncomms7939.html</a>	0
44	THz imaging	<a href="http://www.eurekalert.org/pub_releases/2015-08/ef-icf080615.php">http://www.eurekalert.org/pub_releases/2015-08/ef-icf080615.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/808022032648738/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/808022032648738/</a>	0
44	THz-amplifier	<a href="http://spectrum.ieee.org/tech-talk/telecom/wireless/darpa-builds-first-terahertz-amplifier">http://spectrum.ieee.org/tech-talk/telecom/wireless/darpa-builds-first-terahertz-amplifier</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/752036721580603/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/752036721580603/</a>	0
44	THz in spectroscopy	<a href="http://www.photonics.com/Article.aspx?AID=56212">http://www.photonics.com/Article.aspx?AID=56212</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/739419426175666/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/739419426175666/</a>	0

44	Capture of terahertz rays with graphene	<a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/graphene-offers-a-better-way-to-capture-trays">http://spectrum.ieee.org/tech-talk/biomedical/devices/graphene-offers-a-better-way-to-capture-trays</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/711580405626235/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/711580405626235/</a>	0	
44	THz laser with graphene in a magnetic field	<a href="http://phys.org/news/2014-11-magnetic-fields-lasers-elicite-graphene.html">http://phys.org/news/2014-11-magnetic-fields-lasers-elicite-graphene.html</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/673243236126619/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/673243236126619/</a>	0	
44	THz equipment store opened	<a href="http://www.prweb.com/releases/terahertz/032014/prweb11686016.htm">http://www.prweb.com/releases/terahertz/032014/prweb11686016.htm</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/54574543543067/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/54574543543067/</a>	0	
44	Graphene-based terahertz devices		1	2014 Report by the Committee for the Future		4	
44	THz store	<a href="http://www.prweb.com/releases/terahertz/032014/prweb11686016.htm">http://www.prweb.com/releases/terahertz/032014/prweb11686016.htm</a>	1	2014 Report by the Committee for the Future		0	
44	THz-IR with graphene plasmonics	<a href="http://pubs.acs.org/doi/abs/10.1021/nn406627u">http://pubs.acs.org/doi/abs/10.1021/nn406627u</a> <a href="http://www.tiaformulae.com/en/news/2015/november/formula-e-kinetik-announce-robora-a-global-driverless-championship.aspx">http://www.tiaformulae.com/en/news/2015/november/formula-e-kinetik-announce-robora-a-global-driverless-championship.aspx</a>	1	2014 Report by the Committee for the Future		0	
45	Formula E roborace	<a href="http://www.lvm.fi/julkaisu/4444104/robotit-maallamerella-ja-ilmassa-liikenteen-alykkaan-automatointiedistamissuunnitelma">http://www.lvm.fi/julkaisu/4444104/robotit-maallamerella-ja-ilmassa-liikenteen-alykkaan-automatointiedistamissuunnitelma</a>	4	Veijo Tikka	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/857880414329566/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/857880414329566/</a>	0	
45	Finnish Ministry of Transport and Communications and driverless transportation plan	<a href="http://www.lvm.fi/julkaisu/4444104/robotit-maallamerella-ja-ilmassa-liikenteen-alykkaan-automatointiedistamissuunnitelma">http://www.lvm.fi/julkaisu/4444104/robotit-maallamerella-ja-ilmassa-liikenteen-alykkaan-automatointiedistamissuunnitelma</a>	4	Jarmo Lahti	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/850679491716325/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/850679491716325/</a>	0	
45	Test driving Tesla in Finland	<a href="http://www.stara.fi/2015/10/25/tesla-model-s-autopilot-autosteer/">http://www.stara.fi/2015/10/25/tesla-model-s-autopilot-autosteer/</a>	4	Samuli Laurikainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/844653482318926/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/844653482318926/</a>	0	
45	Uber and self-driving cars	<a href="http://m.fastcompany.com/3050250/what-makes-uber-run">http://m.fastcompany.com/3050250/what-makes-uber-run</a>	9	Tuomas Siltala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/826849590765982/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/826849590765982/</a>	0	
45	Toyota's robotics	<a href="http://spectrum.ieee.org/automaton/robotics/artificial-intelligence/gill-pratt-on-toyota-robot-plans">http://spectrum.ieee.org/automaton/robotics/artificial-intelligence/gill-pratt-on-toyota-robot-plans</a> <a href="http://www.wired.com/2015/03/20/business/elon-musk-says-self-driving-tesla-cars-will-be-in-the-us-by-summer.html?r=0">http://www.wired.com/2015/03/20/business/elon-musk-says-self-driving-tesla-cars-will-be-in-the-us-by-summer.html?r=0</a>	4	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/825949154189359/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/825949154189359/</a>	0	
45	Processor for self-driving cars	<a href="http://www.nytimes.com/2015/03/20/business/elon-musk-says-self-driving-tesla-cars-will-be-in-the-us-by-summer.html?r=0">http://www.nytimes.com/2015/03/20/business/elon-musk-says-self-driving-tesla-cars-will-be-in-the-us-by-summer.html?r=0</a> <a href="http://techcrunch.com/2015/02/02/uber-opening-robotics-research-facility-in-pittsburgh-to-build-self-driving-cars/">http://techcrunch.com/2015/02/02/uber-opening-robotics-research-facility-in-pittsburgh-to-build-self-driving-cars/</a>	3	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/741458072638468/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/741458072638468/</a>	0	
45	Self-driving Tesla	<a href="http://techcrunch.com/2015/02/02/uber-opening-robotics-research-facility-in-pittsburgh-to-build-self-driving-cars/">http://techcrunch.com/2015/02/02/uber-opening-robotics-research-facility-in-pittsburgh-to-build-self-driving-cars/</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/738858082898467/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/738858082898467/</a>	0	
45	Uber to participate in research on self-driving cars	<a href="http://www.businessinsider.in/This-Chart-Shows-That-GM-Is-Making-A-Huge-Bet-On-Self-Driving-Cars/articleshow/45982459.cms">http://www.businessinsider.in/This-Chart-Shows-That-GM-Is-Making-A-Huge-Bet-On-Self-Driving-Cars/articleshow/45982459.cms</a>	9	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/714735821977360/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/714735821977360/</a>	0	
45	Patent race of self-driving cars	<a href="http://360.here.com/2015/01/05/bmw-unveil-future-driving-ces/">http://360.here.com/2015/01/05/bmw-unveil-future-driving-ces/</a>	4	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/711789982271944/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/711789982271944/</a>	0	
45	Self-driving cars and Here		4	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/700149726769303/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/700149726769303/</a>	0	
45	Driverless cars in field tests in the UK	<a href="http://www.bbc.com/news/technology-30316458">http://www.bbc.com/news/technology-30316458</a> <a href="http://www.ess.fi/uutiset/kotimaa/article1820116.ec.e?ref=ece_frontend-section-teaser-groupSection-default">http://www.ess.fi/uutiset/kotimaa/article1820116.ec.e?ref=ece_frontend-section-teaser-groupSection-default</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/678129385638004/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/678129385638004/</a>	0	
45	Self-driving cars and Finland	<a href="http://www.torbes.com/sites/chunkamui/2014/04/17/mit-and-stanford-researchers-show-robotaxis-could-replace-private-cars-and-public-transit/">http://www.torbes.com/sites/chunkamui/2014/04/17/mit-and-stanford-researchers-show-robotaxis-could-replace-private-cars-and-public-transit/</a> <a href="http://www.computerworld.com/s/article/9246418/Half_of_Americans_want_to_live_in_a_smart_city_with_driverless_cars">http://www.computerworld.com/s/article/9246418/Half_of_Americans_want_to_live_in_a_smart_city_with_driverless_cars</a>	4	Ville Vähämäki	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/569702156480728/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/569702156480728/</a>	0	
45	Simulation of robot transportation capacity	<a href="http://www.computerworld.com/s/article/9246418/Half_of_Americans_want_to_live_in_a_smart_city_with_driverless_cars">http://www.computerworld.com/s/article/9246418/Half_of_Americans_want_to_live_in_a_smart_city_with_driverless_cars</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/554155814702029/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/554155814702029/</a>	0	
45	Readiness for self-driving cars	<a href="https://www.media.volvocars.com/global/en-gb/media/pressreleases/136182/volvo-car-group-initiates-world-unique-swedish-pilot-project-with-self-driving-cars">https://www.media.volvocars.com/global/en-gb/media/pressreleases/136182/volvo-car-group-initiates-world-unique-swedish-pilot-project-with-self-driving-cars</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/526703030780641/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/526703030780641/</a>	0	
45	Extensive pilot project with self-driving cars in Sweden	<a href="http://www.usatoday.com/story/money/cars/2015/03/04/mckinsey-self-driving-benefits/24382405/">http://www.usatoday.com/story/money/cars/2015/03/04/mckinsey-self-driving-benefits/24382405/</a>	4	Tero Kauppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/486165114834433/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/486165114834433/</a>	0	
45	Review of self-driving vehicles		4	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/731207150330227/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/731207150330227/</a>	0	
45	Self-driving car GM to invest \$500 million in Lyft as part of self-driving car strategy	<a href="http://www.wired.com/2016/01/gm-and-lyft-are-building-a-network-of-self-driving-cars/">http://www.wired.com/2016/01/gm-and-lyft-are-building-a-network-of-self-driving-cars/</a>	4	2014 Report by the Committee for the Future		5	
45	Robotaxi in South Korea	<a href="http://www.uusisuomi.fi/autot/166221-video-nain-saadaan-taksikusienkin-tyot-loppumaan">http://www.uusisuomi.fi/autot/166221-video-nain-saadaan-taksikusienkin-tyot-loppumaan</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/876774369106837/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/876774369106837/</a>	0	
45	Self-driving car processor – Deep learning	<a href="http://www.hpcwire.com/2016/01/06/nvidia-pascal-gpus-coming-to-automotive-supercomputer/">http://www.hpcwire.com/2016/01/06/nvidia-pascal-gpus-coming-to-automotive-supercomputer/</a>	4	Marko Miinin	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885758234875117/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885758234875117/</a>	0	
46	Robotic shopping bag	<a href="http://nextbigfuture.com/2015/11/skype-cofounders-make-ground-delivery.html">http://nextbigfuture.com/2015/11/skype-cofounders-make-ground-delivery.html</a> <a href="http://valtioneuvosto.fi/artikkeli/-/asset_publisher/muutosta-aletaan-valmistella-kevyet-sahkokulkuneuvot-lailisiksi">http://valtioneuvosto.fi/artikkeli/-/asset_publisher/muutosta-aletaan-valmistella-kevyet-sahkokulkuneuvot-lailisiksi</a>	4	2	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/848663751917899/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/848663751917899/</a>	0
46	Lightweight electric vehicles legal in Finland	<a href="http://www.dx.com/p/evu-x1-2-wheel-self-balance-drifting-electric-vehicle-white-black-370426?utm_source=facebook&amp;utm_medium=banne">http://www.dx.com/p/evu-x1-2-wheel-self-balance-drifting-electric-vehicle-white-black-370426?utm_source=facebook&amp;utm_medium=banne</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/74504852279423/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/74504852279423/</a>	0	
46	2-Wheel Self Balance Drifting Electric Vehicle	<a href="http://www.techcentral.co.za/sa-made-radar-to-keep-cyclists-safe/50704/">http://www.techcentral.co.za/sa-made-radar-to-keep-cyclists-safe/50704/</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/703175443133398/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/703175443133398/</a>	0	
46	Bicycle radar	<a href="http://www.techcentral.co.za/sa-made-radar-to-keep-cyclists-safe/50704/">http://www.techcentral.co.za/sa-made-radar-to-keep-cyclists-safe/50704/</a>	4	Ilkka Pirttimaa	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/703175443133398/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/703175443133398/</a>	0	
46	Urb-E electric scooter	<a href="http://techcrunch.com/2014/02/10/urb-e-the-fold-up-electric-scooter-goes-live-on-indiegogo/">http://techcrunch.com/2014/02/10/urb-e-the-fold-up-electric-scooter-goes-live-on-indiegogo/</a>	1	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/625916924192584/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/625916924192584/</a>	0	
46	Urb-E electric scooter	<a href="http://techcrunch.com/2014/02/10/urb-e-the-fold-up-electric-scooter-goes-live-on-indiegogo/">http://techcrunch.com/2014/02/10/urb-e-the-fold-up-electric-scooter-goes-live-on-indiegogo/</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/533140563470221/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/533140563470221/</a>	0	

46	1- or 2-wheeled vehicles for personal or goods traffic			2014 Report by the Committee for the Future		3
47	Microfilament drone	<a href="http://phys.org/news/2015-11-parc-limit-flight-microfilament.html">http://phys.org/news/2015-11-parc-limit-flight-microfilament.html</a>		5 Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/850343095083298/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/850343095083298/</a>	0
47	Quadcopter delivery	<a href="http://in.reuters.com/article/2015/10/27/wal-mart-stores-drones-idINKCNOSL08120151027">http://in.reuters.com/article/2015/10/27/wal-mart-stores-drones-idINKCNOSL08120151027</a>		4 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845394728911468/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845394728911468/</a>	0
47	Tracking of quadcopters	<a href="https://wtvox.com/robotics/verizon-and-nasa-are-developing-a-system-to-track-drones/">https://wtvox.com/robotics/verizon-and-nasa-are-developing-a-system-to-track-drones/</a>		4 Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/838341436283464/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/838341436283464/</a>	0
47	Public transport and quadcopters	<a href="https://www.facebook.com/worldbulletin/videos/1136275596399437/?fref=nf">https://www.facebook.com/worldbulletin/videos/1136275596399437/?fref=nf</a>		4 Arvo Kukko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/837270443057230/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/837270443057230/</a>	0
47	Quadcopters build a rope bridge	<a href="http://www.bbc.co.uk/news/technology-34327364">http://www.bbc.co.uk/news/technology-34327364</a>		5 Aulikki Holma, Vilho Ahola, Petja Jäppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833319800118961/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833319800118961/</a>	0
47	Lightweight camera quadcopter	<a href="http://www.wired.com/2015/09/dont-fooled-adorable-little-drone-means-business/">http://www.wired.com/2015/09/dont-fooled-adorable-little-drone-means-business/</a>		4 Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/821695361281405/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/821695361281405/</a>	0
47	Quadcopters in farming	<a href="http://www.bloomberg.com/news/articles/2015-03-16/what-the-french-know-about-drones-that-americans-don-t">http://www.bloomberg.com/news/articles/2015-03-16/what-the-french-know-about-drones-that-americans-don-t</a>		7 Marita Kaatrala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/736502279800714/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/736502279800714/</a>	0
47	Quadcopter test by Posti	<a href="http://www.posti.fi/lennot/">http://www.posti.fi/lennot/</a>		4 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/817259501724991/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/817259501724991/</a>	0
47	FAA approves medical delivery quadcopter	<a href="http://www.ibtimes.co.uk/taa-approves-first-drone-delivery-service-amazon-prime-air-loses-race-medical-supply-firm-flirtey-1511175">http://www.ibtimes.co.uk/taa-approves-first-drone-delivery-service-amazon-prime-air-loses-race-medical-supply-firm-flirtey-1511175</a>		4 Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/799904043460501/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/799904043460501/</a>	0
47	Armed quadcopter	<a href="http://www.ibtimes.co.uk/drone-shoots-handgun-while-flying-alarming-video-raises-safety-concerns-1511294">http://www.ibtimes.co.uk/drone-shoots-handgun-while-flying-alarming-video-raises-safety-concerns-1511294</a>		4 Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/799904473460494/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/799904473460494/</a>	0
47	Hoverboard with quadcopter	<a href="http://www.avweb.com/avwebflash/news/Hoverboard-On-The-Market-By-Christmas-224136-1.html">http://www.avweb.com/avwebflash/news/Hoverboard-On-The-Market-By-Christmas-224136-1.html</a>		4 Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/772449842872624/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/772449842872624/</a>	0
47	Quadcopter drone	<a href="https://www.youtube.com/watch?v=kXqL26sF5uc&amp;feature=youtu.be">https://www.youtube.com/watch?v=kXqL26sF5uc&amp;feature=youtu.be</a>		4 Ville Nikkanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/763427667108175/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/763427667108175/</a>	0
47	Quadcopter saving lives	<a href="https://www.facebook.com/groups/TuVRadikaalit/permalink/738858082898467/">https://www.facebook.com/groups/TuVRadikaalit/permalink/738858082898467/</a>		4 Esa Heiskanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/739995386118070/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/739995386118070/</a>	0
47	Quadcopter regulation in the USA	<a href="http://econ.st/1B4ywgh">http://econ.st/1B4ywgh</a>		4 Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/725627230888219/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/725627230888219/</a>	0
47	Quadcopter regulation – Trafi	<a href="http://www.trahi.fi/tietoa_traista/ajankohtaista/3174/miehitattomille_ilma-aluksille_erittain_liberaalia_saantelya">http://www.trahi.fi/tietoa_traista/ajankohtaista/3174/miehitattomille_ilma-aluksille_erittain_liberaalia_saantelya</a>		4 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/716408078476801/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/716408078476801/</a>	0
47	Quadcopter defibrillator	<a href="https://www.facebook.com/photo.php?fbid=10152974941624909&amp;set=gm.705484976235778&amp;type=3">https://www.facebook.com/photo.php?fbid=10152974941624909&amp;set=gm.705484976235778&amp;type=3</a>		4 Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705484972902445/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705484972902445/</a>	0
47	Biodegradable body material in quadcopter	<a href="http://www.newscientist.com/article/mg22429952.400-biodrone-simply-melts-away-when-it-crashes.html">http://www.newscientist.com/article/mg22429952.400-biodrone-simply-melts-away-when-it-crashes.html</a>		6 Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/667016060082670/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/667016060082670/</a>	0
47	Quadcopter defibrillator	<a href="https://www.facebook.com/stjohnfirstaid/videos/857910784251727/">https://www.facebook.com/stjohnfirstaid/videos/857910784251727/</a>		4 Arvo Kukko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/663093263808283/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/663093263808283/</a>	0
47	Quadcopters for medicine deliveries (DHL)	<a href="http://online.wsj.com/articles/deutsche-post-dhl-to-deliver-medicine-via-drone-1411576151?mod=e2tw">http://online.wsj.com/articles/deutsche-post-dhl-to-deliver-medicine-via-drone-1411576151?mod=e2tw</a>		4 Ilkka Kakko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/639501169500826/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/639501169500826/</a>	0
47	Drone fighter	<a href="http://gizmodo.com/unmanned-drones-landing-autonomously-next-to-f-18s-is-a-1623368962">http://gizmodo.com/unmanned-drones-landing-autonomously-next-to-f-18s-is-a-1623368962</a>		4 Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/617919954992281/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/617919954992281/</a>	0
47	A crowd of robots building things	<a href="http://www.dvice.com/2014-4-22/watch-swarms-micro-robots-run-around-making-stuff">http://www.dvice.com/2014-4-22/watch-swarms-micro-robots-run-around-making-stuff</a>		5 Alekski Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/558048294312781/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/558048294312781/</a>	0
47	EU-RPAS (drone) regulation	<a href="https://www.facebook.com/download/1397695460508596/NPA%202014-09.pdf">https://www.facebook.com/download/1397695460508596/NPA%202014-09.pdf</a>		4 Mikko Saarisalo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/548999448550999/">https://www.facebook.com/groups/TuVRa/dikaalit/548999448550999/</a>	0
47	FAA to launch drone tests	<a href="http://www.youtube.com/watch?v=E2stferhRgU">http://www.youtube.com/watch?v=E2stferhRgU</a>		4 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/512540848863526/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/512540848863526/</a>	0
47	Festo robotic bird	<a href="http://www.ted.com/talks/a_robot_that_flies_like_a_bird.html">http://www.ted.com/talks/a_robot_that_flies_like_a_bird.html</a>		4 Risto Linturi, Olli Hietanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/510167679100843/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/510167679100843/</a>	0
47	Amazon's quadcopter announcement in 2013	<a href="http://www.theverge.com/2013/12/1/5164340/delivery-drones-are-coming-jeff-bezos-previews-half-hour-shipping">http://www.theverge.com/2013/12/1/5164340/delivery-drones-are-coming-jeff-bezos-previews-half-hour-shipping</a>		4 Ilkka Kakko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/479786112139000/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/479786112139000/</a>	0
47	Autonomous quadcopters	<a href="https://youtu.be/ZIHNM37maK0">https://youtu.be/ZIHNM37maK0</a>		4 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/872565269527747/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/872565269527747/</a>	0
47	Google to start quadcopter delivery in 2017	<a href="http://myfox8.com/2015/11/28/google-x-hopes-to-launch-drone-deliveries-by-2017/">http://myfox8.com/2015/11/28/google-x-hopes-to-launch-drone-deliveries-by-2017/</a>		4 Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/867244850059789/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/867244850059789/</a>	0
47	Amazon's quadcopter with hybrid design	<a href="http://techcrunch.com/2015/11/29/amazon-shows-off-new-prime-air-drone-with-hybrid-design/">http://techcrunch.com/2015/11/29/amazon-shows-off-new-prime-air-drone-with-hybrid-design/</a>		4 Tapani Alasaarela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/858853534232254/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/858853534232254/</a>	0
47	Quadcopters			2014 Report by the Committee for the Future		5
47	Tree planting by quadcopters – at 15% of current cost	<a href="http://www.ifscience.com/environment/former-nasa-engineer-plans-plant-1-billion-trees-year-using-drones">http://www.ifscience.com/environment/former-nasa-engineer-plans-plant-1-billion-trees-year-using-drones</a>		4 Esko Nuutila	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/879771718807102/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/879771718807102/</a>	0

47	Gimball quadcopter manages tight spots	<a href="http://spectrum.ieee.org/automaton/robotics/aerial-robots/flyabilityvs-gimball-drone-exploring-ice-caves">http://spectrum.ieee.org/automaton/robotics/aerial-robots/flyabilityvs-gimball-drone-exploring-ice-caves</a>	4	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/884578921659715/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/884578921659715/</a>	0
47	Quadcopterboarding on snow	<a href="https://www.facebook.com/verge/videos/1031743590195317/?fref=nf">https://www.facebook.com/verge/videos/1031743590195317/?fref=nf</a>	4	Laura Tiilikainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893671130750494/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893671130750494/</a>	0
47	Quadcopter sports	<a href="https://www.facebook.com/nrkivsstil/videos/10154044139728619/">https://www.facebook.com/nrkivsstil/videos/10154044139728619/</a>	4	Laura Tiilikainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/905390379578569/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/905390379578569/</a>	0
48	Person copter	<a href="https://www.facebook.com/groups/TuVRadikaalit/permalink/851170468333894/">https://www.facebook.com/groups/TuVRadikaalit/permalink/851170468333894/</a> <a href="http://www.bloomberg.com/news/articles/2015-09-17/the-icon-a5-is-the-closest-thing-to-a-flying-car-you-can-buy-today">http://www.bloomberg.com/news/articles/2015-09-17/the-icon-a5-is-the-closest-thing-to-a-flying-car-you-can-buy-today</a>	4	Janne Mähönen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851170468333894/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851170468333894/</a>	0
48	Light aircraft	<a href="https://www.facebook.com/haberaycom/videos/113485556539984/?fref=nf">https://www.facebook.com/haberaycom/videos/113485556539984/?fref=nf</a>	4	Rami Niemi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/830543670396574/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/830543670396574/</a>	0
48	Bicyclecopter	<a href="https://www.facebook.com/haberaycom/videos/113485556539984/?fref=nf">https://www.facebook.com/haberaycom/videos/113485556539984/?fref=nf</a>	4	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/726008594183416/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/726008594183416/</a>	0
48	VTOL light aircraft	<a href="http://www.jobyaviation.com/S2/">http://www.jobyaviation.com/S2/</a>	4	Kate Alhola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706409659476643/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706409659476643/</a>	0
48	Quadcopter for person transport	<a href="https://www.facebook.com/DrSaiSathish/videos/693522244049344/">https://www.facebook.com/DrSaiSathish/videos/693522244049344/</a>	4	Esa Heiskanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/689569884493954/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/689569884493954/</a>	0
48	Person copter	<a href="https://www.youtube.com/watch?v=tNulEaLTHI">https://www.youtube.com/watch?v=tNulEaLTHI</a>	4	Arvo Kukko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/510641985720079/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/510641985720079/</a>	0
48	Arca Hoverboard	<a href="http://nextbigfuture.com/2015/12/arcaspace-makes-true-125-mph-battery.html">http://nextbigfuture.com/2015/12/arcaspace-makes-true-125-mph-battery.html</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/872611112856496/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/872611112856496/</a>	0
48	On demand personal aviation services		4	2014 Report by the Committee for the Future		3
48	Electric aircraft Airbus	<a href="http://www.airbusgroup.com/int/en/innovation-citizenship/airbus-e-fan-the-future-of-electric-aircraft.html">http://www.airbusgroup.com/int/en/innovation-citizenship/airbus-e-fan-the-future-of-electric-aircraft.html</a> <a href="http://www.talkmarkets.com/content/us-markets/the-airbus-e-fan-takes-to-the-skies?post=70721">http://www.talkmarkets.com/content/us-markets/the-airbus-e-fan-takes-to-the-skies?post=70721</a>	4	Olli Pitkänen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832038970247044/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832038970247044/</a>	0
48	Electric aircraft	<a href="http://www.talkmarkets.com/content/us-markets/the-airbus-e-fan-takes-to-the-skies?post=70721">http://www.talkmarkets.com/content/us-markets/the-airbus-e-fan-takes-to-the-skies?post=70721</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/809546529162955/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/809546529162955/</a>	0
48	Electric aircraft 2017 Nasa	<a href="http://nextbigfuture.com/2015/12/nasa-will-test-distributed-electric.html">http://nextbigfuture.com/2015/12/nasa-will-test-distributed-electric.html</a> <a href="http://techcrunch.com/2015/01/15/elon-musk-will-build-a-hyperloop-track-for-ultra-high-speed-transport-">http://techcrunch.com/2015/01/15/elon-musk-will-build-a-hyperloop-track-for-ultra-high-speed-transport-</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/869053209878953/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/869053209878953/</a>	0
49	Hyperloop test track	<a href="http://techcrunch.com/2015/01/15/elon-musk-will-build-a-hyperloop-track-for-ultra-high-speed-transport-">http://techcrunch.com/2015/01/15/elon-musk-will-build-a-hyperloop-track-for-ultra-high-speed-transport-</a>	4	Jari Kotola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705157606268515/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705157606268515/</a>	0
49	Hyperloop test track	<a href="https://www.youtube.com/watch?v=1dXliqyGa5M">https://www.youtube.com/watch?v=1dXliqyGa5M</a>	4	Pekka Neva		0
49	Hyperloop towards testing	<a href="http://www.wired.com/2014/12/jumpstartfund-hyperloop-elon-musk/">http://www.wired.com/2014/12/jumpstartfund-hyperloop-elon-musk/</a> <a href="http://www.mtv.fi/uutiset/kotimaa/artikkeli/junalla-helsingista-tukholmaan-tulevaisuuden-junafirma-kiinnostui-tunnelihankkeesta/5573288">http://www.mtv.fi/uutiset/kotimaa/artikkeli/junalla-helsingista-tukholmaan-tulevaisuuden-junafirma-kiinnostui-tunnelihankkeesta/5573288</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/687480048036271/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/687480048036271/</a>	0
49	Hyperloop from Helsinki to Stockholm?	<a href="http://www.wired.com/2015/12/the-hyperloops-testing-its-propulsion-system-next-month/?mbid=nl_12915">http://www.wired.com/2015/12/the-hyperloops-testing-its-propulsion-system-next-month/?mbid=nl_12915</a>	4	Pekka Pasanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/856490614468546/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/856490614468546/</a>	0
49	Hyperloop tests are advancing	<a href="http://www.wired.com/2015/12/the-hyperloops-testing-its-propulsion-system-next-month/?mbid=nl_12915">http://www.wired.com/2015/12/the-hyperloops-testing-its-propulsion-system-next-month/?mbid=nl_12915</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705157606268515/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705157606268515/</a>	0
49	Vactrains		4	2014 Report by the Committee for the Future		4
49	Interest in Hyperloop from Helsinki to Stockholm	<a href="http://www.mtv.fi/uutiset/kotimaa/artikkeli/junalla-helsingista-tukholmaan-tulevaisuuden-junafirma-kiinnostui-tunnelihankkeesta/5573288">http://www.mtv.fi/uutiset/kotimaa/artikkeli/junalla-helsingista-tukholmaan-tulevaisuuden-junafirma-kiinnostui-tunnelihankkeesta/5573288</a> <a href="http://www.popularmechanics.com/technology/intra-structure/a18872/hyperloop-technologies-physical-tubes-ready-assemble/">http://www.popularmechanics.com/technology/intra-structure/a18872/hyperloop-technologies-physical-tubes-ready-assemble/</a>	4	Pekka Pasanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/856490614468546/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/856490614468546/</a>	0
49	Building of Hyperloop track started	<a href="http://www.popularmechanics.com/technology/intra-structure/a18872/hyperloop-technologies-physical-tubes-ready-assemble/">http://www.popularmechanics.com/technology/intra-structure/a18872/hyperloop-technologies-physical-tubes-ready-assemble/</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/904261219691485/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/904261219691485/</a>	0
50	Magnetic or superconductor-based levitation		6	2014 Report by the Committee for the Future		1
51	Reusable rocket	<a href="http://nextbigfuture.com/2015/08/australia-working-on-reusable-rockets.html">http://nextbigfuture.com/2015/08/australia-working-on-reusable-rockets.html</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/809947495789525/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/809947495789525/</a>	0
51	Inexpensive access to orbit	<a href="http://www.rocketlabusa.com/index.html">http://www.rocketlabusa.com/index.html</a> <a href="http://www.upi.com/Science_News/2015/02/06/Can-jet-planes-launch-small-satellites-into-orbit-on-the-cheap/7371423260087/">http://www.upi.com/Science_News/2015/02/06/Can-jet-planes-launch-small-satellites-into-orbit-on-the-cheap/7371423260087/</a> <a href="https://www.facebook.com/RichardBranson/photos/a.10150152138395872.292541.31325960871/10152552306725872/?type=3">https://www.facebook.com/RichardBranson/photos/a.10150152138395872.292541.31325960871/10152552306725872/?type=3</a>	4	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/755082074609401/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/755082074609401/</a>	0
51	Inexpensive satellites (launched by jet planes, NASA)	<a href="http://www.upi.com/Science_News/2015/02/06/Can-jet-planes-launch-small-satellites-into-orbit-on-the-cheap/7371423260087/">http://www.upi.com/Science_News/2015/02/06/Can-jet-planes-launch-small-satellites-into-orbit-on-the-cheap/7371423260087/</a> <a href="https://www.facebook.com/RichardBranson/photos/a.10150152138395872.292541.31325960871/10152552306725872/?type=3">https://www.facebook.com/RichardBranson/photos/a.10150152138395872.292541.31325960871/10152552306725872/?type=3</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/716573905126885/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/716573905126885/</a>	0
51	Inexpensive launching of satellites	<a href="https://www.facebook.com/RichardBranson/photos/a.10150152138395872.292541.31325960871/10152552306725872/?type=3">https://www.facebook.com/RichardBranson/photos/a.10150152138395872.292541.31325960871/10152552306725872/?type=3</a>	4	Kate Alhola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705435869574022/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705435869574022/</a>	0
51	Satellite Internet with 4,000 satellites	<a href="http://www.cnet.com/news/elon-musk-is-trying-to-bring-the-internet-to-space/">http://www.cnet.com/news/elon-musk-is-trying-to-bring-the-internet-to-space/</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706382486146027/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706382486146027/</a>	0
51	Cubesat WiFi connection	<a href="http://www.ibtimes.com/introducing-outernet-free-worldwide-wi-fi-access-beamed-space-1556016">http://www.ibtimes.com/introducing-outernet-free-worldwide-wi-fi-access-beamed-space-1556016</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/536347086482902/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/536347086482902/</a>	0
51	Landing of carrier rocket (Space-X)	<a href="http://www.nytimes.com/2015/12/22/science/space-x-rocket-landing.html">http://www.nytimes.com/2015/12/22/science/space-x-rocket-landing.html</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/869514039832870/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/869514039832870/</a>	0
51	Cubesat and other minisatellites		4	2014 Report by the Committee for the Future		4

51	Law on the rights of space miners (USA)	<a href="http://www.planetaryresources.com/2015/11/president-obama-signs-bill-recognizing-asteroid-resource-property-rights-into-law/">http://www.planetaryresources.com/2015/11/president-obama-signs-bill-recognizing-asteroid-resource-property-rights-into-law/</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/892257817558492/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/892257817558492/</a>	0
51	EM Drive	<a href="http://www.sciencedirect.com/science/article/pii/S094576515002726?np=y">http://www.sciencedirect.com/science/article/pii/S094576515002726?np=y</a>	4	Seppo Nikkilä	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/849869818463959/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/849869818463959/</a>	0
51	Ion space drive	<a href="http://nextbigfuture.com/2015/09/new-ion-drive-achieves-14600-isp-which.html">http://nextbigfuture.com/2015/09/new-ion-drive-achieves-14600-isp-which.html</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832982270152714/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832982270152714/</a>	0
51	Ramjet	<a href="http://nextbigfuture.com/2015/08/russia-shows-off-supersonic-combusting.html">http://nextbigfuture.com/2015/08/russia-shows-off-supersonic-combusting.html</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/818441224940152/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/818441224940152/</a>	0
51	Ionic thruster	<a href="http://newsoffice.mit.edu/2013/ionic-thrusters-0403">http://newsoffice.mit.edu/2013/ionic-thrusters-0403</a>	4	Henri Heinonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/693521257432150/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/693521257432150/</a>	0
51	Nasa EmDrive (unverified)	<a href="http://blogs.discovermagazine.com/outthere/2014/08/06/nasa-validate-impossible-space-drive-word/">http://blogs.discovermagazine.com/outthere/2014/08/06/nasa-validate-impossible-space-drive-word/</a>	4	Jani Ehro	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/608743765909900/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/608743765909900/</a>	0
52	Glider at 30 km	<a href="http://www.bloomberg.com/news/articles/2015-09-23/gliding-at-the-edge-of-space-for-science">http://www.bloomberg.com/news/articles/2015-09-23/gliding-at-the-edge-of-space-for-science</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832858343498440/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832858343498440/</a>	0
52	Google's base station balloons	<a href="http://bit.ly/1D94lb3">http://bit.ly/1D94lb3</a>	4	Ilkka Nojonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/804685966315678/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/804685966315678/</a>	0
52	Atm satellites Facebook	<a href="https://www.facebook.com/zuck/videos/10102274951725301/">https://www.facebook.com/zuck/videos/10102274951725301/</a>	4	Ilkka Nojonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/805024129615195/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/805024129615195/</a>	0
52	Solar-powered 81-hour flight	<a href="http://www.suasnews.com/2015/07/37499/solar-powered-81-hours-flight-successful-a-new-endurance-world-record/">http://www.suasnews.com/2015/07/37499/solar-powered-81-hours-flight-successful-a-new-endurance-world-record/</a>	4	Ilkka Nojonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/804448299672778/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/804448299672778/</a>	0
52	Atmospheric satellite (Facebook)	<a href="http://www.nytimes.com/2015/03/26/technology/drones-beaming-web-access-are-in-the-stars-for-facebook.html?_r=0">http://www.nytimes.com/2015/03/26/technology/drones-beaming-web-access-are-in-the-stars-for-facebook.html?_r=0</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/742381279212814/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/742381279212814/</a>	0
52	Solar-powered aircraft around the world	<a href="http://www.solarimpulse.com/">http://www.solarimpulse.com/</a>	4	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/73170422694186/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/73170422694186/</a>	0
52	Google Project Loon	<a href="http://www.theverge.com/2015/3/2/8130759/project-loon">http://www.theverge.com/2015/3/2/8130759/project-loon</a>	4	Marko Mikael Tenkanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/728184733965802/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/728184733965802/</a>	0
52	Hovering carriers Darpa	<a href="http://sploid.gizmodo.com/call-the-avengers-the-pentagon-wants-to-make-helicarri-1656968348">http://sploid.gizmodo.com/call-the-avengers-the-pentagon-wants-to-make-helicarri-1656968348</a>	4	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/666077473509862/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/666077473509862/</a>	0
52	Airship freight carrier	<a href="http://www.sahkolamppu.com/2014/09/ilmalaiavakuljettamaan-puuhiihta.html">http://www.sahkolamppu.com/2014/09/ilmalaiavakuljettamaan-puuhiihta.html</a>	4	Esa Turtiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/637378443046432/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/637378443046432/</a>	0
52	Google Loon around the world in 22 days	<a href="http://www.techtimes.com/articles/5216/20140405/googles-loon-balloon-circles-globe-in-just-22-days-internet-for-all-remains-goal.htm">http://www.techtimes.com/articles/5216/20140405/googles-loon-balloon-circles-globe-in-just-22-days-internet-for-all-remains-goal.htm</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/547024905415120/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/547024905415120/</a>	0
52	Google Loon to India	<a href="http://fossbytes.com/googles-project-loon-gets-indian-govt-in-principle-nod/">http://fossbytes.com/googles-project-loon-gets-indian-govt-in-principle-nod/</a>	4	Risto Linturi	<a href="http://www.indiatimes.com/lifestyle/technology/6-must-know-facts-about-google-s-project-loon-which-aims-to-provide-free-">http://www.indiatimes.com/lifestyle/technology/6-must-know-facts-about-google-s-project-loon-which-aims-to-provide-free-</a>	0
52	24h hybrid drone Airstrato	<a href="http://nextbigfuture.com/2015/12/stratospheric-solar-electric-and-hybrid.html">http://nextbigfuture.com/2015/12/stratospheric-solar-electric-and-hybrid.html</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/870977156353225/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/870977156353225/</a>	0
52	Light continuously flying equipments		4	2014 Report by the Committee for the Future		4
52	Atmospheric satellite aircraft Solara being tested	<a href="http://www.theguardian.com/technology/2016/jan/29/project-skybender-google-drone-tests-internet-spaceport-virgin-galactic">http://www.theguardian.com/technology/2016/jan/29/project-skybender-google-drone-tests-internet-spaceport-virgin-galactic</a>	4	Risto Linturi, Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887824888001785/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887824888001785/</a>	0
53	RaspBerry Pi Zero \$5	<a href="http://www.engadget.com/2015/11/28/raspberry-pi-eric-schmidt/">http://www.engadget.com/2015/11/28/raspberry-pi-eric-schmidt/</a>	10	Risto Linturi		2
53	IOT adapters	<a href="http://ruuvi.com/blog/ruuvi-goes-bt-42.html">http://ruuvi.com/blog/ruuvi-goes-bt-42.html</a>	10	Kalle Pihlajasaari	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833909760059965/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833909760059965/</a>	0
53	Raspberry Pi2 \$35	<a href="http://www.bbc.com/news/technology-31088908">http://www.bbc.com/news/technology-31088908</a>	10	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/713792762071666/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/713792762071666/</a>	0
53	Arduino/Raspberry Pi comparison	<a href="http://readwrite.com/2014/05/07/arduino-vs-raspberry-pi-projects-diy-platform">http://readwrite.com/2014/05/07/arduino-vs-raspberry-pi-projects-diy-platform</a>	10	Tatu Lund, Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/665903373527272/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/665903373527272/</a>	0
53	Open hardware	<a href="http://www.open-electronics.org/open-hardware-summit-2014-rome-from-making-open-to-open-manufacturing/">http://www.open-electronics.org/open-hardware-summit-2014-rome-from-making-open-to-open-manufacturing/</a>	10	Matti Pyykkönen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/602394396544837/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/602394396544837/</a>	0
53	EUR 134 robotic hand	<a href="http://www.wired.com/design/2014/03/kickstarter-robot-arm-ufactory/">http://www.wired.com/design/2014/03/kickstarter-robot-arm-ufactory/</a>	10	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/533048886812722/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/533048886812722/</a>	0
53	Modular robotics		10	2014 Report by the Committee for the Future		3
53	Inexpensive robotic hand Katia with 5 degrees of freedom	<a href="http://techcrunch.com/2016/01/06/this-robotic-arm-can-do-everything-from-3d-printing-to-laser-cutting-to-cake-decorating/">http://techcrunch.com/2016/01/06/this-robotic-arm-can-do-everything-from-3d-printing-to-laser-cutting-to-cake-decorating/</a>	10	Kate Ahola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/878770482240559/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/878770482240559/</a>	0
53	\$9 computer, WiFi, Linux, etc.	<a href="http://postscapes.com/9-single-board-computer-chip">http://postscapes.com/9-single-board-computer-chip</a>	10	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/897960153654925/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/897960153654925/</a>	0
54	Robot walking across terrain	<a href="http://www.sciencedaily.com/releases/2015/10/151027132928.htm">http://www.sciencedaily.com/releases/2015/10/151027132928.htm</a>	5	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845846272199647/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845846272199647/</a>	0
54	Two-legged robot walking outside	<a href="http://venturebeat.com/2015/08/15/watch-a-boston-dynamics-humanoid-robot-wander-around-outside/">http://venturebeat.com/2015/08/15/watch-a-boston-dynamics-humanoid-robot-wander-around-outside/</a>	4	Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/813203718797236/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/813203718797236/</a>	0

54	Personal robot	<a href="http://spectrum.ieee.org/automaton/robotics/home-robots/robotbase-personal-robot">http://spectrum.ieee.org/automaton/robotics/home-robots/robotbase-personal-robot</a>	5	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/712485865535689/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/712485865535689/</a>	0
54	A walking robot with hands			2014 Report by the Committee		2
54	Walking robot equipped with hands in the woods and warehouse	<a href="https://www.facebook.com/ThinkInc.org.au/videos/1072335462819210/?fref=nf">https://www.facebook.com/ThinkInc.org.au/videos/1072335462819210/?fref=nf</a> <a href="http://www.smithsonianmag.com/innovation/robots-ees-can-fly-and-swim-whats-next-laser-vision-180957308">http://www.smithsonianmag.com/innovation/robots-ees-can-fly-and-swim-whats-next-laser-vision-180957308</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/903791476405126/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/903791476405126/</a>	0
55	Flying/swimming microbot	<a href="http://www.popsi.com/article/technology/rise-insect-drones">http://www.popsi.com/article/technology/rise-insect-drones</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/853876531396621/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/853876531396621/</a> <a href="https://www.facebook.com/groups/TuVRa/dikaalit/595011737283103/?comment_id=597751717009105">https://www.facebook.com/groups/TuVRa/dikaalit/595011737283103/?comment_id=597751717009105</a>	0
55	Cyber insect		4	Jussi Tunkkari		0
55	The cyber insect			2014 Report by the Committee		2
55	Robot cockroach, flexible structure	<a href="http://qz.com/616386/cockroaches-inspire-the-creation-of-a-cool-robot/">http://qz.com/616386/cockroaches-inspire-the-creation-of-a-cool-robot/</a>	4	Jarmo Kuismanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/899000473550893/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/899000473550893/</a>	0
56	Photo of a 3D-printed lens		5	Pasi Vahimaa	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/857110871073187/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/857110871073187/</a>	0
56	3D-printed cellulose	<a href="http://www.aalto.fi/fi/current/news/2015-11-05-007/">http://www.aalto.fi/fi/current/news/2015-11-05-007/</a>	5	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851872061597068/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851872061597068/</a>	0
56	3D-printed car	<a href="https://t.co/jkM47ycKTC">https://t.co/jkM47ycKTC</a>	5	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832254470225494/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832254470225494/</a>	0
56	Close manufacturing/Adidas	<a href="http://www.reuters.com/article/2015/10/20/us-adidas-robots-idUSKCN0SE1RL20151020">http://www.reuters.com/article/2015/10/20/us-adidas-robots-idUSKCN0SE1RL20151020</a>	5	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/843014842482790/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/843014842482790/</a>	0
56	Quick 3D-printing	<a href="http://wpo.st/Tf990">http://wpo.st/Tf990</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/736980623086213/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/736980623086213/</a>	0
56	Multimaterial extrusion	<a href="http://www.eurekalert.org/pub_releases/2015-09/hu-plf092115.php">http://www.eurekalert.org/pub_releases/2015-09/hu-plf092115.php</a> <a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/graphene-filament-enables-fabrication-of-electronic-devices-with-3d-printing">http://spectrum.ieee.org/nanoclast/semiconductors/materials/graphene-filament-enables-fabrication-of-electronic-devices-with-3d-printing</a>	5	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/831451546972453/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/831451546972453/</a>	0
56	3D-printed graphene	<a href="http://www.eurekalert.org/pub_releases/2015-05/cuso-nct052215.php">http://www.eurekalert.org/pub_releases/2015-05/cuso-nct052215.php</a> <a href="https://l.facebook.com/l.php?u=http%3A%2F%2Fyle.fi%2Fuutiset%2Fnyt_se_on_todellisuutta_taysin_3d-tulostetut_silmalasi%2F7884470&amp;h=LAQHws7E5">https://l.facebook.com/l.php?u=http%3A%2F%2Fyle.fi%2Fuutiset%2Fnyt_se_on_todellisuutta_taysin_3d-tulostetut_silmalasi%2F7884470&amp;h=LAQHws7E5</a> <a href="http://www.geek.com/chips/voxel8-3d-printer-can-print-a-complete-quadcopter-including-the-electronics-1613166/">http://www.geek.com/chips/voxel8-3d-printer-can-print-a-complete-quadcopter-including-the-electronics-1613166/</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/831444096973198/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/831444096973198/</a>	0
56	3D colour coating method	<a href="http://www.eurekalert.org/pub_releases/2015-05/cuso-nct052215.php">http://www.eurekalert.org/pub_releases/2015-05/cuso-nct052215.php</a> <a href="https://l.facebook.com/l.php?u=http%3A%2F%2Fyle.fi%2Fuutiset%2Fnyt_se_on_todellisuutta_taysin_3d-tulostetut_silmalasi%2F7884470&amp;h=LAQHws7E5">https://l.facebook.com/l.php?u=http%3A%2F%2Fyle.fi%2Fuutiset%2Fnyt_se_on_todellisuutta_taysin_3d-tulostetut_silmalasi%2F7884470&amp;h=LAQHws7E5</a> <a href="http://www.geek.com/chips/voxel8-3d-printer-can-print-a-complete-quadcopter-including-the-electronics-1613166/">http://www.geek.com/chips/voxel8-3d-printer-can-print-a-complete-quadcopter-including-the-electronics-1613166/</a>	5	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/770709843046624/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/770709843046624/</a>	0
56	3D-printed lenses	<a href="http://www.geek.com/chips/voxel8-3d-printer-can-print-a-complete-quadcopter-including-the-electronics-1613166/">http://www.geek.com/chips/voxel8-3d-printer-can-print-a-complete-quadcopter-including-the-electronics-1613166/</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/740907446026864/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/740907446026864/</a>	0
56	3D printing of an electronic device	<a href="http://www.geek.com/chips/voxel8-3d-printer-can-print-a-complete-quadcopter-including-the-electronics-1613166/">http://www.geek.com/chips/voxel8-3d-printer-can-print-a-complete-quadcopter-including-the-electronics-1613166/</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/702689523181990/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/702689523181990/</a>	0
56	3D printing – market forecast 2020	<a href="http://techcrunch.com/2014/12/17/innovation-and-investment-in-3d-printing-surges/">http://techcrunch.com/2014/12/17/innovation-and-investment-in-3d-printing-surges/</a>	5	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/685389671578642/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/685389671578642/</a>	0
56	3D-printed knee joint	<a href="http://techcrunch.com/2014/12/15/watch-doctors-successfully-3d-print-a-knee-joint/">http://techcrunch.com/2014/12/15/watch-doctors-successfully-3d-print-a-knee-joint/</a>	7	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/684576761659933/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/684576761659933/</a>	0
56	HP MJF 3D printer	<a href="http://www.engadget.com/2014/10/29/hp-multi-jet-fusion-3d-printer/">http://www.engadget.com/2014/10/29/hp-multi-jet-fusion-3d-printer/</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/659595964158013/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/659595964158013/</a>	0
56	Individual 3D-printed products from Amazon	<a href="http://www.cnet.com/news/amazon-launches-store-to-sell-3d-printed-products/">http://www.cnet.com/news/amazon-launches-store-to-sell-3d-printed-products/</a>	5	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/60718589939020/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/60718589939020/</a>	0
56	3D-printing of lenses	<a href="http://www.azom.com/article.aspx?ArticleID=11129">http://www.azom.com/article.aspx?ArticleID=11129</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/599700673480876/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/599700673480876/</a>	0
56	3D-printed carbon fibre cast	<a href="http://www.iflscience.com/health-and-medicine/3d-printed-cast-speeds-bone-recovery-using-ultrasound">http://www.iflscience.com/health-and-medicine/3d-printed-cast-speeds-bone-recovery-using-ultrasound</a>	7	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/558084300975847/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/558084300975847/</a>	0
56	3D-printing of cars	<a href="http://www.wired.com/autopia/2014/03/edag-3d-printed-car/?mbid=social_twitter">http://www.wired.com/autopia/2014/03/edag-3d-printed-car/?mbid=social_twitter</a>	5	Eetu Simpanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/539006899550254/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/539006899550254/</a>	0
56	3D-printed titanium bicycle	<a href="http://www.gizmag.com/3d-printed-titanium-bicycle-frame/30760/">http://www.gizmag.com/3d-printed-titanium-bicycle-frame/30760/</a>	5	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/517366968380914/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/517366968380914/</a>	0
56	Growth of the 3D-printer market	<a href="http://usfinancepost.com/3d-printer-market-is-about-go-grow-tenfold-in-next-four-years-11511.html">http://usfinancepost.com/3d-printer-market-is-about-go-grow-tenfold-in-next-four-years-11511.html</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/493083070809304/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/493083070809304/</a>	0
56	3D-printed fully functional speaker	<a href="http://gizmodo.com/you-can-now-3d-print-a-fully-functional-speaker-1484084187">http://gizmodo.com/you-can-now-3d-print-a-fully-functional-speaker-1484084187</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/487047734746171/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/487047734746171/</a>	0
56	Local manufacturing, opinion on the future study for the Commerce Committee	<a href="https://www.facebook.com/groups/TuVRadikaalit/permalink/480343765416568/">https://www.facebook.com/groups/TuVRadikaalit/permalink/480343765416568/</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/480343765416568/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/480343765416568/</a>	0
56	Miniaturisation of hydraulics (robot) through 3D-printing	<a href="http://www.technologyreview.com/view/544766/how-to-3d-print-a-hydraulic-powered-robot/">http://www.technologyreview.com/view/544766/how-to-3d-print-a-hydraulic-powered-robot/</a>	5	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/868467943270813/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/868467943270813/</a>	0
56	3D-printing of goods			2014 Report by the Committee		5
56	Efficient 3D-printing of metals	<a href="http://www.eurekalert.org/pub_releases/2016-01/nu-anw011116.php">http://www.eurekalert.org/pub_releases/2016-01/nu-anw011116.php</a>	5	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/880983482019259/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/880983482019259/</a>	0

56	3D-printing of ceramics (strong, precise)	<a href="http://www.popularmechanics.com/science/a18801/3d-printed-wonder-ceramics-wont-shatter/">http://www.popularmechanics.com/science/a18801/3d-printed-wonder-ceramics-wont-shatter/</a> <a href="http://www.forbes.com/sites/eshachhabra/2015/12/30/the-3d-printed-car-that-could-transform-the-auto-industry-on-sale-in-2016/">http://www.forbes.com/sites/eshachhabra/2015/12/30/the-3d-printed-car-that-could-transform-the-auto-industry-on-sale-in-2016/</a>	5	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875310645919876/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875310645919876/</a>	0
56	3D-printed car in the market	<a href="http://www.forbes.com/sites/eshachhabra/2015/12/30/the-3d-printed-car-that-could-transform-the-auto-industry-on-sale-in-2016/">http://www.forbes.com/sites/eshachhabra/2015/12/30/the-3d-printed-car-that-could-transform-the-auto-industry-on-sale-in-2016/</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/874547885996152/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/874547885996152/</a>	0
56	Improvement of metal printing – 10-fold speed	<a href="http://3dprint.com/116276/nvbots-launches-nvlab/">http://3dprint.com/116276/nvbots-launches-nvlab/</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885713598212914/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885713598212914/</a>	0
56	3D-microprinting of copper structures	<a href="http://phys.org/news/2016-01-copper-deposition-fabricate-tiny-3d.html">http://phys.org/news/2016-01-copper-deposition-fabricate-tiny-3d.html</a>	5	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885027438281530/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885027438281530/</a>	0
56	Inexpensive SLS laser on the basis of open-source code	<a href="http://www.eurekalert.org/pub_releases/2016-02/ru-mlc022116.php">http://www.eurekalert.org/pub_releases/2016-02/ru-mlc022116.php</a>	5	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/902721283178812/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/902721283178812/</a>	0
57	3D-printed bridge MX-3D	<a href="https://www.youtube.com/watch?v=NF0QIQDQE">https://www.youtube.com/watch?v=NF0QIQDQE</a>	5	Matti Pyhtälä	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/856567821127492/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/856567821127492/</a>	0
57	Fimatec 3D printer for concrete	<a href="http://www.hs.fi/kotimaa/a1435029017846?jako=a7e13324c9b95eff1ee7f51bc3ce8271&amp;ref=og-url">http://www.hs.fi/kotimaa/a1435029017846?jako=a7e13324c9b95eff1ee7f51bc3ce8271&amp;ref=og-url</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/787284801389128/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/787284801389128/</a>	0
57	3D-printed steel bridge	<a href="http://voc.tv/1cRrjAQ">http://voc.tv/1cRrjAQ</a>	5	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/786723094778632/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/786723094778632/</a>	0
57	3D-printed apartment building (Winsun)	<a href="http://3dprint.com/38144/3d-printed-apartment-building/">http://3dprint.com/38144/3d-printed-apartment-building/</a> <a href="http://www.taloussanomati.fi/ulkomaat/2014/04/19/kiinalaisyhtio-rakensi-kymmenen-kotia-valtavalla-3d-printerilla/20145607/12">http://www.taloussanomati.fi/ulkomaat/2014/04/19/kiinalaisyhtio-rakensi-kymmenen-kotia-valtavalla-3d-printerilla/20145607/12</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706846036099672/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706846036099672/</a>	0
57	3D-printing of buildings	<a href="http://gizmodo.com/how-a-chinese-company-3d-printed-ten-houses-in-a-single-1557613229">http://gizmodo.com/how-a-chinese-company-3d-printed-ten-houses-in-a-single-1557613229</a>	5	Olli Hietanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/554222614695349/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/554222614695349/</a>	0
57	3D-printing of houses in China	<a href="http://gizmodo.com/how-a-chinese-company-3d-printed-ten-houses-in-a-single-1557613229">http://gizmodo.com/how-a-chinese-company-3d-printed-ten-houses-in-a-single-1557613229</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/546195318831412/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/546195318831412/</a>	0
57	3D-printed room	<a href="http://www.youtube.com/watch?v=BV_6QUXFnuE">http://www.youtube.com/watch?v=BV_6QUXFnuE</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/517312465053031/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/517312465053031/</a>	0
57	3D-printing of buildings		5	2014 Report by the Committee for the Future		4
58	3D-printed medicine/FDA	<a href="http://www.washingtonpost.com/news/to-your-health/wp/2015/08/04/fdas-approval-of-first-3-d-printed-pill-opens-up-endless-possibilities-for-">http://www.washingtonpost.com/news/to-your-health/wp/2015/08/04/fdas-approval-of-first-3-d-printed-pill-opens-up-endless-possibilities-for-</a> <a href="http://www.digitajournal.com/news/environment/biotech-firm-creates-fake-rhino-horn-to-help-save-real-rhinos/article/436325">http://www.digitajournal.com/news/environment/biotech-firm-creates-fake-rhino-horn-to-help-save-real-rhinos/article/436325</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/807583599359248/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/807583599359248/</a>	0
58	3D-printed rhino horn	<a href="http://www.cnn.com/2014/11/06/tech/innovation/foodini-machine-print-food/index.html?sr=sharebar_facebook">http://www.cnn.com/2014/11/06/tech/innovation/foodini-machine-print-food/index.html?sr=sharebar_facebook</a>	7	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/785953901522218/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/785953901522218/</a>	0
58	Foodini 3D food printer	<a href="http://www.cnn.com/2014/11/06/tech/innovation/foodini-machine-print-food/index.html?sr=sharebar_facebook">http://www.cnn.com/2014/11/06/tech/innovation/foodini-machine-print-food/index.html?sr=sharebar_facebook</a>	5	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/688482744602668/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/688482744602668/</a>	0
58	Nano-level printing of graphene structures	<a href="http://3dprint.com/27324/graphene-nano-3d-print/">http://3dprint.com/27324/graphene-nano-3d-print/</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/675440325906910/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/675440325906910/</a>	0
58	3D printing of medicines	<a href="http://www.theguardian.com/science/2013/oct/13/craig-ventner-mars">http://www.theguardian.com/science/2013/oct/13/craig-ventner-mars</a>	7	Mikko Vuorela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/577740689010208/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/577740689010208/</a>	0
58	3D and 4D printing of material		6	2014 Report by the Committee for the Future		3
58	Quick nanoscale 3D manufacturing using electron beam	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/nanotechnology/electron-beam-nanofabrication-made-up-to-five-thousand-times-faster">http://spectrum.ieee.org/nanoclast/semiconductors/nanotechnology/electron-beam-nanofabrication-made-up-to-five-thousand-times-faster</a> <a href="http://www.vocativ.com/video/tech/machines/3d-printing-in-gel-could-bring-us-closer-to-replacement-organs/">http://www.vocativ.com/video/tech/machines/3d-printing-in-gel-could-bring-us-closer-to-replacement-organs/</a>	5	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/877888795662061/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/877888795662061/</a>	0
59	3D printing of organs in gel	<a href="http://www.vocativ.com/video/tech/machines/3d-printing-in-gel-could-bring-us-closer-to-replacement-organs/">http://www.vocativ.com/video/tech/machines/3d-printing-in-gel-could-bring-us-closer-to-replacement-organs/</a>	7	Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/835046656612942/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/835046656612942/</a>	0
59	Biomaterial that grows and changes shape	<a href="http://www.eurekalert.org/pub_releases/2015-09/gmuo-smt092415.php">http://www.eurekalert.org/pub_releases/2015-09/gmuo-smt092415.php</a>	7	Kari Vahtiala	<a href="http://www.eurekalert.org/pub_releases/2015-09/gmuo-smt092415.php">http://www.eurekalert.org/pub_releases/2015-09/gmuo-smt092415.php</a>	0
59	3D printing of bone and tissue	<a href="http://3dprint.com/37745/bone-and-tissue-bioprinting/">http://3dprint.com/37745/bone-and-tissue-bioprinting/</a>	7	Tuomas Santakallio	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/710110949106514/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/710110949106514/</a>	0
59	3D printed organs	<a href="http://yle.fi/uutiset/japanilaistutkijat_tuottavat_ruu_miosia_3d_tulostimella/7742395">http://yle.fi/uutiset/japanilaistutkijat_tuottavat_ruu_miosia_3d_tulostimella/7742395</a> <a href="http://www.telegraph.co.uk/news/science/science-news/11333719/Cyborg-spinal-implant-could-help-paralysed-walk-again.html">http://www.telegraph.co.uk/news/science/science-news/11333719/Cyborg-spinal-implant-could-help-paralysed-walk-again.html</a>	7	Jouni Laveri	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705910109526598/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705910109526598/</a>	0
59	Spinal implant	<a href="http://www.telegraph.co.uk/news/science/science-news/11333719/Cyborg-spinal-implant-could-help-paralysed-walk-again.html">http://www.telegraph.co.uk/news/science/science-news/11333719/Cyborg-spinal-implant-could-help-paralysed-walk-again.html</a>	7	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/702983313152611/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/702983313152611/</a>	0
59	3D printing of organs: blood vessels	<a href="https://www.facebook.com/StemCellAndRegenerativeScience/posts/234949486711227">https://www.facebook.com/StemCellAndRegenerativeScience/posts/234949486711227</a>	7	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/529007363883541/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/529007363883541/</a>	0
59	3D printing of organs		7	2014 Report by the Committee for the Future		4
59	3D printing to produce tissue constructs with structural integrity	<a href="http://www.nature.com/nbt/journal/vaop/ncurrent/full/nbt.3413.html">http://www.nature.com/nbt/journal/vaop/ncurrent/full/nbt.3413.html</a>	7	Petri Sirviö	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/900022090115398/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/900022090115398/</a>	0
59	Mini-brains for testing purposes	<a href="http://hub.jhu.edu/2016/02/12/mini-brains-drug-testing">http://hub.jhu.edu/2016/02/12/mini-brains-drug-testing</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/897344060383201/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/897344060383201/</a>	0
59	3D printed heart in 10 years	<a href="http://www.wired.co.uk/news/archive/2013-11/21/3d-printed-whole-heart">http://www.wired.co.uk/news/archive/2013-11/21/3d-printed-whole-heart</a> <a href="http://forums.xilinx.com/t5/Xcell-Daily-Blog/Vision-guided-robotic-phlebotomist-draws-blood-with-near-100/ba-p/504873">http://forums.xilinx.com/t5/Xcell-Daily-Blog/Vision-guided-robotic-phlebotomist-draws-blood-with-near-100/ba-p/504873</a>	7	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/475336749250603/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/475336749250603/</a>	0
60	Blood-drawing robot	<a href="http://forums.xilinx.com/t5/Xcell-Daily-Blog/Vision-guided-robotic-phlebotomist-draws-blood-with-near-100/ba-p/504873">http://forums.xilinx.com/t5/Xcell-Daily-Blog/Vision-guided-robotic-phlebotomist-draws-blood-with-near-100/ba-p/504873</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705710092879933/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705710092879933/</a>	0

60	Surgical microscope.	<a href="http://www.scienceworldreport.com/articles/12903/20140214/next-gen-surgical-microscopes-see-tumor-cells-in-real-time.htm">http://www.scienceworldreport.com/articles/12903/20140214/next-gen-surgical-microscopes-see-tumor-cells-in-real-time.htm</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/522337317883879/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/522337317883879/</a>	0
60	Robotic surgery and other cutting of biological objects		7	2014 Report by the Committee for the Future		2
61	Sensitive robot hand	<a href="http://news.mit.edu/2015/soft-robotic-hand-can-pick-and-identify-wide-array-of-objects-0930">http://news.mit.edu/2015/soft-robotic-hand-can-pick-and-identify-wide-array-of-objects-0930</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834817896635818/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834817896635818/</a>	0
61	Robot hand senses touch	<a href="http://edition.cnn.com/2015/09/15/health/prosthetic-hand-senses-touch/index.html">http://edition.cnn.com/2015/09/15/health/prosthetic-hand-senses-touch/index.html</a>	5	Jarmo Hallikas	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/836348583149416/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/836348583149416/</a>	0
61	Synthetic skin with sense of touch	<a href="http://www.cnet.com/news/prosthetic-smart-skin-can-feel-all-of-the-things/">http://www.cnet.com/news/prosthetic-smart-skin-can-feel-all-of-the-things/</a>	1	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/682614341856175/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/682614341856175/</a>	0
61	Sensitive robot fingers and hands capable of remote work		5	2014 Report by the Committee for the Future		2
61	Kitchen robot (high-quality hands)	<a href="https://www.facebook.com/thisisinsider/videos/1502461713394555/">https://www.facebook.com/thisisinsider/videos/1502461713394555/</a>	5	Vilho Ahola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/785047105946230/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/785047105946230/</a>	0
61	Sensitive robot fingers with artificial muscles	<a href="http://europe.newsweek.com/robotic-fingers-use-artificial-muscles-lift-eggs-without-breaking-them-421701?rm=eu">http://europe.newsweek.com/robotic-fingers-use-artificial-muscles-lift-eggs-without-breaking-them-421701?rm=eu</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891151384335802/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891151384335802/</a>	0
61	Sensitive robot hand for remote work	<a href="https://www.shadowrobot.com/products/dexterous-hand/">https://www.shadowrobot.com/products/dexterous-hand/</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/889974207786853/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/889974207786853/</a>	0
62	Robo-tailoring		5	2014 Report by the Committee for the Future		1
63	Water from air	<a href="http://timesofindia.indiatimes.com/home/science/Now-a-machine-that-makes-drinking-water-from-thin-air/articleshows/34332827.cms">http://timesofindia.indiatimes.com/home/science/Now-a-machine-that-makes-drinking-water-from-thin-air/articleshows/34332827.cms</a>	7	Olli Hietanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/559642507486693/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/559642507486693/</a>	0
63	Nanosurface that convert air moisture to water		6	2014 Report by the Committee for the Future		2
64	Electronics in cyborg plant	<a href="http://gizmodo.com/scientists-have-created-a-cyborg-rose-1743933339">http://gizmodo.com/scientists-have-created-a-cyborg-rose-1743933339</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/855847371199537/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/855847371199537/</a>	0
64	Biobots		7	2014 Report by the Committee for the Future		3
64	Remote controller for camera-carrying cockroach	<a href="https://www.theguardian.com/science/2015/mar/04/cockroach-robots-not-nightmare-fantasy-but-science-lab-reality">https://www.theguardian.com/science/2015/mar/04/cockroach-robots-not-nightmare-fantasy-but-science-lab-reality</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891035437680730/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891035437680730/</a>	0
65	Artificial muscle powered by moisture	<a href="http://qz.com/429309/these-machines-can-capture-a-new-source-of-clean-energy-evaporating-water/">http://qz.com/429309/these-machines-can-capture-a-new-source-of-clean-energy-evaporating-water/</a>	6	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/784922904958651/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/784922904958651/</a>	0
65	Shape-memory metal remains strong after millions of transformations	<a href="http://www.popularmechanics.com/technology/a15773/shape-shifting-metal-alloy/">http://www.popularmechanics.com/technology/a15773/shape-shifting-metal-alloy/</a>	6	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/77451918599023/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/77451918599023/</a>	0
65	Shapeshifting materials from fibres	<a href="http://spectrum.ieee.org/tech-talk/computing/hardware/4d-printing-turns-carbon-fiber-wood-into-shapeshifting-programmable">http://spectrum.ieee.org/tech-talk/computing/hardware/4d-printing-turns-carbon-fiber-wood-into-shapeshifting-programmable</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/745896965527912/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/745896965527912/</a>	0
65	Artificial muscles – robotic hand	<a href="http://www.scienceworldreport.com/articles/23648/20150325/new-robotic-hand-respond-sensitively-muscles-created-smart-wires.htm">http://www.scienceworldreport.com/articles/23648/20150325/new-robotic-hand-respond-sensitively-muscles-created-smart-wires.htm</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/742143009236641/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/742143009236641/</a>	0
65	Synthetic muscle	<a href="http://www.eurekalert.org/pub_releases/2015-01/du-fch011315.php">http://www.eurekalert.org/pub_releases/2015-01/du-fch011315.php</a>	6	Jouni Laveri	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705474859570123/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705474859570123/</a>	0
65	Artificial muscles	<a href="http://mashable.com/2014/07/14/shape-shifting-robot/">http://mashable.com/2014/07/14/shape-shifting-robot/</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/600571073393836/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/600571073393836/</a>	0
65	Biobot/artificial muscle	<a href="https://www.youtube.com/watch?v=sKcZ7FIM34">https://www.youtube.com/watch?v=sKcZ7FIM34</a>	5	Jouni Laveri	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/592550470862563/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/592550470862563/</a>	0
65	Synthetic muscle 100 times stronger	<a href="https://www.sciencerecorder.com/news/2014/02/22/could-superhero-muscle-solve-problem-of-muscle-waste-in-space/">https://www.sciencerecorder.com/news/2014/02/22/could-superhero-muscle-solve-problem-of-muscle-waste-in-space/</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/525393517578259/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/525393517578259/</a>	0
65	Synthetic micromuscles	<a href="http://nextbigfuture.com/2013/12/a-micro-muscular-break-through-1000.html">http://nextbigfuture.com/2013/12/a-micro-muscular-break-through-1000.html</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/492436527540625/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/492436527540625/</a>	0
65	Artificial muscles		6	2014 Report by the Committee for the Future		4
66	Self-healing plastic	<a href="http://www.smithsonianmag.com/innovation/this-plastic-heals-itself-180956495/">http://www.smithsonianmag.com/innovation/this-plastic-heals-itself-180956495/</a>	6	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/823530581097883/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/823530581097883/</a>	0
66	Self-healing polymer	<a href="http://www.gizmag.com/ibm-polymer-discovery-plastic/32088/">http://www.gizmag.com/ibm-polymer-discovery-plastic/32088/</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/567151506735793/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/567151506735793/</a>	0
66	Artificial self-renewing skin		6	2014 Report by the Committee for the Future		2
67	DNA memory		3	2014 Report by the Committee for the Future		2
67	DNA nanobots	<a href="http://cacm.acm.org/magazines/2015/4/184703-molecular-moonshots/fulltext">http://cacm.acm.org/magazines/2015/4/184703-molecular-moonshots/fulltext</a>	7	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/741221565995452/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/741221565995452/</a>	0
68	Cell simulation model	<a href="http://www.scientificamerican.com/article.cfm?id=scientists-successfully-model-a-living-cell-with-software&amp;WT.mc_id=SA_Facebook">http://www.scientificamerican.com/article.cfm?id=scientists-successfully-model-a-living-cell-with-software&amp;WT.mc_id=SA_Facebook</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/497838883667056/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/497838883667056/</a>	0

68	Artificial cell and simulating life on cell level			2014 Report by the Committee for the Future		3	
69	Vegetarian 'egg'	<a href="https://www.facebook.com/gary.yourofsky/videos/892932674095315/?fref=nf">https://www.facebook.com/gary.yourofsky/videos/892932674095315/?fref=nf</a>		7	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/846282398822701/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/846282398822701/</a>	0
69	Synthetic meat	<a href="http://www.sciencealert.com/lab-grown-burgers-could-be-on-your-plate-by-2020">http://www.sciencealert.com/lab-grown-burgers-could-be-on-your-plate-by-2020</a>		7	Ilmari Määttänen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/844854918965449/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/844854918965449/</a>	0
69	Imitation meat and its funding	<a href="https://www.facebook.com/gary.yourofsky/videos/855040404551209/?fref=nf">https://www.facebook.com/gary.yourofsky/videos/855040404551209/?fref=nf</a>		7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/809949069122701/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/809949069122701/</a>	0
69	Synthetic meat is becoming cheaper	<a href="http://www.sciencealert.com/lab-grown-burger-patty-cost-drops-from-325-000-to-12">http://www.sciencealert.com/lab-grown-burger-patty-cost-drops-from-325-000-to-12</a>		7	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/746731258777816/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/746731258777816/</a>	0
69	Vegetarian patty tastes like meat	<a href="http://www.sciencealert.com/news/20140910-26310.html">http://www.sciencealert.com/news/20140910-26310.html</a>		7	Risto Linturi		0
69	Taste of meat for vegetarian burger	<a href="http://impossiblefoods.com/">http://impossiblefoods.com/</a>		7	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/650034821780794/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/650034821780794/</a>	0
69	In-vitro meat and meat-like plant protein			2014 Report by the Committee for the Future		4	
70	Robotic legs for paralysed patients	<a href="http://www.hs.fi/tiede/a1441168890154?jako=a829b8b0e33960c08e33e9dcef3a91ef&amp;ref=tw-share">http://www.hs.fi/tiede/a1441168890154?jako=a829b8b0e33960c08e33e9dcef3a91ef&amp;ref=tw-share</a>		4	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/821887051262236/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/821887051262236/</a>	0
70	Prosthetic leg with sense of touch	<a href="http://europe.newsweek.com/worlds-first-feeling-prosthetic-leg-revealed-328387">http://europe.newsweek.com/worlds-first-feeling-prosthetic-leg-revealed-328387</a>		4	Lassi Valkama	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/791136181003990/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/791136181003990/</a>	0
70	Robotic leg prostheses	<a href="https://www.ted.com/talks/hugh_herr_the_new_bionics_that_let_us_run_climb_and_dance">https://www.ted.com/talks/hugh_herr_the_new_bionics_that_let_us_run_climb_and_dance</a>		7	Haract Zentek	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/658839144233695/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/658839144233695/</a>	0
70	Robotic led prosthesis	<a href="http://bit.ly/1FMbFat">http://bit.ly/1FMbFat</a> <a href="http://www.technologyreview.com/news/530751/authorized-pants-to-help-soldiers-and-stroke-victims/?utm_campaign=socialsync&amp;utm_medium=s">http://www.technologyreview.com/news/530751/authorized-pants-to-help-soldiers-and-stroke-victims/?utm_campaign=socialsync&amp;utm_medium=s</a>		7	Merja Jauhiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/657036804413929/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/657036804413929/</a>	0
70	Soft exoskeleton	<a href="http://www.ted.com/talks/hugh_herr_the_new_bionics_that_let_us_run_climb_and_dance">http://www.ted.com/talks/hugh_herr_the_new_bionics_that_let_us_run_climb_and_dance</a>		4	Merja Jauhiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/635485923235684/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/635485923235684/</a>	0
70	Robotic leg prostheses	<a href="http://www.ted.com/talks/hugh_herr_the_new_bionics_that_let_us_run_climb_and_dance">http://www.ted.com/talks/hugh_herr_the_new_bionics_that_let_us_run_climb_and_dance</a>		7	Jari Kotola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/633442023440074/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/633442023440074/</a>	0
70	Exoskeleton chair	<a href="http://edition.cnn.com/2014/08/20/tech/innovation/the-chairless-chair/index.html">http://edition.cnn.com/2014/08/20/tech/innovation/the-chairless-chair/index.html</a>		4	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/619568971494046/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/619568971494046/</a>	0
70	Exoskeleton for lifting (Korea)	<a href="http://cir.ca/news/daewoo-develops-heavy-lifting-exoskeleton-suit">http://cir.ca/news/daewoo-develops-heavy-lifting-exoskeleton-suit</a>		4	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/611142502336693/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/611142502336693/</a>	0
70	Robotic leg prosthesis	<a href="https://www.youtube.com/watch?v=CDsNZJTWw0w">https://www.youtube.com/watch?v=CDsNZJTWw0w</a>		7	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/586811468103130/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/586811468103130/</a>	0
70	Gait assistant from Honda	<a href="http://www.youtube.com/watch?v=SLSoSy7MRHA">http://www.youtube.com/watch?v=SLSoSy7MRHA</a>		4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/536708873113390/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/536708873113390/</a>	0
70	Robotic legs	<a href="http://gizmodo.com/wheelchair-bound-woman-walks-again-with-a-3d-printed-ex-1528719886">http://gizmodo.com/wheelchair-bound-woman-walks-again-with-a-3d-printed-ex-1528719886</a>		4	Jari Kotola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/526433474140930/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/526433474140930/</a>	0
70	Robotic legs and exoskeleton that reinforces movement			2014 Report by the Committee for the Future		4	
70	Augmented human – prosthesis summary	<a href="https://www.facebook.com/futurism/videos/520599168119287/?fref=nf">https://www.facebook.com/futurism/videos/520599168119287/?fref=nf</a>		7	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890301284420812/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890301284420812/</a>	0
70	Honda rents out a gait assistant robot at EUR 350/month.	<a href="http://www.japantimes.co.jp/news/2015/07/22/business/tech/honda-start-leasing-walking-assistance-device/">http://www.japantimes.co.jp/news/2015/07/22/business/tech/honda-start-leasing-walking-assistance-device/</a> <a href="http://www.natureworldnews.com/articles/6420/20140324/mit-researchers-develop-living-material-using-e-coli.htm">http://www.natureworldnews.com/articles/6420/20140324/mit-researchers-develop-living-material-using-e-coli.htm</a>		7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887869077997366/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887869077997366/</a>	0
71	Electricity-'eating' bacterium	<a href="http://www.teknikkatalous.fi/kemia/tallaista+elama+a+ei+pitanyt+olla+olemassakaan++sahkoa+syovatt+ba+kteerit+laittavat+oppikirjat+uusiksi/a1044302">http://www.teknikkatalous.fi/kemia/tallaista+elama+a+ei+pitanyt+olla+olemassakaan++sahkoa+syovatt+ba+kteerit+laittavat+oppikirjat+uusiksi/a1044302</a>		7	Petja Jäppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/709153975868878/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/709153975868878/</a>	0
71	Electromagnetic characteristics for biofilms using bacteria	<a href="http://www.natureworldnews.com/articles/6420/20140324/mit-researchers-develop-living-material-using-e-coli.htm">http://www.natureworldnews.com/articles/6420/20140324/mit-researchers-develop-living-material-using-e-coli.htm</a>		7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/540890119361932/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/540890119361932/</a>	0
71	Synthetic yeast propagates	<a href="http://www.bbc.com/news/science-environment-26768445">http://www.bbc.com/news/science-environment-26768445</a>		7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/542487322535545/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/542487322535545/</a>	0
71	Genetically modified organisms as producers of multi-use materials			2014 Report by the Committee for the Future		3	
71	Crispr-Cas9 for faster biomaterial production	<a href="http://phys.org/news/2016-01-crispr-cas9-tool-production-biofuel-precursors.html">http://phys.org/news/2016-01-crispr-cas9-tool-production-biofuel-precursors.html</a> <a href="http://www.smh.com.au/technology/sci-tech/glowinthedark-plants-a-step-closer-as-avatars-seeds-bear-fruit-20140117-30zhe.html">http://www.smh.com.au/technology/sci-tech/glowinthedark-plants-a-step-closer-as-avatars-seeds-bear-fruit-20140117-30zhe.html</a>		7	Leo Kärkkäinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887957747988499/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887957747988499/</a>	0
71	Self-luminous seeding plant	<a href="http://www.smh.com.au/technology/sci-tech/glowinthedark-plants-a-step-closer-as-avatars-seeds-bear-fruit-20140117-30zhe.html">http://www.smh.com.au/technology/sci-tech/glowinthedark-plants-a-step-closer-as-avatars-seeds-bear-fruit-20140117-30zhe.html</a>		7	Olli Hietanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/508431179274493/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/508431179274493/</a>	0
72	Circuit speed 245THz	<a href="http://www.gizmag.com/nanoelectronic-circuits-quantum-plasmonic-tunneling/31714/">http://www.gizmag.com/nanoelectronic-circuits-quantum-plasmonic-tunneling/31714/</a>		3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/560118714105739/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/560118714105739/</a>	0
72	3D circuit structure boosts efficiency of electronics	<a href="http://phys.org/news/2015-12-skyscraper-style-chip-boosts-fold.html">http://phys.org/news/2015-12-skyscraper-style-chip-boosts-fold.html</a>		6	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/863775693740038/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/863775693740038/</a>	0
72	Extremely dense processors that take quantum phenomena into account			2014 Report by the Committee for the Future		2	

72	Intel 16 billion for massive parallel computing	<a href="http://motherboard.vice.com/read/intel-bets-167-billion-on-the-massively-parallel-future">http://motherboard.vice.com/read/intel-bets-167-billion-on-the-massively-parallel-future</a>	3	Tapio Rinne, Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875719905878950/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875719905878950/</a>	0
72	Cooling of quantum computer resolved at Aalto University	<a href="http://www.aalto.fi/fi/current/news/2016-02-002/">http://www.aalto.fi/fi/current/news/2016-02-002/</a>	3	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891118551005752/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891118551005752/</a>	0
73	Carbon-neutral cement	<a href="http://nextbigfuture.com/2015/09/carbon-neutral-cement-manufacturing.html">http://nextbigfuture.com/2015/09/carbon-neutral-cement-manufacturing.html</a>	6	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834462193338055/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834462193338055/</a>	0
73	Porous concrete	<a href="https://www.facebook.com/techinsider/videos/419013808296981/?fref=nf">https://www.facebook.com/techinsider/videos/419013808296981/?fref=nf</a>	6	Jani Ehro	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833498486767759/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833498486767759/</a>	0
73	Emission-free concrete substitute	<a href="http://www.pbs.org/newshour/bb/cement-alternative-absorbs-carbon-dioxide-like-sponge/">http://www.pbs.org/newshour/bb/cement-alternative-absorbs-carbon-dioxide-like-sponge/</a> <a href="https://www.kamk.fi/en/Business-Services/Research-and-Development/Mechanical-and-Mining/GeoMaterials">https://www.kamk.fi/en/Business-Services/Research-and-Development/Mechanical-and-Mining/GeoMaterials</a>	6	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/">https://www.facebook.com/groups/TuVRa/dikaalit/</a>	0
73	Concrete substitutes in Finland	<a href="https://www.kamk.fi/en/Business-Services/Research-and-Development/Mechanical-and-Mining/GeoMaterials">https://www.kamk.fi/en/Business-Services/Research-and-Development/Mechanical-and-Mining/GeoMaterials</a>	6	Mikko Mononen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/862795240504750/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/862795240504750/</a>	0
73	New building materials that replace or reinforce concrete		6	2014 Report by the Committee for the Future		3
73	Bacterial curing of bricks at room temperature	<a href="http://www.inc.com/kevin-i-ryan/best-industries-2016-sustainable-building-materials.html">http://www.inc.com/kevin-i-ryan/best-industries-2016-sustainable-building-materials.html</a>	6	Kalle Pihlajasaari	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/898604510257156/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/898604510257156/</a>	0
74	Antibacterial surfaces	<a href="http://www.eurekalert.org/pub_releases/2015-11/uos-uct110915.php">http://www.eurekalert.org/pub_releases/2015-11/uos-uct110915.php</a> <a href="http://www.scienceworldreport.com/articles/23182/20150310/new-tough-paint-super-water-repellent-self-cleans-video.htm">http://www.scienceworldreport.com/articles/23182/20150310/new-tough-paint-super-water-repellent-self-cleans-video.htm</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851792474938360/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851792474938360/</a>	0
74	Self-cleaning painted surface Antibacterial and other dirt-repellent materials and surfaces		6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/732464963537779/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/732464963537779/</a>	0
74			6	2014 Report by the Committee for the Future		2
75	Spinning of nanofibres	<a href="http://www.eurekalert.org/pub_releases/2015-06/miot-unp060415.php">http://www.eurekalert.org/pub_releases/2015-06/miot-unp060415.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/778840308900244/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/778840308900244/</a>	0
75	Growing laser nanowires	<a href="http://www.eurekalert.org/pub_releases/2015-04/uow-snm041015.php">http://www.eurekalert.org/pub_releases/2015-04/uow-snm041015.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/752098271574448/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/752098271574448/</a>	0
75	Conductive graphene yarn	<a href="http://www.gizmag.com/stretchable-graphene-yarn/32657/">http://www.gizmag.com/stretchable-graphene-yarn/32657/</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/588217947962482/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/588217947962482/</a>	0
75	Carbon nanotube yarn or thread		6	2014 Report by the Committee for the Future		3
75	Extensive review of nano carbon fibres	<a href="http://www.sciencedirect.com/science/article/pii/S1369702115002084">http://www.sciencedirect.com/science/article/pii/S1369702115002084</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890487574402183/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890487574402183/</a>	0
75	Graphen fibre conductors	<a href="http://phys.org/news/2015-09-layering-technique-graphene-fiber-strength.html-jCp">http://phys.org/news/2015-09-layering-technique-graphene-fiber-strength.html-jCp</a>	6	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/82351247766360/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/82351247766360/</a>	0
75	Mass production of spider web	<a href="http://www.wired.com/2015/06/bolt-threads-spider-silk/?mbid=social_fb">http://www.wired.com/2015/06/bolt-threads-spider-silk/?mbid=social_fb</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/779390445511897/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/779390445511897/</a>	0
75	Magnetospinning of nanofibres	<a href="http://www.eurekalert.org/pub_releases/2015-05/uog-rdn052015.php">http://www.eurekalert.org/pub_releases/2015-05/uog-rdn052015.php</a> <a href="https://l.facebook.com/l.php?u=http%3A%2F%2Fwww.iflscience.com%2Ftechnology%2Fsuperhero-strength-spider-silk-coming-market&amp;h=AQHofJ06">https://l.facebook.com/l.php?u=http%3A%2F%2Fwww.iflscience.com%2Ftechnology%2Fsuperhero-strength-spider-silk-coming-market&amp;h=AQHofJ06</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/769631926487749/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/769631926487749/</a>	0
75	Strong spider web launched in the market		6	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/535525436565067/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/535525436565067/</a>	0
76	Water purification	<a href="http://spectrum.ieee.org/energywise/energy/environment/shocking-trick-to-desalinate-water">http://spectrum.ieee.org/energywise/energy/environment/shocking-trick-to-desalinate-water</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851877518263189/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851877518263189/</a>	0
76	Diode for fluids	<a href="http://physics.aps.org/synopsis-for/10.1103/PhysRevLett.115.134503">http://physics.aps.org/synopsis-for/10.1103/PhysRevLett.115.134503</a>	6	Ville Nikkanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833157683468506/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833157683468506/</a>	0
76	Water purification with graphene	<a href="http://phys.org/news/2014-02-graphene-affair.html">http://phys.org/news/2014-02-graphene-affair.html</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/521181774666100/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/521181774666100/</a>	0
76	Energy-efficient separation of salt from water	<a href="http://interestingengineering.com/mit-discovers-new-way-to-separate-salt-from-water/">http://interestingengineering.com/mit-discovers-new-way-to-separate-salt-from-water/</a>	6	Tuomas Santakallio	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/860109314106676/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/860109314106676/</a>	0
76	Nanocarbons in salt or bacterial removal and other separation techniques based		6	2014 Report by the Committee for the Future		2
76	Graphene filter for nuclear waste	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/graphene-filter-offers-a-tenfold-reduction-in-energy-requirements-for-cleaning-nuclear-waste">http://spectrum.ieee.org/nanoclast/semiconductors/materials/graphene-filter-offers-a-tenfold-reduction-in-energy-requirements-for-cleaning-nuclear-waste</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/877827639001510/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/877827639001510/</a>	0
76	New filtering method for heavy metals	<a href="http://www.eurekalert.org/pub_releases/2016-01/ez-heh012216.php">http://www.eurekalert.org/pub_releases/2016-01/ez-heh012216.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887441004706840/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887441004706840/</a>	0
76	Water desalination using battery technology	<a href="http://www.eurekalert.org/pub_releases/2016-02/uoia-btc020416.php">http://www.eurekalert.org/pub_releases/2016-02/uoia-btc020416.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893629844087956/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893629844087956/</a>	0
76	Porous liquid	<a href="http://www.eurekalert.org/pub_releases/2015-11/qub-qub111115.php">http://www.eurekalert.org/pub_releases/2015-11/qub-qub111115.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/852633661520908/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/852633661520908/</a>	0
76	Mining-water purification using electric charge	<a href="http://www.eurekalert.org/pub_releases/2015-12/uof-qcn121015.php">http://www.eurekalert.org/pub_releases/2015-12/uof-qcn121015.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/864232203694387/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/864232203694387/</a>	0
77	Carbon improves insulation of conductors	<a href="http://www.nyteknik.se/nyheter/energi_miljo/vindkraft/article3879035.ece">http://www.nyteknik.se/nyheter/energi_miljo/vindkraft/article3879035.ece</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/716526935131582/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/716526935131582/</a>	0

77	Nanocarbon as a reinforcement or as a functional surface			2014 Report by the Committee for the Future		3
77	Graphene coating keeps wing ice-free	<a href="http://www.eurekalert.org/pub_releases/2016-01/ru-gcm012516.php">http://www.eurekalert.org/pub_releases/2016-01/ru-gcm012516.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887416168042657/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887416168042657/</a>	0
78	Nanocellulose design	<a href="http://www.eurekalert.org/pub_releases/2015-10/nu-nmb100215.php">http://www.eurekalert.org/pub_releases/2015-10/nu-nmb100215.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/835877923196482/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/835877923196482/</a>	0
78	Nanocellulose applications (VTT)	<a href="http://oske.ketek.fi/Nanoselluloosa-Kokkola_31_5_2012.pdf">http://oske.ketek.fi/Nanoselluloosa-Kokkola_31_5_2012.pdf</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/770889106362031/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/770889106362031/</a>	0
78	Inexpensive nanocellulose production method	<a href="http://www.fstjournal.org/news/new-low-cost-process-make-nanocellulose/670">http://www.fstjournal.org/news/new-low-cost-process-make-nanocellulose/670</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/741927549258187/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/741927549258187/</a>	0
78	Cellulose nanofiber and microfiber			2014 Report by the Committee for the Future		2
78	Small but growing market for nanocellulose	<a href="https://globenewswire.com/news-release/2016/01/29/805894/0/en/Global-Nanocellulose-Market-Analysis-Trends-Report-2016-">https://globenewswire.com/news-release/2016/01/29/805894/0/en/Global-Nanocellulose-Market-Analysis-Trends-Report-2016-</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891107121006895/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891107121006895/</a>	0
79	Materials that levitate on nanolevel			2014 Report by the Committee for the Future		2
79	Frictionless material	<a href="http://www.sciencedaily.com/releases/2015/07/150721194001.htm">http://www.sciencedaily.com/releases/2015/07/150721194001.htm</a>	6	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/802371209880487/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/802371209880487/</a>	0
79	Frictionless surface	<a href="http://www.rsc.org/chemistryworld/2015/05/graphene-wrapped-diamond-ball-bearings-cut-friction-nothing">http://www.rsc.org/chemistryworld/2015/05/graphene-wrapped-diamond-ball-bearings-cut-friction-nothing</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/767005286750413/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/767005286750413/</a>	0
79	Acoustic levitation	<a href="http://www.tekniikkatalous.fi/innovaatiot/akustinen+levitaatio+paranee+aani+saa+pienet+esineet+leijumaan+ja+liikkumaan+ilmassa/a1040361?service=mo">http://www.tekniikkatalous.fi/innovaatiot/akustinen+levitaatio+paranee+aani+saa+pienet+esineet+leijumaan+ja+liikkumaan+ilmassa/a1040361?service=mo</a>	5	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/702430476541228/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/702430476541228/</a>	0
80	Aerogel as thermal insulation material	<a href="http://www.tekniikkatalous.fi/tekniikka/kemia/2012-02-02/Halpa-aerogeeli-on-tulevaisuuden-supereriste-3307075.html">http://www.tekniikkatalous.fi/tekniikka/kemia/2012-02-02/Halpa-aerogeeli-on-tulevaisuuden-supereriste-3307075.html</a>	6	Kari Vahtiala, Olli Orkoneva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/857378864379721/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/857378864379721/</a>	0
80	Strong welded joint	<a href="http://www.eurekalert.org/pub_releases/2015-10/osu-mco102915.php">http://www.eurekalert.org/pub_releases/2015-10/osu-mco102915.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/846445175473090/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/846445175473090/</a>	0
80	20 km-high tower	<a href="http://nextbigfuture.com/2015/08/canadian-inflated-tower-would-be-20.html">http://nextbigfuture.com/2015/08/canadian-inflated-tower-would-be-20.html</a>	6	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/811977925586482/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/811977925586482/</a>	0
80	Lightweight metal foams	<a href="http://www.eurekalert.org/pub_releases/2015-07/ncsu-sfm071715.php">http://www.eurekalert.org/pub_releases/2015-07/ncsu-sfm071715.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/799065550211053/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/799065550211053/</a>	0
80	Floating metal foam	<a href="http://www.eurekalert.org/pub_releases/2015-05/nyup-amc051215.php">http://www.eurekalert.org/pub_releases/2015-05/nyup-amc051215.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/766839883433620/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/766839883433620/</a>	0
80	3D printable aerogel	<a href="http://www.eurekalert.org/pub_releases/2015-04/dlnl-co042215.php">http://www.eurekalert.org/pub_releases/2015-04/dlnl-co042215.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/757610954356513/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/757610954356513/</a>	0
80	Electrical curing of carbon fibre	<a href="http://www.eurekalert.org/pub_releases/2015-04/miot-tam041415.php">http://www.eurekalert.org/pub_releases/2015-04/miot-tam041415.php</a>	6	Kari Vahtiala	<a href="http://www.eurekalert.org/pub_releases/2015-04/miot-tam041415.php">http://www.eurekalert.org/pub_releases/2015-04/miot-tam041415.php</a>	0
80	Strong aluminium foam	<a href="http://www.wired.com/2014/12/aluminum-foam-trains/">http://www.wired.com/2014/12/aluminum-foam-trains/</a>	6	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/68203321914277/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/68203321914277/</a>	0
80	Light and strong magnesium alloy	<a href="http://www.eurekalert.org/pub_releases/2015-12/uoc-urc122315.php">http://www.eurekalert.org/pub_releases/2015-12/uoc-urc122315.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/870415213076086/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/870415213076086/</a>	0
80	Lightweight and strong materials	<a href="http://www.eurekalert.org/pub_releases/2015-12/dbnl-tam121115.php">http://www.eurekalert.org/pub_releases/2015-12/dbnl-tam121115.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/864799506970990/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/864799506970990/</a>	0
80	Ultralight and strong materials			2014 Report by the Committee for the Future		5
80	Metallic glue bond	<a href="http://phys.org/news/2016-01-metallic-soldering-welding.html">http://phys.org/news/2016-01-metallic-soldering-welding.html</a>	6	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/87888668562272/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/87888668562272/</a>	0
80	Strong and light lattice structure through pyrolysis	<a href="http://www.nature.com/nmat/journal/voop/ncurrent/full/nmat4561.html">http://www.nature.com/nmat/journal/voop/ncurrent/full/nmat4561.html</a>	6	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891602090957398/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891602090957398/</a>	0
80	Titanium strength at 1/10th of the price	<a href="http://www.roadandtrack.com/new-cars/car-technology/a24939/new-steel-alloy-titanium/">http://www.roadandtrack.com/new-cars/car-technology/a24939/new-steel-alloy-titanium/</a>	6	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/894564827327791/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/894564827327791/</a>	0
81	Spray-on textiles			2014 Report by the Committee for the Future		1
82	Roof tile solar panel	<a href="http://inhabitat.com/heat-your-home-with-soltech-energys-beautiful-glass-roof-tiles/">http://inhabitat.com/heat-your-home-with-soltech-energys-beautiful-glass-roof-tiles/</a>	8	Tero Puranen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/818059344978340/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/818059344978340/</a>	0
82	Transparent solar panel	<a href="http://www.offgridquest.com/extra/a-fully-transparent-solar-cell-that-coul">http://www.offgridquest.com/extra/a-fully-transparent-solar-cell-that-coul</a>	8	Lasse Lumiaho	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/792318567552418/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/792318567552418/</a>	0
82	Solar power in Finland in 2050	<a href="http://yle.fi/uutiset/tutkijaryhma_ivo_laskemat_poytaan_suomeen_rakennettava_yli_100_000_aurinkovoimalaa_2050_mennessa/8053034">http://yle.fi/uutiset/tutkijaryhma_ivo_laskemat_poytaan_suomeen_rakennettava_yli_100_000_aurinkovoimalaa_2050_mennessa/8053034</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/779422138842061/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/779422138842061/</a>	0
82	Solar panel road being tested	<a href="http://www.aljazeera.com/news/2015/05/150510092535171.html">http://www.aljazeera.com/news/2015/05/150510092535171.html</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/76533480250927/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/76533480250927/</a>	0
82	Solar power 2-4 c/KWh in 2050 conservative	<a href="http://www.agora-energievwende.org/fileadmin/downloads/publikation/en/Studien/PV_Cost_2050/AgoraEnergievwende_Curr">http://www.agora-energievwende.org/fileadmin/downloads/publikation/en/Studien/PV_Cost_2050/AgoraEnergievwende_Curr</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751429464974662/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751429464974662/</a>	0

82	Solar panel road	<a href="https://www.facebook.com/pakscienceclub/videos/10152510729393518/">https://www.facebook.com/pakscienceclub/videos/10152510729393518/</a> <a href="http://spectrum.ieee.org/energywise/green-tech/solar/new-trick-promises-perovskite-solar-films-for-windows-and-walls">http://spectrum.ieee.org/energywise/green-tech/solar/new-trick-promises-perovskite-solar-films-for-windows-and-walls</a>	8	Juha Wiskari	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/750688825048726/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/750688825048726/</a>	0
82	Perovskite PV film	<a href="http://awareness-time.com/award-winning-design-glass-roof-tiles-capture-solar-energy-to-heat-your-home-during-winter/">http://awareness-time.com/award-winning-design-glass-roof-tiles-capture-solar-energy-to-heat-your-home-during-winter/</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/738548006262808/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/738548006262808/</a>	0
82	Solar panel roof tiles	<a href="http://greenpeaceblogs.org/2014/07/10/us-senator-claims-us-jobs-solar-coal-hes-right/">http://greenpeaceblogs.org/2014/07/10/us-senator-claims-us-jobs-solar-coal-hes-right/</a>	8	Petja Jäppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/724990672485208/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/724990672485208/</a>	0
82	Jobs in solar power industry	<a href="http://mitel.mit.edu/news/how-make-perfect-solar-absorber">http://mitel.mit.edu/news/how-make-perfect-solar-absorber</a>	8	Juha Krapinoja	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/677629512354658/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/677629512354658/</a>	0
82	Solar power from light and heat	<a href="http://www.extremetech.com/extreme/188667-a-fully-transparent-solar-cell-that-could-make-every-window-and-screen-a-power-source">http://www.extremetech.com/extreme/188667-a-fully-transparent-solar-cell-that-could-make-every-window-and-screen-a-power-source</a>	8	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/668177113299898/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/668177113299898/</a>	0
82	Transparent solar cell	<a href="http://www.vox.com/2014/10/16/6987915/solar-power-cheaper-balance-of-systems-costs">http://www.vox.com/2014/10/16/6987915/solar-power-cheaper-balance-of-systems-costs</a>	8	Jussi Ruohonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/662060927244850/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/662060927244850/</a>	0
82	Rooftop solar power becoming cheaper	<a href="http://www.sciencedaily.com/releases/2014/10/141003064336.htm">http://www.sciencedaily.com/releases/2014/10/141003064336.htm</a> <a href="http://www.impactlab.net/2014/09/18/100b-invested-in-wind-or-solar-will-produce-more-energy-than-oil/">http://www.impactlab.net/2014/09/18/100b-invested-in-wind-or-solar-will-produce-more-energy-than-oil/</a>	8	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/654416104675999/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/654416104675999/</a>	0
82	Solar cell that stores power	<a href="http://www.sciencedaily.com/releases/2014/10/141003064336.htm">http://www.sciencedaily.com/releases/2014/10/141003064336.htm</a>	8	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/644849972299279/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/644849972299279/</a>	0
82	Investment in oil vs. PV	<a href="http://spectrum.ieee.org/energywise/green-tech/solar/cheap-solar-cells-offer-hydrogen-hope">http://spectrum.ieee.org/energywise/green-tech/solar/cheap-solar-cells-offer-hydrogen-hope</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/636811079769835/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/636811079769835/</a>	0
82	Perovskite PV	<a href="http://bit.ly/1v6XQez">http://bit.ly/1v6XQez</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/640387936078816/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/640387936078816/</a>	0
82	DIY solar panel		8	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/603903189727291/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/603903189727291/</a>	0
82	Solar panel road	<a href="http://www.wired.com/2014/05/solar-road/">http://www.wired.com/2014/05/solar-road/</a> <a href="http://www.collective-evolution.com/2014/11/09/netherlands-is-the-first-country-to-open-solar-road-for-public/">http://www.collective-evolution.com/2014/11/09/netherlands-is-the-first-country-to-open-solar-road-for-public/</a>	8	Jussi Tunkkari	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/565180713599539/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/565180713599539/</a>	0
82	Solar panel bike lane		8	Risto Linturi		0
82	Solar windows of quantum dots	<a href="http://www.iflscience.com/technology/quantum-dot-technology-could-lead-solar-panel-windows">http://www.iflscience.com/technology/quantum-dot-technology-could-lead-solar-panel-windows</a> <a href="http://www.telegraph.co.uk/tinance/comment/ambrorsevans_pritchard/10755598/Global-solar-dominance-in-sight-as-science-trumps-fossil-">http://www.telegraph.co.uk/tinance/comment/ambrorsevans_pritchard/10755598/Global-solar-dominance-in-sight-as-science-trumps-fossil-</a>	6	Arvo Kukko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/553227941461483/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/553227941461483/</a>	0
82	PV effect on oil countries	<a href="http://www.wired.com/dangerroom/2014/03/space-solar/">http://www.wired.com/dangerroom/2014/03/space-solar/</a> <a href="http://www.economist.com/news/science-and-technology/21596924-way-double-efficiency-solar-cells-about-go-mainstream-stacking">http://www.economist.com/news/science-and-technology/21596924-way-double-efficiency-solar-cells-about-go-mainstream-stacking</a>	8	Esko Nuutila	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/549900095127601/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/549900095127601/</a>	0
82	Solar power captured and projected to Earth		8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/537773499673594/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/537773499673594/</a>	0
82	Coloured solar panels 35%		8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/525463990904545/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/525463990904545/</a>	0
82	Discussion of solar power		8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/501936703257274/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/501936703257274/</a>	0
82	Rapidly cheapening solar energy		8	2014 Report by the Committee for the Future		5
82	Stable, efficient perovskite solar cell	<a href="http://spectrum.ieee.org/energywise/green-tech/solar/stable-perovskite-cell-boosts-solar-power">http://spectrum.ieee.org/energywise/green-tech/solar/stable-perovskite-cell-boosts-solar-power</a> <a href="http://www.firstsolar.com/en/Technologies-and-Capabilities/PV-Modules/First-Solar-Series-3-Black-Module/CdTe-Technology.aspx">http://www.firstsolar.com/en/Technologies-and-Capabilities/PV-Modules/First-Solar-Series-3-Black-Module/CdTe-Technology.aspx</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/878663528917921/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/878663528917921/</a>	0
82	FS: efficient thin-film PV 2017		8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/874557479328526/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/874557479328526/</a>	0
82	Transparent solar panel to turn windows into solar power generators	<a href="https://www.facebook.com/futurism/videos/519521464893724/?fref=nf">https://www.facebook.com/futurism/videos/519521464893724/?fref=nf</a>	8	Kaisu Annala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890483094402631/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890483094402631/</a>	0
82	Valoe: 40-year guarantee for solar panels	<a href="http://fi.valoe.com/aurinkomuoduli/">http://fi.valoe.com/aurinkomuoduli/</a>	8	Karoliina Auvinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890347317749542/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890347317749542/</a>	0
82	Perovskite stability problem about to be solved	<a href="http://spectrum.ieee.org/energywise/green-tech/solar/stable-perovskite-cell-boosts-solar-power">http://spectrum.ieee.org/energywise/green-tech/solar/stable-perovskite-cell-boosts-solar-power</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/878663528917921/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/878663528917921/</a>	0
82	Solar power integrated into tin roof	<a href="http://www.virtesolar.fi/">http://www.virtesolar.fi/</a> <a href="http://www.pv-magazine.com/news/details/beitrag/sunpower-claims-228-module-record_100023318/">http://www.pv-magazine.com/news/details/beitrag/sunpower-claims-228-module-record_100023318/</a>	8	Mikael Kallavuo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/895899363861004/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/895899363861004/</a>	0
82	Sun Power PV 22.8%		8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/902443629873244/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/902443629873244/</a>	0
83	Rectenna: Electricity from light	<a href="http://www.kurzweilai.net/first-optical-rectenna-converts-light-to-dc-current">http://www.kurzweilai.net/first-optical-rectenna-converts-light-to-dc-current</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834194356698172/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834194356698172/</a>	0
83	Flexible electronics	<a href="http://phys.org/news/2015-09-scientists-approach-quest-solar-panels.html">http://phys.org/news/2015-09-scientists-approach-quest-solar-panels.html</a> <a href="https://www.minds.com/blog/view/488083692665712640/mass-produced-printable-solar-cells-enter-market-and-could-change-everything">https://www.minds.com/blog/view/488083692665712640/mass-produced-printable-solar-cells-enter-market-and-could-change-everything</a>	6	Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/828353483948926/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/828353483948926/</a>	0
83	PV printed on rolls	<a href="http://yle.fi/uutiset/suomalainen_aurinkokenno_teki_maailmanennatyksen_markkinoille_yhden_vuosien_matka/8127155">http://yle.fi/uutiset/suomalainen_aurinkokenno_teki_maailmanennatyksen_markkinoille_yhden_vuosien_matka/8127155</a>	8	Petri Sirviö	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/827588764025398/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/827588764025398/</a>	0
83	PV record with silicon cells		8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/811414669003441/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/811414669003441/</a>	0
83	Thin solar cells	<a href="http://www.eurekalert.org/pub_releases/2015-07/anu-st072015.php">http://www.eurekalert.org/pub_releases/2015-07/anu-st072015.php</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/800725406711734/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/800725406711734/</a>	0

83	Finnish solar cell technology	<a href="http://www.aalto.fi/fi/current/news/2015-05-18-002/">http://www.aalto.fi/fi/current/news/2015-05-18-002/</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/768920706558871/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/768920706558871/</a>	0
83	Solar power with 34% efficiency	<a href="http://gizmodo.com/this-could-be-the-worlds-most-efficient-solar-system-1705184079">http://gizmodo.com/this-could-be-the-worlds-most-efficient-solar-system-1705184079</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/768724113245197/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/768724113245197/</a>	0
83	Magnetic nanoparticles in PV films	<a href="http://spectrum.ieee.org/nanoclast/green-tech/solar/magnetic-nanoparticles-boost-polymer-solar-cells">http://spectrum.ieee.org/nanoclast/green-tech/solar/magnetic-nanoparticles-boost-polymer-solar-cells</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/72981787135821/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/72981787135821/</a>	0
83	Solar panels printed on rolls	<a href="https://www.youtube.com/watch?v=5evOle4lvP8">https://www.youtube.com/watch?v=5evOle4lvP8</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/708471525937123/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/708471525937123/</a>	0
83	Graphene converts photon into multiple electrons (PV)	<a href="http://spectrum.ieee.org/nanoclast/green-tech/solar/graphene-gets-another-boost-in-high-conversion-efficiency-photovoltaics">http://spectrum.ieee.org/nanoclast/green-tech/solar/graphene-gets-another-boost-in-high-conversion-efficiency-photovoltaics</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/708955572555385/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/708955572555385/</a>	0
83	40% solar cell	<a href="http://www.businessinsider.com.au/australian-solar-energy-researchers-have-found-a-way-to-get-40-efficiency-for-converting-sunlight-into-electricity-">http://www.businessinsider.com.au/australian-solar-energy-researchers-have-found-a-way-to-get-40-efficiency-for-converting-sunlight-into-electricity-</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/679907332126876/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/679907332126876/</a>	0
83	Flexible graphene PV 15.6%	<a href="http://www.gizmag.com/graphene-solar-cell-record-efficiency/30466/">http://www.gizmag.com/graphene-solar-cell-record-efficiency/30466/</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/502524723198472/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/502524723198472/</a>	0
83	Efficient and light solar panels		8	2014 Report by the Committee for the Future		4
83	Organic PV 13% efficiency	<a href="http://www.electronics-eetimes.com/en/heliatek-claims-opv-world-record-efficiency-of-13.2-percent.html?cmp_id=7&amp;news_id=222927415">http://www.electronics-eetimes.com/en/heliatek-claims-opv-world-record-efficiency-of-13.2-percent.html?cmp_id=7&amp;news_id=222927415</a>	8	Seppo Nikkilä	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/895197780597829/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/895197780597829/</a>	0
83	Micrometre-thin solar panel	<a href="http://www.sciencedirect.com/science/article/pii/S1566119916300222">http://www.sciencedirect.com/science/article/pii/S1566119916300222</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/905606572890283/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/905606572890283/</a>	0
83	CdTe solar cells are evolving	<a href="http://www.nature.com/articles/nenergy201615">http://www.nature.com/articles/nenergy201615</a>	8	Petri Sirviö	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/908247042626236/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/908247042626236/</a>	0
83	Graphene for PV surface	<a href="http://aabgu.org/bgu-makes-significant-advance-in-graphene-generation/">http://aabgu.org/bgu-makes-significant-advance-in-graphene-generation/</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/802895446494730/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/802895446494730/</a>	0
84	Methane from electricity 50%	<a href="http://www.rdmag.com/news/2015/08/milestone-achieved-hybrid-artificial-photosynthesis">http://www.rdmag.com/news/2015/08/milestone-achieved-hybrid-artificial-photosynthesis</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/817603348357273/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/817603348357273/</a>	0
84	Hydrogen from light	<a href="http://www.kurzweilai.net/making-hydrogen-fuel-from-water-and-visible-light-at-100-times-higher-efficiency">http://www.kurzweilai.net/making-hydrogen-fuel-from-water-and-visible-light-at-100-times-higher-efficiency</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/816559255128349/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/816559255128349/</a>	0
84	Artificial photosynthesis	<a href="http://phys.org/news/2015-10-ten-fold-efficiency-carbon-dioxide-fuel.html">http://phys.org/news/2015-10-ten-fold-efficiency-carbon-dioxide-fuel.html</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845557595561848/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845557595561848/</a>	0
84	Cheap catalyst for hydrogen production	<a href="http://nextbigfuture.com/2015/09/carbon-fiber-with-molybdenum-disulfide.html">http://nextbigfuture.com/2015/09/carbon-fiber-with-molybdenum-disulfide.html</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833689920081949/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833689920081949/</a>	0
84	22% of solar energy captured as hydrogen	<a href="http://www.techtimes.com/articles/77142/20150818/this-artificial-leaf-could-be-humanitys-lifeline-when-fossil-fuels-are-out.htm">http://www.techtimes.com/articles/77142/20150818/this-artificial-leaf-could-be-humanitys-lifeline-when-fossil-fuels-are-out.htm</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/814860075298267/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/814860075298267/</a>	0
84	Artificial leaf and synthetic fuel from sunlight and carbon dioxide		8	2014 Report by the Committee for the Future		4
84	Methanol from methane with manganese catalyst	<a href="http://www.eurekalert.org/pub_releases/2016-01/uosd-hto012816.php">http://www.eurekalert.org/pub_releases/2016-01/uosd-hto012816.php</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890585984392342/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890585984392342/</a>	0
84	Fuel from CO2&H2O using sunlight and heat	<a href="http://www.eurekalert.org/pub_releases/2016-02/uota-pop022216.php">http://www.eurekalert.org/pub_releases/2016-02/uota-pop022216.php</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/902733129844294/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/902733129844294/</a>	0
84	Diesel fuel from air	<a href="http://www.bbc.com/news/business-34064072">http://www.bbc.com/news/business-34064072</a>	8	Ari Lanamäki	<a href="http://www.bbc.com/news/business-34064072">http://www.bbc.com/news/business-34064072</a>	0
84	Low-cost hydrogen production	<a href="http://www.geek.com/science/stanford-discovers-cheap-way-to-produce-hydrogen-247-1626195/">http://www.geek.com/science/stanford-discovers-cheap-way-to-produce-hydrogen-247-1626195/</a>	8	Jouni Kari	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/788952451222363/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/788952451222363/</a>	0
84	Diesel fuel from water and carbon dioxide	<a href="http://www.sciencealert.com/audi-have-successfully-made-diesel-fuel-from-air-and-water">http://www.sciencealert.com/audi-have-successfully-made-diesel-fuel-from-air-and-water</a>	8	Jarmo Martela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/759718380812437/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/759718380812437/</a>	0
84	Cheap hydrogen electrolysis	<a href="http://spectrum.ieee.org/nanoclast/green-tech/fuel-cells/nanoscale-material-enables-cheap-emissionfree-hydrogen-production">http://spectrum.ieee.org/nanoclast/green-tech/fuel-cells/nanoscale-material-enables-cheap-emissionfree-hydrogen-production</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/737095699741372/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/737095699741372/</a>	0
84	Graphene produces hydrogen from air	<a href="http://phys.org/news/2014-11-protons-fuel-graphene-prospects.html">http://phys.org/news/2014-11-protons-fuel-graphene-prospects.html</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/674313202686289/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/674313202686289/</a>	0
84	Production of hydrogen from molybdene sulph. (Rice)		8	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/662865683831041/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/662865683831041/</a>	0
84	Electricity produces aviation fuel from sea water	<a href="http://www.hindustantimes.com/world-news/us-navy-plane-flies-on-sea-water/article1-1206789.aspx">http://www.hindustantimes.com/world-news/us-navy-plane-flies-on-sea-water/article1-1206789.aspx</a>	8	Jari Kotola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/550604835057127/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/550604835057127/</a>	0
84	Ethanol from CO2 at room temperature	<a href="http://news.stanford.edu/news/2014/april/ethanol-without-plants-040914.html">http://news.stanford.edu/news/2014/april/ethanol-without-plants-040914.html</a>	8	Lassi Valkama	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/548971325220478/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/548971325220478/</a>	0
84	Hydrogen production	<a href="http://www.kurzweilai.net/making-hydrogen-fuel-from-water-and-visible-light-at-100-times-higher-efficiency">http://www.kurzweilai.net/making-hydrogen-fuel-from-water-and-visible-light-at-100-times-higher-efficiency</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/816559255128349/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/816559255128349/</a>	0
84	Hydrogen from water at over 80% efficiency	<a href="http://news.stanford.edu/news/2015/june/water-splitter-catalyst-062315.html">http://news.stanford.edu/news/2015/june/water-splitter-catalyst-062315.html</a>	8	Tapio Rinne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/874148549369419/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/874148549369419/</a>	0
85	Algae become a source of electricity	<a href="http://www.eurekalert.org/pub_releases/2015-10/ws-mpp100215.php">http://www.eurekalert.org/pub_releases/2015-10/ws-mpp100215.php</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/83588363195911/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/83588363195911/</a>	0

85	Hydrogen production	<a href="http://www.eurekalert.org/pub_releases/2015-04/vt-dbv040215.php">http://www.eurekalert.org/pub_releases/2015-04/vt-dbv040215.php</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751456561638619/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751456561638619/</a>	0
85	E.coli to produce propane	<a href="http://www.utu.fi/fi/Ajankohtaista/Uutiset/Sivut/Mikrobit-saatiin-tuottamaan-propaania.aspx">http://www.utu.fi/fi/Ajankohtaista/Uutiset/Sivut/Mikrobit-saatiin-tuottamaan-propaania.aspx</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/711564965627779/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/711564965627779/</a>	0
85	Synthetic propane	<a href="http://www.mtv.fi/uutiset/kotimaa/artikkeli/suomalaistutkijat-kehittavat-uusiutuuaa-propaania/4383382">http://www.mtv.fi/uutiset/kotimaa/artikkeli/suomalaistutkijat-kehittavat-uusiutuuaa-propaania/4383382</a>	8	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/645801528870790/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/645801528870790/</a>	0
85	GMO E.coli produces propane	<a href="http://www.theguardian.com/environment/2014/sep/02/propane-renewable-sources-ecoli-genes">http://www.theguardian.com/environment/2014/sep/02/propane-renewable-sources-ecoli-genes</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/625973684186908/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/625973684186908/</a>	0
85	The production of biofuels using enzymes, bacteria or algae		8	2014 Report by the Committee for the Future		2
85	E.coli produces propane (Finland), etc.	<a href="http://www.utu.fi/fi/Ajankohtaista/Uutiset/Sivut/Mikrobit-saatiin-tuottamaan-propaania.aspx">http://www.utu.fi/fi/Ajankohtaista/Uutiset/Sivut/Mikrobit-saatiin-tuottamaan-propaania.aspx</a>	8	Kari Vahtiala, Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/711564965627779/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/711564965627779/</a>	0
86	Wind power without blades	<a href="http://www.wired.com/2015/05/future-wind-turbines-no-blades/">http://www.wired.com/2015/05/future-wind-turbines-no-blades/</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/853241388126802/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/853241388126802/</a>	0
86	Windside wind spiral 100 m	<a href="http://yle.fi/uutiset/windside_virittelee_sadan_metrin_tuuliruuvia_valkeakoskelle/7989676">http://yle.fi/uutiset/windside_virittelee_sadan_metrin_tuuliruuvia_valkeakoskelle/7989676</a> <a href="http://www.tekniikkatalous.fi/Linkenne/rahtialus+hiikkuu+tuulen+voimalla+automaattiohjaus+loytaa+energiapihimman+purjehdusreitit/a1043105">http://www.tekniikkatalous.fi/Linkenne/rahtialus+hiikkuu+tuulen+voimalla+automaattiohjaus+loytaa+energiapihimman+purjehdusreitit/a1043105</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/766079526842989/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/766079526842989/</a>	0
86	Ship sails on wind power		8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706931076091168/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706931076091168/</a>	0
86	Quadcopter kite energy	<a href="http://www.skywindpower.com/">http://www.skywindpower.com/</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/695430327241243/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/695430327241243/</a>	0
86	Kite energy	<a href="http://www.awelabs.com/awelabs-awecs-proposal/">http://www.awelabs.com/awelabs-awecs-proposal/</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/559443694173241/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/559443694173241/</a>	0
86	Vertical wind power	<a href="https://www.facebook.com/EarthTheOperatorsManual.Page/">https://www.facebook.com/EarthTheOperatorsManual.Page/</a>	8	Karoliina Topelius	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/522713631179581/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/522713631179581/</a>	0
86	Flying wind power and other new ways to produce wind power		8	2014 Report by the Committee for the Future		3
86	Convection power plant	<a href="http://www.fastcoexist.com/3030110/this-giant-tower-in-the-desert-could-generate-as-much-power-as-the-hoover-dam">http://www.fastcoexist.com/3030110/this-giant-tower-in-the-desert-could-generate-as-much-power-as-the-hoover-dam</a>	8	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/571576846293259/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/571576846293259/</a>	0
86	Electricity from flowing salt water	<a href="http://arstechnica.com/science/2014/04/flowing-salt-water-over-graphene-generates-electricity/">http://arstechnica.com/science/2014/04/flowing-salt-water-over-graphene-generates-electricity/</a>	8	Sulka Haro	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/551194348331509/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/551194348331509/</a>	0
86	Wave power plant test	<a href="http://yle.fi/uutiset/suomalaisen_aaltovoimalan_testituloksia_julki_erittain_rohkaisevaa/7073948">http://yle.fi/uutiset/suomalaisen_aaltovoimalan_testituloksia_julki_erittain_rohkaisevaa/7073948</a>	8	Jouni Laveri	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/517166121734332/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/517166121734332/</a>	0
87	Mechanic energy converted into magnetic	<a href="http://nextbigfuture.com/2015/09/galfenol-can-convert-70-percent-of.html">http://nextbigfuture.com/2015/09/galfenol-can-convert-70-percent-of.html</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834450626672545/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834450626672545/</a>	0
87	Piezoelectrical energy sources, harvesting of kinetic energy		8	2014 Report by the Committee for the Future		1
87	Rubber generates electricity from movement (Ricoh)	<a href="http://ricoh.com/release/2015/0518_1.html">http://ricoh.com/release/2015/0518_1.html</a> <a href="http://www.extremetech.com/extreme/150551-the-500mw-molten-salt-nuclear-reactor-safe-half-the-price-of-light-water-and-shipped-to-order-">http://www.extremetech.com/extreme/150551-the-500mw-molten-salt-nuclear-reactor-safe-half-the-price-of-light-water-and-shipped-to-order-</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891609727623301/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891609727623301/</a>	0
88	Molten salt reactor		8	Tuomas Santakallio	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/850483945069213/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/850483945069213/</a>	0
88	TWR reactor	<a href="http://nextbigfuture.com/2015/09/bill-gates-terrapower-and-china.html">http://nextbigfuture.com/2015/09/bill-gates-terrapower-and-china.html</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833681970082744/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833681970082744/</a>	0
88	Fusion energy	<a href="http://news.sciencemag.org/physics/2015/06/mystery-company-blazes-trail-fusion-energy">http://news.sciencemag.org/physics/2015/06/mystery-company-blazes-trail-fusion-energy</a> <a href="http://www.gu.se/omuniversitetet/aktuellt/nyheter/detalj//smaskalig-karnfusion-kan-bli-ny-energikalla.cid1323710">http://www.gu.se/omuniversitetet/aktuellt/nyheter/detalj//smaskalig-karnfusion-kan-bli-ny-energikalla.cid1323710</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/81143485640789/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/81143485640789/</a>	0
88	Small nuclear reactors		8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832190756898532/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832190756898532/</a>	0
88	Molten salt reactor review	<a href="http://nextbigfuture.com/2015/09/molten-salt-nuclear-reactor-review-and.html">http://nextbigfuture.com/2015/09/molten-salt-nuclear-reactor-review-and.html</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833360616781546/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833360616781546/</a>	0
88	LENR hypothesis	<a href="http://animpossibleinvention.com/2015/10/15/swedish-scientists-claim-lenr-explanation-break-through/">http://animpossibleinvention.com/2015/10/15/swedish-scientists-claim-lenr-explanation-break-through/</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/840898616027746/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/840898616027746/</a>	0
88	LENR patent	<a href="http://fcnp.com/2015/08/27/the-peak-oil-crisis-cold-fusion-gets-a-u-s-patent/">http://fcnp.com/2015/08/27/the-peak-oil-crisis-cold-fusion-gets-a-u-s-patent/</a>	8	Jouni Tuomela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/818866428230965/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/818866428230965/</a>	0
88	Small Tokamak	<a href="http://news.mit.edu/2015/small-modular-efficient-fusion-plant-0810">http://news.mit.edu/2015/small-modular-efficient-fusion-plant-0810</a>	8	Antti Raike		0
88	Small Tokamak	<a href="http://physicsworld.com/cws/article/news/2015/feb/16/smaller-fusion-reactors-could-deliver-big-gains">http://physicsworld.com/cws/article/news/2015/feb/16/smaller-fusion-reactors-could-deliver-big-gains</a> <a href="https://www.facebook.com/MartinFleischmannMemorialProject/photos/a.587293604634676.1073741827.466698113360893/941079882589378/?type=3&amp;f">https://www.facebook.com/MartinFleischmannMemorialProject/photos/a.587293604634676.1073741827.466698113360893/941079882589378/?type=3&amp;f</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751437128307229/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751437128307229/</a>	0
88	LENR Parkhomov		8	Tapani Alasaarela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/738647566252852/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/738647566252852/</a>	0
88	LENR E-Cat testing report	<a href="http://pressly.it/pIXb">http://pressly.it/pIXb</a> <a href="http://nari.arc.nasa.gov/sites/default/files/Wells_TM_2014-218283%20Low%20Energy%20Nuclear%20Reaction%20">http://nari.arc.nasa.gov/sites/default/files/Wells_TM_2014-218283%20Low%20Energy%20Nuclear%20Reaction%</a>	8	Kate Alhola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/648260565291553/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/648260565291553/</a>	0
88	LENR aircraft		8	Tapani Alasaarela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/652300421554234/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/652300421554234/</a>	0

88	Lockheed fusion	<a href="http://www.theguardian.com/environment/2014/oct/15/lockheed-breakthrough-nuclear-fusion-energy">http://www.theguardian.com/environment/2014/oct/15/lockheed-breakthrough-nuclear-fusion-energy</a>	8	Kai Kaasalainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/652253508225592/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/652253508225592/</a>	0
88	Fusion reactor (High-Beta)	<a href="http://www.washington.edu/news/2014/10/08/uw-fusion-reactor-concept-could-be-cheaper-than-coal/">http://www.washington.edu/news/2014/10/08/uw-fusion-reactor-concept-could-be-cheaper-than-coal/</a>	8	Kate Alhola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/649522205165389/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/649522205165389/</a>	0
88	Thorium reactor	<a href="http://www.youtube.com/watch?v=uK367T7h6ZY">http://www.youtube.com/watch?v=uK367T7h6ZY</a>	8	Jukka Kilpiö	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/648235198627423/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/648235198627423/</a>	0
88	Thorium reactor	<a href="http://www.itheo.org/articles/world%E2%80%99s-first-thorium-reactor-designed">http://www.itheo.org/articles/world%E2%80%99s-first-thorium-reactor-designed</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/600515406732736/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/600515406732736/</a>	0
88	Thorium reactor	<a href="http://youtu.be/N2vzotsvkw">http://youtu.be/N2vzotsvkw</a>	8	Mikko Vuorela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/595090487275228/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/595090487275228/</a>	0
88	Cyclone LENR recruitment	<a href="http://pesn.com/2013/12/04/9602399_Nuclear-Engineer-joins-Cyclone-to-pursue-LENR-Applications/">http://pesn.com/2013/12/04/9602399_Nuclear-Engineer-joins-Cyclone-to-pursue-LENR-Applications/</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/485880231529588/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/485880231529588/</a>	0
88	Small reactor PRISM	<a href="http://en.wikipedia.org/wiki/PRISM_%28reactor%29">http://en.wikipedia.org/wiki/PRISM_%28reactor%29</a>	8	Henri Heinonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/466872393430372/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/466872393430372/</a>	0
88	LENR critics	<a href="https://medium.com/starts-with-a-bang/the-e-cat-cold-fusion-or-scientific-fraud-624f15676f96">https://medium.com/starts-with-a-bang/the-e-cat-cold-fusion-or-scientific-fraud-624f15676f96</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/867241213393486/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/867241213393486/</a>	0
88	Small fusion reactor	<a href="http://motherboard.vice.com/read/an-alternative-approach-to-nuclear-fusion-think-smaller">http://motherboard.vice.com/read/an-alternative-approach-to-nuclear-fusion-think-smaller</a>	8	Mikko Leppänen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/867249403392667/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/867249403392667/</a>	0
88	Fusion power W-7-X in operation	<a href="http://www.ipp.mpg.de/3984226/12_15">http://www.ipp.mpg.de/3984226/12_15</a>	8	Juhani Sademaa	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/863878720396402/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/863878720396402/</a>	0
88	Review of nuclear power development	<a href="http://thirdway.org/report/advanced-nuclear-101">http://thirdway.org/report/advanced-nuclear-101</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834027093381565/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/834027093381565/</a>	0
88	Serial production of small nuclear reactors, fission and fusion		8	2014 Report by the Committee for the Future		4
89	Efficient sodium battery	<a href="http://www.broadbit.com/">http://www.broadbit.com/</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/835176413266633/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/835176413266633/</a>	0
89	Lithium-air battery	<a href="http://phys.org/news/2015-10-path-ultimate-battery.html-jCp">http://phys.org/news/2015-10-path-ultimate-battery.html-jCp</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/846450285472579/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/846450285472579/</a>	0
89	400 Wh/kg battery Bosch	<a href="http://nextbigfuture.com/2015/09/bosch-claims-they-will-commercialize.html">http://nextbigfuture.com/2015/09/bosch-claims-they-will-commercialize.html</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832038970247044/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832038970247044/</a>	0
89	Feasible sodium batteries	<a href="http://phys.org/news/2015-09-cathode-material-possibilities-sodium-ion-batteries.html">http://phys.org/news/2015-09-cathode-material-possibilities-sodium-ion-batteries.html</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832443526873255/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832443526873255/</a>	0
89	Long-lasting built-in batteries	<a href="http://www.kurzweilai.net/rechargeable-batteries-with-almost-indefinite-lifetimes-coming-say-mit-samsung-engineers">http://www.kurzweilai.net/rechargeable-batteries-with-almost-indefinite-lifetimes-coming-say-mit-samsung-engineers</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/817106088406999/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/817106088406999/</a>	0
89	Flexible conductor of boron nitride	<a href="http://www.eurekalert.org/pub_releases/2015-08/ps-fdp080615.php-.VCy_8kTWhuo.facebook">http://www.eurekalert.org/pub_releases/2015-08/ps-fdp080615.php-.VCy_8kTWhuo.facebook</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/808938079223800/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/808938079223800/</a>	0
89	Nano-sandwich material	<a href="http://www.eurekalert.org/pub_releases/2015-08/du-de081415.php">http://www.eurekalert.org/pub_releases/2015-08/du-de081415.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/812491632201778/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/812491632201778/</a>	0
89	Quickly rechargeable battery	<a href="http://www.msn.com/en-us/news/it-insider/an-mit-battery-breakthrough-could-charge-your-smartphone-in-6-minutes/ar-BBIGWuY?ocid=wispr">http://www.msn.com/en-us/news/it-insider/an-mit-battery-breakthrough-could-charge-your-smartphone-in-6-minutes/ar-BBIGWuY?ocid=wispr</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/811798658937742/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/811798658937742/</a>	0
89	Samsung LI battery improves by 50–80%	<a href="http://www.neowin.net/news/samsung-doubles-lithium-battery-capacity-with-graphene-and-silicon">http://www.neowin.net/news/samsung-doubles-lithium-battery-capacity-with-graphene-and-silicon</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/788995721218036/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/788995721218036/</a>	0
89	Supercapacitor made with graphene	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/3d-hybrid-supercapacitor-made-with-graphene">http://spectrum.ieee.org/nanoclast/semiconductors/materials/3d-hybrid-supercapacitor-made-with-graphene</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/742632185854390/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/742632185854390/</a>	0
89	High energy density in lithium-sulphur battery	<a href="http://www.extremetech.com/extreme/200255-glass-coated-sulfur-particles-could-improve-battery-life-1000-percent">http://www.extremetech.com/extreme/200255-glass-coated-sulfur-particles-could-improve-battery-life-1000-percent</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/729011143883161/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/729011143883161/</a>	0
89	Quickly rechargeable battery	<a href="http://www.bbc.com/news/technology-30708945">http://www.bbc.com/news/technology-30708945</a>	7	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/701991466585129/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/701991466585129/</a>	0
89	Higher energy density in lithium battery	<a href="http://www.technologyreview.com/news/533541/a-prototype-battery-could-double-the-range-of-electric-cars/">http://www.technologyreview.com/news/533541/a-prototype-battery-could-double-the-range-of-electric-cars/</a>	8	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/694232324027710/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/694232324027710/</a>	0
89	Graphene-based supercapacitors	<a href="http://www.itscience.com/technology/graphene-based-supercapacitors-could-eliminate-batteries-electric-cars-within-5-years">http://www.itscience.com/technology/graphene-based-supercapacitors-could-eliminate-batteries-electric-cars-within-5-years</a>	6	Micco Juvonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/667237250060551/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/667237250060551/</a>	0
89	Graphene capacitor charger keeps devices powered on the go	<a href="http://androidcommunity.com/zaago-graphene-supercapacitor-charger-charges-in-five-minutes-20141111/">http://androidcommunity.com/zaago-graphene-supercapacitor-charger-charges-in-five-minutes-20141111/</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/666411490143127/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/666411490143127/</a>	0
89	Carbon nanotube supercapacitor	<a href="http://cleantechnica.com/2014/05/12/new-graphene-carbon-nanotube-supercapacitor/">http://cleantechnica.com/2014/05/12/new-graphene-carbon-nanotube-supercapacitor/</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/566755226775421/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/566755226775421/</a>	0
89	Supercapacitors made with cellulose	<a href="http://www.nanotech-now.com/news.cgi?story_id=49290">http://www.nanotech-now.com/news.cgi?story_id=49290</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/547895975328013/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/547895975328013/</a>	0
89	Supercapacitor made with graphene	<a href="http://www.extremetech.com/computing/163071-graphene-supercapacitors-created-with-traditional-paper-making-process-rivals-lead-acid-battery">http://www.extremetech.com/computing/163071-graphene-supercapacitors-created-with-traditional-paper-making-process-rivals-lead-acid-battery</a>	8	Antti Halonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/452140991570179/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/452140991570179/</a>	0
89	Plastic supercapacitor using LIG process	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/laserinduced-graphene-looks-to-duplicate-batteries-with-supercapacitors">http://spectrum.ieee.org/nanoclast/semiconductors/materials/laserinduced-graphene-looks-to-duplicate-batteries-with-supercapacitors</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/861254997325441/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/861254997325441/</a>	0

89	Supercapacitors made with cellulose	<a href="http://www.sciencedaily.com/releases/2015/12/151203111337.htm">http://www.sciencedaily.com/releases/2015/12/151203111337.htm</a>	8	Marko Mikael Tenkanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/860521894065418/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/860521894065418/</a>	0
89	Rapidly charging light batteries and supercapacitors		8	2014 Report by the Committee for the Future		4
89	Li battery keeps itself warm in cold weather	<a href="http://www.gizmag.com/all-climate-lithium-battery/41429/">http://www.gizmag.com/all-climate-lithium-battery/41429/</a>	8	Jarmo Martela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885330458251228/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885330458251228/</a>	0
89	\$54/kWh polymer battery in the pipeline	<a href="http://cleantechnica.com/2016/02/26/new-energy-storage-solution-could-hit-magic-54-mark/">http://cleantechnica.com/2016/02/26/new-energy-storage-solution-could-hit-magic-54-mark/</a> <a href="http://spectrum.ieee.org/transportation/advanced-cars/an-electric-car-battery-that-will-get-you-from-paris-to-brussels-and-back">http://spectrum.ieee.org/transportation/advanced-cars/an-electric-car-battery-that-will-get-you-from-paris-to-brussels-and-back</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/905646879552919/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/905646879552919/</a>	0
89	Lithium-air battery under development		8	Aino Tuominen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/906707259446881/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/906707259446881/</a>	0
90	Low-cost battery material	<a href="http://www.gizmag.com/fools-gold-replace-lithium-batteries/40404/">http://www.gizmag.com/fools-gold-replace-lithium-batteries/40404/</a>	8	Pekka Pasanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/854978051286469/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/854978051286469/</a>	0
90	Low-cost battery material	<a href="http://pubs.acs.org/doi/abs/10.1021/acs.chemmater.5b03531?journalCode=cmater&amp;">http://pubs.acs.org/doi/abs/10.1021/acs.chemmater.5b03531?journalCode=cmater&amp;</a>	8	Arvo Kukko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/854113521372922/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/854113521372922/</a>	0
90	Flux capacitor	<a href="http://advances.sciencemag.org/content/advances/1/9/e1500605.full.pdf">http://advances.sciencemag.org/content/advances/1/9/e1500605.full.pdf</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845087472275527/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845087472275527/</a>	0
90	Molten salt-based storage of energy	<a href="http://spectrum.ieee.org/green-tech/solar/a-tower-of-molten-salt-will-deliver-solar-power-after-sunset">http://spectrum.ieee.org/green-tech/solar/a-tower-of-molten-salt-will-deliver-solar-power-after-sunset</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/843698025747805/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/843698025747805/</a>	0
90	Aquion salt water battery	<a href="http://www.aquionenergy.com/grid-scale-batteries">http://www.aquionenergy.com/grid-scale-batteries</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833376666779941/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833376666779941/</a>	0
90	Flow battery for homes	<a href="http://www.eurekalert.org/pub_releases/2015-09/hu-gsf091715.php">http://www.eurekalert.org/pub_releases/2015-09/hu-gsf091715.php</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832984743485800/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832984743485800/</a>	0
90	Profitability of energy storage in the USA	<a href="http://www.greentechmedia.com/articles/read/battery-storage-pays-back-in-less-than-five-years-sc-finds">http://www.greentechmedia.com/articles/read/battery-storage-pays-back-in-less-than-five-years-sc-finds</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/766632703454338/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/766632703454338/</a>	0
90	VTT's study on energy storage systems	<a href="http://www.vtt.fi/inf/pdf/tiedotteet/2003/T2199.pdf">http://www.vtt.fi/inf/pdf/tiedotteet/2003/T2199.pdf</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/765174250266850/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/765174250266850/</a>	0
90	Tesla battery for houses	<a href="http://thenextweb.com/gadgets/2015/05/01/elonricity/">http://thenextweb.com/gadgets/2015/05/01/elonricity/</a> <a href="https://energy.stanford.edu/news/aluminum-battery-stanford-offers-safe-alternative-conventional-batteries">https://energy.stanford.edu/news/aluminum-battery-stanford-offers-safe-alternative-conventional-batteries</a>	8	Sami Niemelä, Ari Lanamäki	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/761705180613757/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/761705180613757/</a>	0
90	Aluminium battery	<a href="http://cleantechnica.com/2015/01/29/eos-energy-storages-aurora-battery-system-commercially-available-2016-160kwh/">http://cleantechnica.com/2015/01/29/eos-energy-storages-aurora-battery-system-commercially-available-2016-160kwh/</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/749450965172512/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/749450965172512/</a>	0
90	EOS Aurora \$160/kWh		8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/712829355501340/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/712829355501340/</a>	0
90	Summary of energy storage systems	<a href="http://energystorage.org/system/files/resources/2014storageplanassessment-recs-for-doe-sep2014.pdf">http://energystorage.org/system/files/resources/2014storageplanassessment-recs-for-doe-sep2014.pdf</a>	8	Tero Kauppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/681842951933314/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/681842951933314/</a>	0
90	Flow battery EUR 240/kWh	<a href="https://cleantechnica.com/2014/12/01/us-navy-pushes-solar-energy-storage-solution/">https://cleantechnica.com/2014/12/01/us-navy-pushes-solar-energy-storage-solution/</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/678144028969873/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/678144028969873/</a>	0
90	Flow battery	<a href="http://jes.ecsdl.org/content/161/9/A1371.full?sid=e4be8ba7-839f-4669-9a85-5b9c42d73289">http://jes.ecsdl.org/content/161/9/A1371.full?sid=e4be8ba7-839f-4669-9a85-5b9c42d73289</a>	8	Toke Lahti	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/652569251527351/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/652569251527351/</a>	0
90	Undersea energy storage	<a href="http://dspace.mit.edu/handle/1721.1/78934">http://dspace.mit.edu/handle/1721.1/78934</a> <a href="http://www.acs.org/content/acs/en/pressroom/new-releases/2014/august/could-hemp-nanosheets-topple-graphene-for-making-the-ideal-">http://www.acs.org/content/acs/en/pressroom/new-releases/2014/august/could-hemp-nanosheets-topple-graphene-for-making-the-ideal-</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/640959802688296/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/640959802688296/</a>	0
90	Hemp as battery material		8	Marita Kaatrala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/617509298366680/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/617509298366680/</a>	0
90	Market forecast for energy storage systems	<a href="http://cleantechnica.com/2014/06/09/solar-energy-storage-system-market-germany-approaching-boom/">http://cleantechnica.com/2014/06/09/solar-energy-storage-system-market-germany-approaching-boom/</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/580636028720674/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/580636028720674/</a>	0
90	Tesla's Gigafactory \$5 billion	<a href="http://www.batterynews.org/2014/02/27/tesla-open-5-billion-battery-factory-electric-cars/">http://www.batterynews.org/2014/02/27/tesla-open-5-billion-battery-factory-electric-cars/</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/528498047267806/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/528498047267806/</a>	0
90	Sugar battery	<a href="http://phys.org/news/2014-01-energy-dense-sugar-battery.html">http://phys.org/news/2014-01-energy-dense-sugar-battery.html</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/508890312561913/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/508890312561913/</a>	0
90	Metal powders for fuel	<a href="http://www.eurekalert.org/pub_releases/2015-12/mu-cmp120915.php">http://www.eurekalert.org/pub_releases/2015-12/mu-cmp120915.php</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/863508380433436/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/863508380433436/</a>	0
90	Massive storage of energy in high capacity batteries		8	2014 Report by the Committee for the Future		4
90	Costs of energy storage down by 70% by 2030	<a href="https://www.worldenergy.org/publications/2016/e-storage-shifting-from-cost-to-value-2016/">https://www.worldenergy.org/publications/2016/e-storage-shifting-from-cost-to-value-2016/</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/888171271300480/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/888171271300480/</a>	0
90	Energy storage in soil cylinder	<a href="http://www.heindl-energy.com/hydraulic-rock-storage/overview.html">http://www.heindl-energy.com/hydraulic-rock-storage/overview.html</a>	8	Toke Lahti	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/888895501228057/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/888895501228057/</a>	0
91	Heat capture AHOOD	<a href="http://koti.ts.fi/rakenna/aktiivivaippa-nappaa-ilmaislammun-talteen">http://koti.ts.fi/rakenna/aktiivivaippa-nappaa-ilmaislammun-talteen</a> <a href="http://www.tekniikkatalous.fi/tekniikka/suomalaisiryitys-kehitti-mullistavan-kaukolampoputken-siirron-hyotysuhde-100-prosenttiin-6064861">http://www.tekniikkatalous.fi/tekniikka/suomalaisiryitys-kehitti-mullistavan-kaukolampoputken-siirron-hyotysuhde-100-prosenttiin-6064861</a>	8	Martti Kallinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/855798567871084/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/855798567871084/</a>	0
91	Capture of district heat		8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/853915394726068/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/853915394726068/</a>	0
91	Solar heat Polarsol	<a href="http://www.polarsol.com/">http://www.polarsol.com/</a>	8	Ilkka Kakko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/763419560442319/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/763419560442319/</a>	0

91	Storage of solar heat, phase change	<a href="http://www.google.com/patents/US8231804">http://www.google.com/patents/US8231804</a> <a href="http://spectrum.ieee.org/tech-talk/green-tech/solar/passive-radiators-cool-by-sending-heat-straight-to-outer-space">http://spectrum.ieee.org/tech-talk/green-tech/solar/passive-radiators-cool-by-sending-heat-straight-to-outer-space</a>	8	Esa Turtiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751550861629189/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/751550861629189/</a>	0
91	Passive radiator for cooling	<a href="http://www.theguardian.com/environment/2014/sep/28/solar-energy-sunflower-ibm-airlight-electricity">http://www.theguardian.com/environment/2014/sep/28/solar-energy-sunflower-ibm-airlight-electricity</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/728122147305394/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/728122147305394/</a>	0
91	IBM 80% solar energy collector	<a href="https://www.facebook.com/st1suomi/videos/1122831784394302/?fref=nf">https://www.facebook.com/st1suomi/videos/1122831784394302/?fref=nf</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/641765135941096/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/641765135941096/</a>	0
91	Geothermal heat from depths (ST1)	<a href="http://www.solixi.com/index.cfm?siivu=176">http://www.solixi.com/index.cfm?siivu=176</a>	8	Tero Kauppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/866902050094069/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/866902050094069/</a>	0
91	Solixi energy storage		8	Jyri Jaakkola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859930504124557/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859930504124557/</a>	0
91	Solar heat and long term storage of heat	<a href="http://yle.fi/uutiset/espoossa_aletaan_nostaa_kauko_lampoa_maasta_120_asteista_vetta_kilometrien_sy_vydesta/7657222">http://yle.fi/uutiset/espoossa_aletaan_nostaa_kauko_lampoa_maasta_120_asteista_vetta_kilometrien_sy_vydesta/7657222</a>	8	2014 Report by the Committee for the Future		3
91	Geothermal power plant in Espoo	<a href="http://www.chiyoda-corp.com/news/en/2013/post_77.html">http://www.chiyoda-corp.com/news/en/2013/post_77.html</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/675458432571766/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/675458432571766/</a>	0
92	Storage of hydrogen in toluene	<a href="http://phys.org/news/2015-06-simple-hydrogen-storage-solution-powered.html">http://phys.org/news/2015-06-simple-hydrogen-storage-solution-powered.html</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/709638262487116/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/709638262487116/</a>	0
92	Inexpensive storage of hydrogen in nanostructures	<a href="http://phys.org/news/2014-06-hydrogen-breakthrough-game-changer-future-car.html">http://phys.org/news/2014-06-hydrogen-breakthrough-game-changer-future-car.html</a> <a href="http://www.scienceworldreport.com/articles/12112/20140110/wireless-power-transfer-range-vastly-extended-with-superlens.htm">http://www.scienceworldreport.com/articles/12112/20140110/wireless-power-transfer-range-vastly-extended-with-superlens.htm</a>	8	2014 Report by the Committee for the Future		2
92	Storage of hydrogen in benzene using solar energy	<a href="http://www.digitaltrends.com/cool-tech/ossia-cota-wireless-charging/">http://www.digitaltrends.com/cool-tech/ossia-cota-wireless-charging/</a> <a href="http://spectrum.ieee.org/tech-talk/consumer-electronics/portable-devices/wicharge-promises-phone-charging-by-infrared-laser">http://spectrum.ieee.org/tech-talk/consumer-electronics/portable-devices/wicharge-promises-phone-charging-by-infrared-laser</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891633647620909/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891633647620909/</a>	0
92	Transportation of hydrogen (in cars)	<a href="http://www.uusisuomi.fi/teknologia/75325-usan-armeija-otti-juuri-kayttoon-1-laseraseen-047-eu-laukaus">http://www.uusisuomi.fi/teknologia/75325-usan-armeija-otti-juuri-kayttoon-1-laseraseen-047-eu-laukaus</a>	8	Ilkka Pirttimaa	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/604089699708640/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/604089699708640/</a>	0
93	Wireless electricity transmission	<a href="http://www.theguardian.com/technology/2015/oct/07/drone-death-ray-device-liteye-auds?CMP=twi_a-technology_b-gdntech">http://www.theguardian.com/technology/2015/oct/07/drone-death-ray-device-liteye-auds?CMP=twi_a-technology_b-gdntech</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/500991693351775/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/500991693351775/</a>	0
93	Wireless charging of cars	<a href="http://www.engadget.com/2015/03/04/lockheed-martin-laser-athena-test/?ncid=rss_truncated">http://www.engadget.com/2015/03/04/lockheed-martin-laser-athena-test/?ncid=rss_truncated</a>	4	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/744463319004610/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/744463319004610/</a>	0
93	Wireless charging 10 m	<a href="http://news.yahoo.com/blogs/power-players-abc-news/technologies-once-available-only-in-movies-are-now-a-reality-for-the-us-navy-225652354.html">http://news.yahoo.com/blogs/power-players-abc-news/technologies-once-available-only-in-movies-are-now-a-reality-for-the-us-navy-225652354.html</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/449089501875328/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/449089501875328/</a>	0
93	Wireless electricity transmission (magnetism) for electric cars and other	<a href="http://yle.fi/uutiset/venaja_esittelee_mikroaaltokanun_tuhoaa_lentokoneiden_ja_lennokkien_elektroiniikan/8075687">http://yle.fi/uutiset/venaja_esittelee_mikroaaltokanun_tuhoaa_lentokoneiden_ja_lennokkien_elektroiniikan/8075687</a>	8	2014 Report by the Committee for the Future		2
93	Wireless charging	<a href="http://www.miltechmag.com/2014/03/todays-directed-energy-weapons-meeting.html">http://www.miltechmag.com/2014/03/todays-directed-energy-weapons-meeting.html</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/877861608998113/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/877861608998113/</a>	0
93	Cota wireless charging 10 m + other links	<a href="http://www.petapixel.com/2015/07/23/anti-drone-systems-are-starting-to-take-off/-more-173279">http://www.petapixel.com/2015/07/23/anti-drone-systems-are-starting-to-take-off/-more-173279</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891701010947506/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891701010947506/</a>	0
93	Wireless charging by infrared laser	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/837460756371532/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/837460756371532/</a>	8	Kari Vahtiala		0
94	Anti-UAV	<a href="http://www.engage.com/2015/03/04/lockheed-martin-laser-athena-test/?ncid=rss_truncated">http://www.engage.com/2015/03/04/lockheed-martin-laser-athena-test/?ncid=rss_truncated</a>	4	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/802341639883444/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/802341639883444/</a>	0
94	Antidrone weapons	<a href="http://www.uusisuomi.fi/teknologia/75325-usan-armeija-otti-juuri-kayttoon-1-laseraseen-047-eu-laukaus">http://www.uusisuomi.fi/teknologia/75325-usan-armeija-otti-juuri-kayttoon-1-laseraseen-047-eu-laukaus</a>	4	Hannu Kokko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/724760194308256/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/724760194308256/</a>	0
94	Laser weapon stops car	<a href="http://news.yahoo.com/blogs/power-players-abc-news/technologies-once-available-only-in-movies-are-now-a-reality-for-the-us-navy-225652354.html">http://news.yahoo.com/blogs/power-players-abc-news/technologies-once-available-only-in-movies-are-now-a-reality-for-the-us-navy-225652354.html</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/730705473713728/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/730705473713728/</a>	0
94	Bofors HMP directed energy weapon	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/681848301932779/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/681848301932779/</a>	4	Harri Vartiainen		0
94	UAV combatting	<a href="http://www.miltechmag.com/2014/03/todays-directed-energy-weapons-meeting.html">http://www.miltechmag.com/2014/03/todays-directed-energy-weapons-meeting.html</a>	4	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/646567452127531/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/646567452127531/</a>	0
94	Laser weapon in use (USA)	<a href="http://www.uusisuomi.fi/teknologia/75325-usan-armeija-otti-juuri-kayttoon-1-laseraseen-047-eu-laukaus">http://www.uusisuomi.fi/teknologia/75325-usan-armeija-otti-juuri-kayttoon-1-laseraseen-047-eu-laukaus</a>	4	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/749534878497454/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/749534878497454/</a>	0
94	US Navy development projects High performance lasers, wireless power transfer, laser weapons	<a href="http://www.miltechmag.com/2014/03/todays-directed-energy-weapons-meeting.html">http://www.miltechmag.com/2014/03/todays-directed-energy-weapons-meeting.html</a>	4	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/783751681742440/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/783751681742440/</a>	0
94	EMP cannon	<a href="http://yle.fi/uutiset/venaja_esittelee_mikroaaltokanun_tuhoaa_lentokoneiden_ja_lennokkien_elektroiniikan/8075687">http://yle.fi/uutiset/venaja_esittelee_mikroaaltokanun_tuhoaa_lentokoneiden_ja_lennokkien_elektroiniikan/8075687</a>	4	Jani Ehro		0
95	Nanoradio	<a href="http://www.engadget.com/2015/03/04/lockheed-martin-laser-athena-test/?ncid=rss_truncated">http://www.engadget.com/2015/03/04/lockheed-martin-laser-athena-test/?ncid=rss_truncated</a>	1	2014 Report by the Committee for the Future		2
95	Injectable-size intrabody radio transmitter	<a href="http://www.uusisuomi.fi/teknologia/75325-usan-armeija-otti-juuri-kayttoon-1-laseraseen-047-eu-laukaus">http://www.uusisuomi.fi/teknologia/75325-usan-armeija-otti-juuri-kayttoon-1-laseraseen-047-eu-laukaus</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/899199340197673/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/899199340197673/</a>	0
96	LIFI 100Gbit/s	<a href="http://www.electronicstimes.com/en/li-fi-achieves-224-gbps-data-transmission-speeds-with-room-scale-">http://www.electronicstimes.com/en/li-fi-achieves-224-gbps-data-transmission-speeds-with-room-scale-</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/722918907825718/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/722918907825718/</a>	0
96	LIFI achieves 224-Gbps data transmission speed		1	Seppo Nikkilä		0

96	LiFi identification, etc.	<a href="http://spectrum.ieee.org/tech-talk/telecom/wireless/fuuitsu-forges-lifiike-gr-code">http://spectrum.ieee.org/tech-talk/telecom/wireless/fuuitsu-forges-lifiike-gr-code</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/720944504689825/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/720944504689825/</a>	0
96	LED 'radio'			2014 Report by the Committee for the Future		3
96	Photonics modem (NASA)	<a href="http://www.kurzweilai.net/nasa-engineers-to-build-first-integrated-photonics-modem">http://www.kurzweilai.net/nasa-engineers-to-build-first-integrated-photonics-modem</a>	1	Tapio Rinne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893773807406893/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893773807406893/</a>	0
97	Doubling of speed on the radio path	<a href="http://www.technologyreview.com/news/532616/simple-circuit-could-double-cell-phone-data-speeds/">http://www.technologyreview.com/news/532616/simple-circuit-could-double-cell-phone-data-speeds/</a> <a href="http://www.scienceworldreport.com/articles/14261/20140425/using-light-and-microresonators-for-ultra-fast-data-transmission.htm">http://www.scienceworldreport.com/articles/14261/20140425/using-light-and-microresonators-for-ultra-fast-data-transmission.htm</a>	1	Arvo Kukko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/673773236073619/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/673773236073619/</a>	0
97	Transmission speed 1 Tb/s		3	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/560118714105739/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/560118714105739/</a>	0
97	Discussion of vortex beam Wireless transmission 2.5 terabytes per second (vortex beam)		1	Arvo Kukko, Ossi Pöllänen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/536384249812519/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/536384249812519/</a>	0
97	Vortex beam and quantum entanglement	<a href="http://spectrum.ieee.org/telecom/security/two-steps-closer-to-a-quantum-internet">http://spectrum.ieee.org/telecom/security/two-steps-closer-to-a-quantum-internet</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/874361776014763/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/874361776014763/</a>	0
98	Multi-channel communication and software-based controlling of information			2014 Report by the Committee for the Future		3
99	Paypal/Bitcoin during the euro crisis	<a href="https://www.cryptocoinsnews.com/paypal-shuts-greece-bitcoin-still-operates/">https://www.cryptocoinsnews.com/paypal-shuts-greece-bitcoin-still-operates/</a> <a href="http://www.slideshare.net/PekkoVehvilinen/worlds-first-bitcoin-transfer-into-a-human-this-is-how-we-did-it">http://www.slideshare.net/PekkoVehvilinen/worlds-first-bitcoin-transfer-into-a-human-this-is-how-we-did-it</a>	9	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/79690720426836/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/79690720426836/</a>	0
99	Subcutaneous Bitcoin wallet		1	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/725867407530868/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/725867407530868/</a>	0
99	Bitcoin via radio	<a href="http://kryptoradio.koodilehto.fi/">http://kryptoradio.koodilehto.fi/</a>	9	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/598872840230326/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/598872840230326/</a>	0
99	Electronic money, time banks			2014 Report by the Committee for the Future		3
99	Blockchain money for Tunisia's post office	<a href="http://goo.gl/qwGDTH">http://goo.gl/qwGDTH</a>	10	Tom Starwalker	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/874242423693364/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/874242423693364/</a>	0
99	Bitcoin critics	<a href="https://www.washingtonpost.com/news/innovations/wp/2016/01/19/r-i-p-bitcoin-its-time-to-move-on/">https://www.washingtonpost.com/news/innovations/wp/2016/01/19/r-i-p-bitcoin-its-time-to-move-on/</a> <a href="http://spectrum.ieee.org/cars-that-think/transportation/infrastructure/cars-talk-to-cars-on-the-autobahn">http://spectrum.ieee.org/cars-that-think/transportation/infrastructure/cars-talk-to-cars-on-the-autobahn</a>	10	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/884531404997800/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/884531404997800/</a>	0
100	Car-to-car communication		9	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/853950004722607/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/853950004722607/</a>	0
100	Internet of space	<a href="https://tools.ietf.org/html/rfc4838">https://tools.ietf.org/html/rfc4838</a>	1	Tuomas Santakallio	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/710122612438681/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/710122612438681/</a>	0
100	Internet for robots	<a href="http://www.fastcoexist.com/3024972/robots-can-now-teach-other-robots-thanks-to-the-robo-internet">http://www.fastcoexist.com/3024972/robots-can-now-teach-other-robots-thanks-to-the-robo-internet</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/587159278068349/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/587159278068349/</a>	0
100	Internet for robots	<a href="http://www.bbc.co.uk/news/technology-25727110">http://www.bbc.co.uk/news/technology-25727110</a>	1	Aki Airomaa, Mari Heimala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/504526856331592/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/504526856331592/</a>	0
100	Internet for robots			2014 Report by the Committee for the Future		3
100	5G, IOT situation in 2016	<a href="http://www.techweekeurope.co.uk/networks/voip/mobile-telecoms-predictions-2016-182776">http://www.techweekeurope.co.uk/networks/voip/mobile-telecoms-predictions-2016-182776</a> <a href="http://indianexpress.com/article/technology/tech-news-technology/google-project-skybender-5g-internet-planes/">http://indianexpress.com/article/technology/tech-news-technology/google-project-skybender-5g-internet-planes/</a>	10	Timo Ali-Vehmas	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875239235927017/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875239235927017/</a>	0
100	Google's Skybender 5G plan uses millimetre waves	<a href="http://www.tut.fi/tietoa-yliopistosta/uutiset-ja-tapahtumat/5g-tarvitsee-digitaalista-signaalikasittelya-x123729c2">http://www.tut.fi/tietoa-yliopistosta/uutiset-ja-tapahtumat/5g-tarvitsee-digitaalista-signaalikasittelya-x123729c2</a>	10	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890337231083884/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/890337231083884/</a>	0
100	5G networks		10	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/842821732502101/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/842821732502101/</a>	0
100	5G networks	<a href="https://www.facebook.com/ZTECorp/photos/pcb.755127304567731/755126827901112/?type=3">https://www.facebook.com/ZTECorp/photos/pcb.755127304567731/755126827901112/?type=3</a>	10	Antti-Pekka Puonti	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/691648474286095/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/691648474286095/</a>	0
100	Nokia 5G White-Paper	<a href="http://hsn.com/file/28771/hsn-5g-white-paper?download">http://hsn.com/file/28771/hsn-5g-white-paper?download</a> <a href="http://www.fastcoexist.com/3048492/in-this-huge-urban-farming-lab-led-recipes-grow-juicier-tomatoes-and-sweeter-basil">http://www.fastcoexist.com/3048492/in-this-huge-urban-farming-lab-led-recipes-grow-juicier-tomatoes-and-sweeter-basil</a>	10	Ossi Pöllänen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/538030412981236/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/538030412981236/</a>	0
101	LED cultivation (Philips)		7	Jouni Valkonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/803516053099336/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/803516053099336/</a>	0
101	Lighting and milk production	<a href="http://www.nyteknik.se/nyheter/energi_miljo/article3933600.ece">http://www.nyteknik.se/nyheter/energi_miljo/article3933600.ece</a>	7	Jouni Tuomela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832994730151468/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832994730151468/</a>	0
101	LED cultivation in Finland	<a href="http://www.silmusalaatti.fi/viljely/">http://www.silmusalaatti.fi/viljely/</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/820959908021617/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/820959908021617/</a>	0
101	LED cultivation at Silmusalaatti	<a href="http://www.hs.fi/tiede/a1439520997977?jako=65a7ada6a9f2a41fd8d132dbdfb3863e&amp;ref=tw-share">http://www.hs.fi/tiede/a1439520997977?jako=65a7ada6a9f2a41fd8d132dbdfb3863e&amp;ref=tw-share</a>	7	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/813200995464175/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/813200995464175/</a>	0
101	Vertical cultivation	<a href="http://iq.intel.com/could-high-tech-vertical-farming-feed-the-future/">http://iq.intel.com/could-high-tech-vertical-farming-feed-the-future/</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/779414852176123/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/779414852176123/</a>	0
101	Grasshoppers grown in containers	<a href="http://www.kauppalehti.fi/uutiset/tama-keksinto-ratkaisee-nalanhadan-maailmasta/3ESU7BIR">http://www.kauppalehti.fi/uutiset/tama-keksinto-ratkaisee-nalanhadan-maailmasta/3ESU7BIR</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/779234195527522/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/779234195527522/</a>	0

101	Indoor cultivation, hemp	<a href="http://www.mielleyhtyma.com/wp/there-no-business-like-business/kivi-paperi-hamppu/">http://www.mielleyhtyma.com/wp/there-no-business-like-business/kivi-paperi-hamppu/</a>	7	Petja Jäppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/756334554484153/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/756334554484153/</a>	0
101	Urban/multilayer cultivation	<a href="http://weburbanist.com/2015/04/02/plantlab-urban-farms-40-times-more-productive-than-open-fields/">http://weburbanist.com/2015/04/02/plantlab-urban-farms-40-times-more-productive-than-open-fields/</a> <a href="http://upriser.com/posts/largest-indoor-farm-100x-more-productive-99-less-water-40-less-power-80-less-waste">http://upriser.com/posts/largest-indoor-farm-100x-more-productive-99-less-water-40-less-power-80-less-waste</a>	7	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/746730465444562/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/746730465444562/</a>	0
101	LED multi-layer cultivation (Japan)	<a href="http://www.kauppalehti.fi/omaviritys/suomalainen+alypuutarha+leviaa+tanskassa+ja+saksassa/201412711806">http://www.kauppalehti.fi/omaviritys/suomalainen+alypuutarha+leviaa+tanskassa+ja+saksassa/201412711806</a>	7	Petja Jäppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/703617016422574/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/703617016422574/</a>	0
101	Kitchen cultivation product		7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/681514218632854/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/681514218632854/</a>	0
101	Vertical cultivation	<a href="http://www.youtube.com/watch?v=2nFQOkzEjxQ">http://www.youtube.com/watch?v=2nFQOkzEjxQ</a>	7	Antti Kivivalli	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/506949762755968/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/506949762755968/</a>	0
101	Cultivation experiment on the Moon	<a href="http://newswatch.nationalgeographic.com/2013/12/05/nasa-may-test-its-lunar-green-thumb/">http://newswatch.nationalgeographic.com/2013/12/05/nasa-may-test-its-lunar-green-thumb/</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/482724901845121/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/482724901845121/</a>	0
101	Urban multilayer cultivation/LED cultivation		7	Preliminary investigation – new		4
101	Commercialised container cultivation, EUR 20,000/year	<a href="https://www.facebook.com/HuffingtonPost/videos/10153593374106130/">https://www.facebook.com/HuffingtonPost/videos/10153593374106130/</a>	7	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/880053315445609/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/880053315445609/</a>	0
101	Critical (incompletely) view to vertical cultivation	<a href="https://usu.app.box.com/s/6t2qfa3xng2bb4rpa2536lg4yrgf4sug">https://usu.app.box.com/s/6t2qfa3xng2bb4rpa2536lg4yrgf4sug</a> <a href="http://spectrum.ieee.org/computing/embedded-systems/mits-food-computer-the-future-of-urban-agriculture">http://spectrum.ieee.org/computing/embedded-systems/mits-food-computer-the-future-of-urban-agriculture</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875599375891003/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875599375891003/</a>	0
101	MIT invests in LED/vertical cultivation	<a href="http://spectrum.ieee.org/computing/embedded-systems/mits-food-computer-the-future-of-urban-agriculture">http://spectrum.ieee.org/computing/embedded-systems/mits-food-computer-the-future-of-urban-agriculture</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885048428279431/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/885048428279431/</a>	0
101	Product of LED/container cultivation	<a href="https://www.facebook.com/HuffingtonPost/videos/10153593374106130/?fref=nf">https://www.facebook.com/HuffingtonPost/videos/10153593374106130/?fref=nf</a>	7	Petja Jäppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/884552081662399/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/884552081662399/</a>	0
102	Sugar fuel cell	<a href="https://www.facebook.com/download/915787981841799/P020141125389402985500.pdf">https://www.facebook.com/download/915787981841799/P020141125389402985500.pdf</a>	8	Tuomas Santakallio	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/855849681199306/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/855849681199306/</a>	0
102	Electricity from methane	<a href="http://phys.org/news/2015-10-microorganisms-sea-power-nanowire-cables.html">http://phys.org/news/2015-10-microorganisms-sea-power-nanowire-cables.html</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/843697422414532/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/843697422414532/</a>	0
102	Microbial fuel cell	<a href="https://en.wikipedia.org/wiki/Microbial_fuel_cell">https://en.wikipedia.org/wiki/Microbial_fuel_cell</a> <a href="https://www.iea.org/publications/freepublications/publication/TechnologyRoadmapHydrogenandFuelCells.pdf">https://www.iea.org/publications/freepublications/publication/TechnologyRoadmapHydrogenandFuelCells.pdf</a>	8	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/732807203503555/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/732807203503555/</a>	0
102	Fuel cell review	<a href="http://spectrum.ieee.org/energywise/green-tech/fuel-cells/ge-claims-fuel-cell-breakthrough-starts-pilot-production">http://spectrum.ieee.org/energywise/green-tech/fuel-cells/ge-claims-fuel-cell-breakthrough-starts-pilot-production</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832652090185732/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/832652090185732/</a>	0
102	Fuel cells 95% S+L		8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/815757875208487/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/815757875208487/</a>	0
102	Small fuel cells	<a href="http://www.redoxpowersystems.com/products/">http://www.redoxpowersystems.com/products/</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/708905162560426/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/708905162560426/</a>	0
102	Toyota gives away fuel cell patents	<a href="http://www.geekwire.com/2015/toyota-gives-away-patents-build-game-changing-car-future/">http://www.geekwire.com/2015/toyota-gives-away-patents-build-game-changing-car-future/</a>	8	Kalle Varvikko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/709110569206552/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/709110569206552/</a>	0
102	5,000 fuel cell patents made available (Toyota)	<a href="http://www.geekwire.com/2015/toyota-gives-away-patents-build-game-changing-car-future/">http://www.geekwire.com/2015/toyota-gives-away-patents-build-game-changing-car-future/</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/700644416719834/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/700644416719834/</a>	0
102	Fuel cell (commercial)	<a href="http://www.powercell.se/products/fuel-cell/">http://www.powercell.se/products/fuel-cell/</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/816559255128349/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/816559255128349/</a>	0
102	Inexpensive small fuel cell		8	Preliminary investigation – new		4
102	Nickel to replace platinum in fuel cells	<a href="http://www.eurekalert.org/pub_releases/2016-01/uod-fca011416.php">http://www.eurekalert.org/pub_releases/2016-01/uod-fca011416.php</a> <a href="http://www.viessmann-us.com/content/dam/internet-global/pdf_documents/com/brochures_english/ppr-">http://www.viessmann-us.com/content/dam/internet-global/pdf_documents/com/brochures_english/ppr-</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/88308521809055/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/88308521809055/</a>	0
102	Over 80% efficiency in household fuel cell	<a href="http://www.viessmann-us.com/content/dam/internet-global/pdf_documents/com/brochures_english/ppr-">http://www.viessmann-us.com/content/dam/internet-global/pdf_documents/com/brochures_english/ppr-</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/88331365117804/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/88331365117804/</a>	0
103	Tesla 800 km on a single charge	<a href="http://nextbigfuture.com/2015/09/tesla-model-s-driven-452-miles-on.html">http://nextbigfuture.com/2015/09/tesla-model-s-driven-452-miles-on.html</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/821214991329442/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/821214991329442/</a>	0
103	Rolling friction into energy	<a href="http://www.eurekalert.org/pub_releases/2015-06/uow-nnh062915.php">http://www.eurekalert.org/pub_releases/2015-06/uow-nnh062915.php</a>	4	Kari Vahtiala	<a href="http://www.eurekalert.org/pub_releases/2015-06/uow-nnh062915.php">http://www.eurekalert.org/pub_releases/2015-06/uow-nnh062915.php</a>	0
103	Airless tyre (Michelin)	<a href="http://www.kauppalehti.fi/etusivu/michelin+avasi+il-mattomien+renkaiden+tehtaan/201411709584">http://www.kauppalehti.fi/etusivu/michelin+avasi+il-mattomien+renkaiden+tehtaan/201411709584</a>	4	Arvo Kukko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/673269949457281/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/673269949457281/</a>	0
103	Compressed air car AIRPod	<a href="http://themindunleashed.org/2014/05/10000-car-runs-air.html">http://themindunleashed.org/2014/05/10000-car-runs-air.html</a>	4	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/648136838637259/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/648136838637259/</a>	0
103	Compressed air/gas hybrid car	<a href="http://www.engadget.com/2014/10/03/citroen-airflow-2l-concept-hands-on/">http://www.engadget.com/2014/10/03/citroen-airflow-2l-concept-hands-on/</a> <a href="http://www.helahalsingland.se/allmant/halsingland/nu-borjar-den-varldsunika-elvagen-mellan-sandviken-och-storvik-byggas">http://www.helahalsingland.se/allmant/halsingland/nu-borjar-den-varldsunika-elvagen-mellan-sandviken-och-storvik-byggas</a>	4	Fama Dumbouya	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/64585285532324/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/64585285532324/</a>	0
103	Trolley truck in Sweden, electric car	<a href="http://www.helahalsingland.se/allmant/halsingland/nu-borjar-den-varldsunika-elvagen-mellan-sandviken-och-storvik-byggas">http://www.helahalsingland.se/allmant/halsingland/nu-borjar-den-varldsunika-elvagen-mellan-sandviken-och-storvik-byggas</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/860360017414939/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/860360017414939/</a>	0
103	New power sources for vehicles		4	Preliminary investigation – new		5
104	Plug-in hybrid ship	<a href="http://cleantechnica.com/2015/10/26/norway-plans-to-construct-a-fleet-of-plug-in-hybrid-ships/">http://cleantechnica.com/2015/10/26/norway-plans-to-construct-a-fleet-of-plug-in-hybrid-ships/</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845567945560813/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845567945560813/</a>	0

104	Foiling	<a href="http://edition.cnn.com/videos/tv/2015/03/11/spc-mainsail-design-special-a.cnn">http://edition.cnn.com/videos/tv/2015/03/11/spc-mainsail-design-special-a.cnn</a>	4	Kari Mikkela	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/736280609822881/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/736280609822881/</a>	0
104	Robotic ships RR+VTT	<a href="http://www.tekniikkatalous.fi/Liikenne/suomalaiset+kehittavat+automaattiohjausta+laivoihin++kapteeni+tuijottaa+naytto/a1036716">http://www.tekniikkatalous.fi/Liikenne/suomalaiset+kehittavat+automaattiohjausta+laivoihin++kapteeni+tuijottaa+naytto/a1036716</a> <a href="http://inhabitat.com/the-seaorbiter-futuristic-marine-research-vessel-reaches-crowdfunding-goal-nears-construction-start/">http://inhabitat.com/the-seaorbiter-futuristic-marine-research-vessel-reaches-crowdfunding-goal-nears-construction-start/</a>	4	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/693896260727983/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/693896260727983/</a>	0
104	SeaOrbiter funded		4	Eetu Simpanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/512793608838250/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/512793608838250/</a>	0
104	Radical development of waterborne traffic		4	Preliminary investigation – new		2
105	Carbon and energy from natural gas	<a href="http://www.kit.edu/kit/pi_2015_139_crack-it-fossile-energie-ohne-klimagase.php">http://www.kit.edu/kit/pi_2015_139_crack-it-fossile-energie-ohne-klimagase.php</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/855032101281064/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/855032101281064/</a>	0
105	CO2 capture	<a href="http://www.eurekalert.org/pub_releases/2015-10/uof-dbc_1102215.php">http://www.eurekalert.org/pub_releases/2015-10/uof-dbc_1102215.php</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845085778942363/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/845085778942363/</a>	0
105	CO2 capture from sea water	<a href="http://www.jacobsschool.ucsd.edu/news/news_releases/release.sfe?id=1817">http://www.jacobsschool.ucsd.edu/news/news_releases/release.sfe?id=1817</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833136446803963/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/833136446803963/</a>	0
105	Nanocarbons without CO2	<a href="http://www.bbc.com/news/science-environment-33998697">http://www.bbc.com/news/science-environment-33998697</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/814612158656392/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/814612158656392/</a>	0
105	IEA 2050 vision	<a href="http://www.iea.org/etp/explore/">http://www.iea.org/etp/explore/</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/813406825443592/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/813406825443592/</a>	0
105	Driverless electric cars to reduce CO2 emissions by 90%	<a href="http://www.popsci.com/green-argument-driverless-cars">http://www.popsci.com/green-argument-driverless-cars</a>	4	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/793758450741763/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/793758450741763/</a>	0
105	Synthetic photosynthesis, CO2 capture	<a href="http://pubs.acs.org/doi/abs/10.1021/acs.nanolett.5b01254?journalCode=nalefd">http://pubs.acs.org/doi/abs/10.1021/acs.nanolett.5b01254?journalCode=nalefd</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/754265001357775/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/754265001357775/</a>	0
105	Fast-growing GMO tree	<a href="http://www.manchester.ac.uk/discover/news/article/?id=14313">http://www.manchester.ac.uk/discover/news/article/?id=14313</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/759154840868791/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/759154840868791/</a>	0
105	CO2 capture	<a href="http://www.nature.com/nature/journal/v519/n7543/full/nature14327.html">http://www.nature.com/nature/journal/v519/n7543/full/nature14327.html</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/739443022839973/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/739443022839973/</a>	0
105	Laser ignition improves engine efficiency	<a href="http://spectrum.ieee.org/energywise/energy/fossil-fuels/lasers-could-boost-engine-efficiency-by-27">http://spectrum.ieee.org/energywise/energy/fossil-fuels/lasers-could-boost-engine-efficiency-by-27</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/726075904176685/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/726075904176685/</a>	0
105	CO2 capture	<a href="http://decarboni.se/news/search-cheaper-carbon-capture-system-goes-using-common-materials">http://decarboni.se/news/search-cheaper-carbon-capture-system-goes-using-common-materials</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/715840451866897/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/715840451866897/</a>	0
105	Summary of radical technologies in the electricity market	<a href="http://energia.fi/sites/default/files/dokumentit/energiateollisuus/Tutkimus/ST-pooli/lu_risto_linturi.pdf">http://energia.fi/sites/default/files/dokumentit/energiateollisuus/Tutkimus/ST-pooli/lu_risto_linturi.pdf</a> <a href="http://motherboard.vice.com/read/scientists-propose-using-lasers-to-fight-global-warming-from-space">http://motherboard.vice.com/read/scientists-propose-using-lasers-to-fight-global-warming-from-space</a>	8	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/646916315425978/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/646916315425978/</a>	0
105	Satellite laser to fight global warming	<a href="http://www.businessinsider.com/17-emerging-energy-technologies-2014-4?utm_content=bufferbd038&amp;utm_medium=social&amp;">http://www.businessinsider.com/17-emerging-energy-technologies-2014-4?utm_content=bufferbd038&amp;utm_medium=social&amp;</a>	8	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/621032764681000/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/621032764681000/</a>	0
105	Review of new energy technologies		8	Arvo Kukko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/558131594304451/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/558131594304451/</a>	0
105	Hydrogen and graphite from methane	<a href="https://youtu.be/SuSi5HEwTEM">https://youtu.be/SuSi5HEwTEM</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/862576010526673/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/862576010526673/</a>	0
105	Renewables provide 95% of energy in Uruguay	<a href="http://gu.com/p/4ekpc/sfb">http://gu.com/p/4ekpc/sfb</a>	8	Tero Kauppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/861003020683972/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/861003020683972/</a>	0
105	CO2 capture		8	Preliminary investigation – new		5
105	CO2 converted into fuel with great efficiency	<a href="http://www.sciencealert.com/new-material-converts-co2-into-clean-fuel-with-unprecedented-efficiency">http://www.sciencealert.com/new-material-converts-co2-into-clean-fuel-with-unprecedented-efficiency</a>	8	Pekka Neva, Juha Viitala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/878780502239557/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/878780502239557/</a>	0
105	Carbon dioxide captured from air converted into methanol	<a href="http://phys.org/news/2016-01-carbon-dioxide-captured-air-methanol.html">http://phys.org/news/2016-01-carbon-dioxide-captured-air-methanol.html</a> <a href="https://www.facebook.com/download/1508362316135159/CERES_BNEF_MTG_Overview_Deck_27January.pdf">https://www.facebook.com/download/1508362316135159/CERES_BNEF_MTG_Overview_Deck_27January.pdf</a>	8	Anita Özönül	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893087010808906/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893087010808906/</a>	0
105	Review of funding of the fight against global warming		8	Jarmo Kuismanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/888387991278808/">https://www.facebook.com/groups/TuVRa/dikaalit/888387991278808/</a>	0
106	Soundwave levitation	<a href="http://www.kurzweilai.net/holographic-sonic-tractor-beam-lifts-and-moves-objects-using-soundwaves">http://www.kurzweilai.net/holographic-sonic-tractor-beam-lifts-and-moves-objects-using-soundwaves</a>	5	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/84563652553955/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/84563652553955/</a>	0
106	Shapeshifting surface	<a href="https://www.facebook.com/verge/videos/979655132070830/?fref=nf">https://www.facebook.com/verge/videos/979655132070830/?fref=nf</a>	5	Petja Jäppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/842592849191656/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/842592849191656/</a>	0
106	'Tractor beam' in water	<a href="http://www.sciencealert.com.au/news/20141108-26002.html">http://www.sciencealert.com.au/news/20141108-26002.html</a>	5	Haract Zentek	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/613797888737821/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/613797888737821/</a>	0
106	Motorised 3D table surface	<a href="http://www.dezeen.com/2014/04/16/mit-media-lab-transform-table-technology-milan-2014/">http://www.dezeen.com/2014/04/16/mit-media-lab-transform-table-technology-milan-2014/</a>	5	Ossi Pöllänen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/569879093129701/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/569879093129701/</a>	0
106	New methods for transferring goods/materials		5	Preliminary investigation – new		2
106	Soundwave-based manipulation of materials	<a href="http://futurism.com/links/new-class-of-sound-wave/">http://futurism.com/links/new-class-of-sound-wave/</a>	7	Tom Starwalker	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/87900589883684/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/87900589883684/</a>	0
107	Yumi assembly robot	<a href="http://new.abb.com/products/robotics/yumi">http://new.abb.com/products/robotics/yumi</a>	5	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/850321951752079/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/850321951752079/</a>	0

107	Trash collector robot	<a href="http://www.theverge.com/2015/9/16/9336229/volv-os-robots-roar-trash-collection">http://www.theverge.com/2015/9/16/9336229/volv-os-robots-roar-trash-collection</a>	4	Jouni Laveri	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/82889693894605/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/82889693894605/</a>	0
107	Self-assembling robot	<a href="http://gizmodo.com/this-tiny-self-folding-robot-will-destroy-itself-when-i-1707655885">http://gizmodo.com/this-tiny-self-folding-robot-will-destroy-itself-when-i-1707655885</a>	5	Jon Sundell	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/774392649345010/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/774392649345010/</a>	0
107	Robotic parking	<a href="https://www.facebook.com/bintjibel.org/videos/849625878437994/?fref=nf">https://www.facebook.com/bintjibel.org/videos/849625878437994/?fref=nf</a>	5	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/754209721363303/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/754209721363303/</a>	0
107	Robotic cook 2017	<a href="http://www.bbc.com/news/science-environment-32282131">http://www.bbc.com/news/science-environment-32282131</a>	5	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/752657704851838/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/752657704851838/</a>	0
107	Roof trusses made by robots	<a href="http://www.trussmatic.fi/">http://www.trussmatic.fi/</a>	5	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/735695796548029/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/735695796548029/</a>	0
107	Digitalisation of engineering workshops – flowing production	<a href="http://www.hermiagroup.fi/champion/TTP_Lehtonen.pdf">http://www.hermiagroup.fi/champion/TTP_Lehtonen.pdf</a>	5	Juha Paronen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/688665391251070/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/688665391251070/</a>	0
107	Co-operation between humans and robots	<a href="http://qz.com/255093/human-workers-will-take-orders-from-robots-and-they-will-like-it/">http://qz.com/255093/human-workers-will-take-orders-from-robots-and-they-will-like-it/</a>	5	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/621760587941551/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/621760587941551/</a>	0
107	Robotic manufacturing/service		5	Preliminary investigation – new		3
107	MIT review of the state of robotics in 2015	<a href="http://www.technologyreview.com/news/544901/what-robots-and-ai-learned-in-2015/">http://www.technologyreview.com/news/544901/what-robots-and-ai-learned-in-2015/</a> <a href="http://cacm.acm.org/magazines/2016/2/197416-self-repair-techniques-point-to-robots-that-design-themselves/fulltext">http://cacm.acm.org/magazines/2016/2/197416-self-repair-techniques-point-to-robots-that-design-themselves/fulltext</a>	5	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/874515319332742/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/874515319332742/</a>	0
107	Self-repair techniques for robots	<a href="http://cacm.acm.org/magazines/2016/2/197416-self-repair-techniques-point-to-robots-that-design-themselves/fulltext">http://cacm.acm.org/magazines/2016/2/197416-self-repair-techniques-point-to-robots-that-design-themselves/fulltext</a>	5	Pekka Ketola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/907105329407074/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/907105329407074/</a>	0
108	Inexpensive IOT controller	<a href="https://www.olimex.com/Products/IoT/ESP8266-EVB/open-source-hardware">https://www.olimex.com/Products/IoT/ESP8266-EVB/open-source-hardware</a> <a href="http://www.tekniikkatalous.fi/innovaaiot/90+miljoonaa+katuvaloa++suomalainen+startup+aikoo+valloittaa+ne+kaikki/a1028485">http://www.tekniikkatalous.fi/innovaaiot/90+miljoonaa+katuvaloa++suomalainen+startup+aikoo+valloittaa+ne+kaikki/a1028485</a>	5	Kate Alhola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/723340474450228/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/723340474450228/</a>	0
108	Street lighting on demand	<a href="https://www.linkedin.com/pulse/article/20140925043829-1409028-what-is-internet-of-things?trk=object-photo">https://www.linkedin.com/pulse/article/20140925043829-1409028-what-is-internet-of-things?trk=object-photo</a>	5	Haract Zentec	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/668027539981522/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/668027539981522/</a>	0
108	IOT – the big picture		5	Matti Pyykkönen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/639717342812542/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/639717342812542/</a>	0
108	NFC-based user interface (IOT?)	<a href="http://vimeo.com/96316406">http://vimeo.com/96316406</a>	5	Matti Pyykkönen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/639719216145688/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/639719216145688/</a>	0
108	IOT development	<a href="https://www.facebook.com/photo.php?fbid=10152009298118472&amp;set=gm.504216893029255&amp;type=3">https://www.facebook.com/photo.php?fbid=10152009298118472&amp;set=gm.504216893029255&amp;type=3</a>	1	Ilkka Kakko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/504216893029255/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/504216893029255/</a>	0
108	Ubique environment (IOT)		5	Preliminary investigation – new		2
108	Paper surface with artificial sensory functions	<a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/paper-skin-mimics-the-real-thing">http://spectrum.ieee.org/tech-talk/biomedical/devices/paper-skin-mimics-the-real-thing</a> <a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/new-production-method-could-make-graphene-100-times-cheaper-to-manufacture">http://spectrum.ieee.org/nanoclast/semiconductors/materials/new-production-method-could-make-graphene-100-times-cheaper-to-manufacture</a>	5	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/900930930024514/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/900930930024514/</a>	0
109	Less expensive graphene production	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/new-production-method-could-make-graphene-100-times-cheaper-to-manufacture">http://spectrum.ieee.org/nanoclast/semiconductors/materials/new-production-method-could-make-graphene-100-times-cheaper-to-manufacture</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/856198931164381/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/856198931164381/</a>	0
109	AMI's graphene production to reach 1,000 tons in 2016	<a href="http://www.nanotech-now.com/news.cgi?story_id=52605">http://www.nanotech-now.com/news.cgi?story_id=52605</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/855946867856254/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/855946867856254/</a>	0
109	CNT, Graphene & optical transistors	<a href="http://www.eurekalert.org/pub_releases/2015-09/nu-rcn090815.php">http://www.eurekalert.org/pub_releases/2015-09/nu-rcn090815.php</a> <a href="http://www.popularmechanics.com/science/a14651/this-scientist-invented-a-simply-way-to-mass-produce-graphene/">http://www.popularmechanics.com/science/a14651/this-scientist-invented-a-simply-way-to-mass-produce-graphene/</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/825035240947417/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/825035240947417/</a>	0
109	Energy-efficiency of graphene production	<a href="http://www.popularmechanics.com/science/a14651/this-scientist-invented-a-simply-way-to-mass-produce-graphene/">http://www.popularmechanics.com/science/a14651/this-scientist-invented-a-simply-way-to-mass-produce-graphene/</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/739888122795463/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/739888122795463/</a>	0
109	Price of flawless graphene crystal falls	<a href="http://nextbigfuture.com/2015/01/price-of-flawless-graphene-will-be.html">http://nextbigfuture.com/2015/01/price-of-flawless-graphene-will-be.html</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/711188455665430/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/711188455665430/</a>	0
109	Very affordable graphene	<a href="http://delta.tudelft.nl/article/making-graphene-affordable/29377">http://delta.tudelft.nl/article/making-graphene-affordable/29377</a> <a href="http://spectrum.ieee.org/nanoclast/semiconductors/nanotechnology/graphenebased-supercapacitors-enable-wearable-electronics">http://spectrum.ieee.org/nanoclast/semiconductors/nanotechnology/graphenebased-supercapacitors-enable-wearable-electronics</a>	6	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/710066159110993/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/710066159110993/</a>	0
109	LIG graphene	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/nanotechnology/graphenebased-supercapacitors-enable-wearable-electronics">http://spectrum.ieee.org/nanoclast/semiconductors/nanotechnology/graphenebased-supercapacitors-enable-wearable-electronics</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/707157142735228/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/707157142735228/</a>	0
109	Several news about graphene	<a href="http://phys.org/news/2014-12-future-batteries-lithium-sulfur-graphene-wrapper.html">http://phys.org/news/2014-12-future-batteries-lithium-sulfur-graphene-wrapper.html</a> <a href="http://physicsworld.com/cws/article/news/2014/oct/28/graphene-boosts-thermal-conductivity-of-popular-plastic">http://physicsworld.com/cws/article/news/2014/oct/28/graphene-boosts-thermal-conductivity-of-popular-plastic</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/687402091377400/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/687402091377400/</a>	0
109	Graphene improves thermal conductivity of PET plastic	<a href="http://physicsworld.com/cws/article/news/2014/oct/28/graphene-boosts-thermal-conductivity-of-popular-plastic">http://physicsworld.com/cws/article/news/2014/oct/28/graphene-boosts-thermal-conductivity-of-popular-plastic</a> <a href="http://androidcommunity.com/samsung-producing-graphene-the-material-for-flexible-displays-20140404/">http://androidcommunity.com/samsung-producing-graphene-the-material-for-flexible-displays-20140404/</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/659503520833924/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/659503520833924/</a>	0
109	Faultless graphene surfaces for displays from Samsung	<a href="http://androidcommunity.com/samsung-producing-graphene-the-material-for-flexible-displays-20140404/">http://androidcommunity.com/samsung-producing-graphene-the-material-for-flexible-displays-20140404/</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/546172332167044/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/546172332167044/</a>	0
109	Graphene production in China	<a href="http://english.eastday.com/e/131226/u1a7852709.html">http://english.eastday.com/e/131226/u1a7852709.html</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/493924054058539/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/493924054058539/</a>	0
109	Graphene production		6	Preliminary investigation – new		4
109	High-quality graphene surface on sodium glass for electronic applications	<a href="http://phys.org/news/2016-02-scientists-common-glass-optimize-graphene.html">http://phys.org/news/2016-02-scientists-common-glass-optimize-graphene.html</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/897527253698215/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/897527253698215/</a>	0
110	Local grid	<a href="http://cleantecnica.com/2015/10/14/the-future-of-energy-in-australia-may-be-renewable-micro-grids/">http://cleantecnica.com/2015/10/14/the-future-of-energy-in-australia-may-be-renewable-micro-grids/</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/84260016254258/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/84260016254258/</a>	0

110	Off Grid housing – Ecocapsule	<a href="http://www.huffingtonpost.com/2015/05/26/tiny-house_n_7443744.html">http://www.huffingtonpost.com/2015/05/26/tiny-house_n_7443744.html</a>	8	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/775637509220524/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/775637509220524/</a>	0
110	Off Grid solutions		8	Preliminary investigation – new		3
110	P2P electricity trading	<a href="http://www.technologyreview.com/news/544471/renewable-energy-trading-launched-in-germany/">http://www.technologyreview.com/news/544471/renewable-energy-trading-launched-in-germany/</a>	9	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/873995032718104/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/873995032718104/</a>	0
111	MyData in government platform	<a href="http://fi.okfn.org/2015/05/29/mydata-mukana-strategisessa-hallitusohjelmassa/">http://fi.okfn.org/2015/05/29/mydata-mukana-strategisessa-hallitusohjelmassa/</a>	9	Pia Erkinheimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/776489205802021/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/776489205802021/</a>	0
111	MyData	<a href="http://www.hs.fi/paakirjoitukset/a1402548692688?ako=95b0ef985b6f760000529c9bb30bf7da">http://www.hs.fi/paakirjoitukset/a1402548692688?ako=95b0ef985b6f760000529c9bb30bf7da</a>	9	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/582556635195280/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/582556635195280/</a>	0
111	Ecosystem of traffic data	<a href="http://www2.liikennevirasto.fi/julkaisut/pdf8/lts_2014-42_liikennetiedon_visiot_web.pdf">http://www2.liikennevirasto.fi/julkaisut/pdf8/lts_2014-42_liikennetiedon_visiot_web.pdf</a>	9	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/580563142061296/">https://www.facebook.com/groups/TuVRa/dikaalit/580563142061296/</a>	0
111	MyData		9	Preliminary investigation – new		2
111	MyData's value for the national economy	<a href="http://www.libertyglobal.com/PDF/public-policy/The-Value-of-Our-Digital-Identity.pdf">http://www.libertyglobal.com/PDF/public-policy/The-Value-of-Our-Digital-Identity.pdf</a>	9	Ossi Kuittinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/882444951873112/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/882444951873112/</a>	0
112	Bitcoin/Blockchain impacts	<a href="http://www.telegraph.co.uk/technology/news/10881213/The-coming-digital-anarchy.html?fb">http://www.telegraph.co.uk/technology/news/10881213/The-coming-digital-anarchy.html?fb</a>	9	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/593093860808224/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/593093860808224/</a>	0
112	Blockchain development opportunities	<a href="https://www.youtube.com/watch?v=Pu4PAMFPo5Y">https://www.youtube.com/watch?v=Pu4PAMFPo5Y</a>	9	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/556189214498689/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/556189214498689/</a>	0
112	Blockchain and other p2p solutions		9	Preliminary investigation – new		3
112	Blockchain-based structures of trust, several links	<a href="http://www.ibtimes.co.uk/tactom-signs-smart-city-deal-roll-out-blockchain-verification-across-china-1542059">http://www.ibtimes.co.uk/tactom-signs-smart-city-deal-roll-out-blockchain-verification-across-china-1542059</a>	10	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893134734137467/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893134734137467/</a>	0
112	Blockchain for a logistics solution (Kouvola innovation, IBM)	<a href="http://www.kinno.fi/article/teknologiajatti-ibm-ja-kouvola-innovation-yhteistyohon-kehitteilla-teollisen-internetin">http://www.kinno.fi/article/teknologiajatti-ibm-ja-kouvola-innovation-yhteistyohon-kehitteilla-teollisen-internetin</a>	10	Veijo Tikka	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/898379963612944/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/898379963612944/</a>	0
112	Blockchain applications, several links	<a href="http://www.blockchaintechnologies.com/blockchain-applications">http://www.blockchaintechnologies.com/blockchain-applications</a>	10	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893134734137467/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893134734137467/</a>	0
113	Financial news robot	<a href="http://www.theverge.com/2015/1/29/7939067/ap-journalism-automation-robots-financial-reporting">http://www.theverge.com/2015/1/29/7939067/ap-journalism-automation-robots-financial-reporting</a>	2	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/712311798886429/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/712311798886429/</a>	0
113	Chat bots	<a href="http://www.bbc.com/future/story/20140609-how-online-bots-are-tricking-you">http://www.bbc.com/future/story/20140609-how-online-bots-are-tricking-you</a>	2	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/58520084930935/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/58520084930935/</a>	0
113	Robot writing news for LA Times	<a href="http://www.bbc.com/news/technology-26614051">http://www.bbc.com/news/technology-26614051</a>	2	Ilkka Kakko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/538487842935493/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/538487842935493/</a>	0
113	Digital helper that understands speech	<a href="http://time.com/4209859/amazon-echo-new-features-2016/">http://time.com/4209859/amazon-echo-new-features-2016/</a>	2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893837697400504/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/893837697400504/</a>	0
113	Virtual character relieves depression	<a href="http://www.tiede.fi/artikkeli/uutiset/masennus-lieve-nee-virtuaalihakmon-avulla">http://www.tiede.fi/artikkeli/uutiset/masennus-lieve-nee-virtuaalihakmon-avulla</a>	2	Krista Lagus, Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/898907136893560/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/898907136893560/</a>	0
113	MS Verbot experiment in China	<a href="http://uk.businessinsider.com/microsoft-xiaoice-turing-test-in-china-2016-2">http://uk.businessinsider.com/microsoft-xiaoice-turing-test-in-china-2016-2</a>	2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/894294084021532/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/894294084021532/</a>	0
150	Faster vaccine manufacturing	<a href="http://www.eurekalert.org/pub_releases/2015-11/byu-ceh111815.php">http://www.eurekalert.org/pub_releases/2015-11/byu-ceh111815.php</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/854686637982277/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/854686637982277/</a>	0
150	Electrical stimulation replaces antibiotics	<a href="http://www.eurekalert.org/pub_releases/2015-11/wsu-rda110915.php">http://www.eurekalert.org/pub_releases/2015-11/wsu-rda110915.php</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851377734979834/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/851377734979834/</a>	0
150	Health effects of spruce resin	<a href="http://www.uusisuomi.fi/tiede-ja-ymparisto/59304-tutkija-osoitti-perimatiedon-todeksi-suomen-metsissa-kasvaa">http://www.uusisuomi.fi/tiede-ja-ymparisto/59304-tutkija-osoitti-perimatiedon-todeksi-suomen-metsissa-kasvaa</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/759326517518290/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/759326517518290/</a>	0
150	Graphene with anticancer potential	<a href="http://www.medicalnewstoday.com/articles/289978.php">http://www.medicalnewstoday.com/articles/289978.php</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/726144134169862/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/726144134169862/</a>	0
150	UV LED for disinfection	<a href="http://www.savonsanomati.fi/uutiset/talous/led-suutari-sai-kansainvalisen-laatupalkinnon/1971147?pwbi=d845cd2b75ec522f8b">http://www.savonsanomati.fi/uutiset/talous/led-suutari-sai-kansainvalisen-laatupalkinnon/1971147?pwbi=d845cd2b75ec522f8b</a>	7	Ville Vähämäki	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/707130672737875/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/707130672737875/</a>	0
150	Antibiotic that works on MRSA	<a href="http://yle.fi/uutiset/tutkijat-uskovat-loytaneensa-muuttaneen-antibiootin-oli-kaivettuna-maahan-taka-pihalle/7724435">http://yle.fi/uutiset/tutkijat-uskovat-loytaneensa-muuttaneen-antibiootin-oli-kaivettuna-maahan-taka-pihalle/7724435</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/701481419969467/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/701481419969467/</a>	0
150	Getting bacteria under control with liposomes	<a href="http://www.tekniikkatalous.fi/innovaatiot/rasvalla+ulehdusten+kimppuun+antibioottien+sijaan+kokeet+i-hmispotilailla+alkavat+ensi+vuonna/a1027451">http://www.tekniikkatalous.fi/innovaatiot/rasvalla+ulehdusten+kimppuun+antibioottien+sijaan+kokeet+i-hmispotilailla+alkavat+ensi+vuonna/a1027451</a>	7	Antti Tulonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/668704689913807/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/668704689913807/</a>	0
150	Human Protein Atlas	<a href="http://yle.fi/uutiset/ruotsalaiset-piirsivat-ihmisen-pr-oteiinikartaston-13-miljoonaa-kuvaa-julki-internet-issa/7606422">http://yle.fi/uutiset/ruotsalaiset-piirsivat-ihmisen-pr-oteiinikartaston-13-miljoonaa-kuvaa-julki-internet-issa/7606422</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/664056017045341/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/664056017045341/</a>	0
150	Map of human proteins	<a href="http://www.itscience.com/health-and-medicine/first-complete-mapping-human-proteome-discovers-193-new-proteins">http://www.itscience.com/health-and-medicine/first-complete-mapping-human-proteome-discovers-193-new-proteins</a>	7	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/574071402710470/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/574071402710470/</a>	0
150	Cooling of trauma patients (hibernation)	<a href="http://io9.com/humanity-is-now-officially-ready-for-suspended-animation-1581727874">http://io9.com/humanity-is-now-officially-ready-for-suspended-animation-1581727874</a>	7	Lassi Valkama	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/572771912840419/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/572771912840419/</a>	0
150	Suspended animation to be tested in humans	<a href="http://www.extremetech.com/extreme/179296-humans-will-be-kept-between-life-and-death-in-the-first-suspended-animation-trials">http://www.extremetech.com/extreme/179296-humans-will-be-kept-between-life-and-death-in-the-first-suspended-animation-trials</a>	7	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/544332002351077/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/544332002351077/</a>	0

150	Malaria vaccine tested in mice	<a href="http://news.sciencemag.org/health/2014/05/new-malaria-vaccine-shows-promise-mice">http://news.sciencemag.org/health/2014/05/new-malaria-vaccine-shows-promise-mice</a>	7	Arvo Kukko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/572622252855385/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/572622252855385/</a>	0
150	Cholesterol vaccine	<a href="http://news.unm.edu/news/unm-nih-researchers-develop-vaccine-to-treat-high-cholesterol">http://news.unm.edu/news/unm-nih-researchers-develop-vaccine-to-treat-high-cholesterol</a>	7	Pekka Pasanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/858794424238165/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/858794424238165/</a>	0
150	Medicine – protein map!!		7	Preliminary investigation – new		4
150	Rabbit's brain frozen without breaking the structure	<a href="http://www.sciencealert.com/a-mammal-s-brain-has-been-cryonically-frozen-and-recovered-for-the-first-time">http://www.sciencealert.com/a-mammal-s-brain-has-been-cryonically-frozen-and-recovered-for-the-first-time</a>	7	Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/898893813561559/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/898893813561559/</a>	0
200	Hypersonic passenger plane	<a href="http://nextbigfuture.com/2015/11/skreemr-hypersonic-passenger-plane.html">http://nextbigfuture.com/2015/11/skreemr-hypersonic-passenger-plane.html</a>	4	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/850309305086677/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/850309305086677/</a>	0
200	Good discussion on supersonic planes		4	Henri Heinonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/807023279415280/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/807023279415280/</a>	0
200	Zeno phenomenon	<a href="http://phys.org/news/2015-10-zeno-effect-verifiedatoms-wont.html">http://phys.org/news/2015-10-zeno-effect-verifiedatoms-wont.html</a>	6	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/844080385709569/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/844080385709569/</a>	0
200	Energy links NEO2015	<a href="http://www.bloomberg.com/company/new-energy-outlook/">http://www.bloomberg.com/company/new-energy-outlook/</a> <a href="http://www.maaseuduntulevaisuus.fi/ymp%C3%A4rist%C3%B6/sitra-kotimaistah%C3%A4rk%C3%A4papua-tuontisoijan-tilalle">http://www.maaseuduntulevaisuus.fi/ymp%C3%A4rist%C3%B6/sitra-kotimaistah%C3%A4rk%C3%A4papua-tuontisoijan-tilalle</a>	8	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/821240524660222/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/821240524660222/</a>	0
200	Circular economy	<a href="http://www.sciencealert.com/scientists-have-finally-discovered-massless-particles-and-they-could-radically-speed-up-electronics">http://www.sciencealert.com/scientists-have-finally-discovered-massless-particles-and-they-could-radically-speed-up-electronics</a>	7	Antti Raike	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/820068291444112/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/820068291444112/</a>	0
200	Weyl fermion	<a href="http://www.sciencealert.com/scientists-have-finally-discovered-massless-particles-and-they-could-radically-speed-up-electronics">http://www.sciencealert.com/scientists-have-finally-discovered-massless-particles-and-they-could-radically-speed-up-electronics</a>	6	Kari Alanne	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/804322019685406/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/804322019685406/</a>	0
200	Remote audio sensors, HD phone call	<a href="http://spectrum.ieee.org/telecom/standards/full-hd-voice-will-soon-give-your-phone-an-audio-upgrade">http://spectrum.ieee.org/telecom/standards/full-hd-voice-will-soon-give-your-phone-an-audio-upgrade</a> <a href="https://www.facebook.com/notes/risto-linturi/esineiden-internet-hankkeen-thing2datan-hanke-esite-t%C3%A4m%C3%A4nkaltaista-kai">https://www.facebook.com/notes/risto-linturi/esineiden-internet-hankkeen-thing2datan-hanke-esite-t%C3%A4m%C3%A4nkaltaista-kai</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/774168119367463/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/774168119367463/</a>	0
200	Thing2Data – individual identity of goods	<a href="https://www.facebook.com/notes/risto-linturi/esineiden-internet-hankkeen-thing2datan-hanke-esite-t%C3%A4m%C3%A4nkaltaista-kai">https://www.facebook.com/notes/risto-linturi/esineiden-internet-hankkeen-thing2datan-hanke-esite-t%C3%A4m%C3%A4nkaltaista-kai</a>	9	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/773349142782694/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/773349142782694/</a>	0
200	Express building	<a href="https://www.youtube.com/watch?v=rwvrmu5JmXk">https://www.youtube.com/watch?v=rwvrmu5JmXk</a>	5	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/732382896879319/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/732382896879319/</a>	4
200	Spherical robot in military tests	<a href="http://www.iflscience.com/technology/meet-guardbot-spherical-amphibious-robot">http://www.iflscience.com/technology/meet-guardbot-spherical-amphibious-robot</a>	4	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/722052241245718/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/722052241245718/</a>	0
200	Data security through quantum entanglement	<a href="http://phys.org/news/2014-12-fraud-proof-credit-cards-quantum-physics.html">http://phys.org/news/2014-12-fraud-proof-credit-cards-quantum-physics.html</a>	2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/684903618293914/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/684903618293914/</a>	0
200	Privatisation of health care services in Finland	<a href="http://yle.fi/uutiset/terveyspalvelut_yksityistyvat_no_peasti/7623506">http://yle.fi/uutiset/terveyspalvelut_yksityistyvat_no_peasti/7623506</a> <a href="http://www.uusisuomi.fi/tiede-ja-ymparisto/72056-tieteellinen-lapimurto-nokia-n9n-kameralla-maailmankaikkeuden-ika-ei-riita">http://www.uusisuomi.fi/tiede-ja-ymparisto/72056-tieteellinen-lapimurto-nokia-n9n-kameralla-maailmankaikkeuden-ika-ei-riita</a>	7	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/667222516728691/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/667222516728691/</a>	0
200	Encryption with camera cell	<a href="http://www.uusisuomi.fi/tiede-ja-ymparisto/72056-tieteellinen-lapimurto-nokia-n9n-kameralla-maailmankaikkeuden-ika-ei-riita">http://www.uusisuomi.fi/tiede-ja-ymparisto/72056-tieteellinen-lapimurto-nokia-n9n-kameralla-maailmankaikkeuden-ika-ei-riita</a>	2	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/633492396768370/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/633492396768370/</a>	0
200	Hubless wheel	<a href="https://www.youtube.com/watch?v=cPsY2NfPJtw">https://www.youtube.com/watch?v=cPsY2NfPJtw</a>	4	Arvo Kukko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/625019537615656/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/625019537615656/</a>	0
200	Virtual windows	<a href="http://www.virgin.com/richard-branson/virgin-launches-glass-bottomed-plane">http://www.virgin.com/richard-branson/virgin-launches-glass-bottomed-plane</a> <a href="http://www.washington.edu/news/2013/09/30/uw-engineers-invent-programming-language-to-build-synthetic-dna/">http://www.washington.edu/news/2013/09/30/uw-engineers-invent-programming-language-to-build-synthetic-dna/</a>	3	Pekko Vehviläinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/620192484765028/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/620192484765028/</a>	0
200	DNA programming language	<a href="http://www.washington.edu/news/2013/09/30/uw-engineers-invent-programming-language-to-build-synthetic-dna/">http://www.washington.edu/news/2013/09/30/uw-engineers-invent-programming-language-to-build-synthetic-dna/</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/449078905209721/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/449078905209721/</a>	0
200	Miscellaneous		0	Preliminary investigation – new		0
200	Public transport solution on the road	<a href="https://www.youtube.com/watch?v=1gTzc7-lbQ">https://www.youtube.com/watch?v=1gTzc7-lbQ</a> <a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/new-theory-leading-to-gigahertz-antenna-on-a-chip-is-questioned">http://spectrum.ieee.org/tech-talk/biomedical/devices/new-theory-leading-to-gigahertz-antenna-on-a-chip-is-questioned</a>	4	Jarmo Kuismanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/880881178696156/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/880881178696156/</a>	0
200	GHz antenna on a chip has been questioned	<a href="http://spectrum.ieee.org/tech-talk/biomedical/devices/new-theory-leading-to-gigahertz-antenna-on-a-chip-is-questioned">http://spectrum.ieee.org/tech-talk/biomedical/devices/new-theory-leading-to-gigahertz-antenna-on-a-chip-is-questioned</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887951164655824/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887951164655824/</a>	0
200	Waste paper turned into new paper in the office	<a href="https://www.facebook.com/ScienceNaturePage/videos/765132843618976/">https://www.facebook.com/ScienceNaturePage/videos/765132843618976/</a>	5	Petja Jäppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887017951415812/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887017951415812/</a>	0
200	Quick encryption (MS)	<a href="http://www.theregister.co.uk/2016/02/09/researchers_break_homomorphic_encryption/">http://www.theregister.co.uk/2016/02/09/researchers_break_homomorphic_encryption/</a>	11	Leo Kärkkäinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/895275350590072/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/895275350590072/</a>	0
200	Communication network made of fungi	<a href="http://www.bbc.com/earth/story/20141111-plants-have-a-hidden-internet">http://www.bbc.com/earth/story/20141111-plants-have-a-hidden-internet</a>	11	Otto Tiisanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/894282910689316/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/894282910689316/</a>	0
200	Passive WiFi (almost without power)	<a href="http://www.eurekalert.org/pub_releases/2016-02/uow-uea022316.php">http://www.eurekalert.org/pub_releases/2016-02/uow-uea022316.php</a> <a href="http://spectrum.ieee.org/tech-talk/at-work/test-and-measurement/femtosecond-lasers-drive-a-new-generation-of-network-vector-analyzers">http://spectrum.ieee.org/tech-talk/at-work/test-and-measurement/femtosecond-lasers-drive-a-new-generation-of-network-vector-analyzers</a>	11	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/903731693077771/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/903731693077771/</a>	0
300	Femtosecond lasers for network analysis	<a href="http://www.nrl.navy.mil/media/news-releases/2015/transparent-armor-from-nrl-spinel-could-also-ruggedize-your-smart-phone">http://www.nrl.navy.mil/media/news-releases/2015/transparent-armor-from-nrl-spinel-could-also-ruggedize-your-smart-phone</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/853895998061341/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/853895998061341/</a>	0
300	Transparent aluminium	<a href="http://www.nrl.navy.mil/media/news-releases/2015/transparent-armor-from-nrl-spinel-could-also-ruggedize-your-smart-phone">http://www.nrl.navy.mil/media/news-releases/2015/transparent-armor-from-nrl-spinel-could-also-ruggedize-your-smart-phone</a>	6	Petja Jäppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/849934265124181/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/849934265124181/</a>	0
300	Nanoscale optical switch	<a href="http://www.eurekalert.org/pub_releases/2015-10/lmsu-tw102715.php">http://www.eurekalert.org/pub_releases/2015-10/lmsu-tw102715.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/846101405507467/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/846101405507467/</a>	0
300	White laser with QDs	<a href="http://spectrum.ieee.org/tech-talk/semiconductors/devices/the-first-white-laser">http://spectrum.ieee.org/tech-talk/semiconductors/devices/the-first-white-laser</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/803834713067470/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/803834713067470/</a>	0

300	Low-cost femtosecond laser	<a href="http://www.eurekalert.org/pub_releases/2015-08/fopu-sia082015.php">http://www.eurekalert.org/pub_releases/2015-08/fopu-sia082015.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/814778361973105/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/814778361973105/</a>	0
300	Nanoscale diode, transistor	<a href="http://www.eurekalert.org/pub_releases/2015-07/dbnl-mth072915.php">http://www.eurekalert.org/pub_releases/2015-07/dbnl-mth072915.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/805694316214843/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/805694316214843/</a>	0
300	Small and fast optical modulator	<a href="http://www.eurekalert.org/pub_releases/2015-07/ez-sfc072715.php">http://www.eurekalert.org/pub_releases/2015-07/ez-sfc072715.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/803582319759376/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/803582319759376/</a>	0
300	Quantum dot-based white-blue LED	<a href="http://www.eurekalert.org/pub_releases/2015-06/hu-niu060515.php">http://www.eurekalert.org/pub_releases/2015-06/hu-niu060515.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/778836162233992/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/778836162233992/</a>	0
300	Transparent electromagnetic absorber	<a href="http://www.eurekalert.org/pub_releases/2015-07/aurdt072015.php">http://www.eurekalert.org/pub_releases/2015-07/aurdt072015.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/800080450109563/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/800080450109563/</a>	0
300	Nanoscale light resonator	<a href="http://www.eurekalert.org/pub_releases/2015-07/uow-nld071315.php">http://www.eurekalert.org/pub_releases/2015-07/uow-nld071315.php</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/796722100445398/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/796722100445398/</a>	0
300	Perovskite transistor	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/for-first-time-researchers-fabricate-a-transistor-out-of-perovskite">http://spectrum.ieee.org/nanoclast/semiconductors/materials/for-first-time-researchers-fabricate-a-transistor-out-of-perovskite</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/765523920231883/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/765523920231883/</a>	0
300	Printable lightpaper	<a href="http://www.fastcompany.com/3038890/rohinnis-lightpaper-is-incredibly-thin-and-printable">http://www.fastcompany.com/3038890/rohinnis-lightpaper-is-incredibly-thin-and-printable</a> <a href="http://www.natureworldnews.com/articles/12016/20150116/rice-sized-laser-leads-the-way-in-quantum-computing.htm">http://www.natureworldnews.com/articles/12016/20150116/rice-sized-laser-leads-the-way-in-quantum-computing.htm</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/708984649219144/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/708984649219144/</a>	0
300	Millimetre-scale microwave laser	<a href="http://www.iltasanomat.fi/asuminen/art-1419908515249.html">http://www.iltasanomat.fi/asuminen/art-1419908515249.html</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705889572861985/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/705889572861985/</a>	0
300	Risks of LED lights	<a href="http://www.iltasanomat.fi/asuminen/art-1419908515249.html">http://www.iltasanomat.fi/asuminen/art-1419908515249.html</a>	7	Olli Hietanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/694576957326580/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/694576957326580/</a>	0
300	Small efficient accelerator	<a href="http://phys.org/news/2014-12-world-compact-tabletop-particle.html">http://phys.org/news/2014-12-world-compact-tabletop-particle.html</a> <a href="http://www.independent.co.uk/news/science/blackest-is-the-new-black-scientists-have-developed-a-material-so-dark-that-you-cant-see-it-9602504.html">http://www.independent.co.uk/news/science/blackest-is-the-new-black-scientists-have-developed-a-material-so-dark-that-you-cant-see-it-9602504.html</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/680928258691450/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/680928258691450/</a>	0
300	Black material 0.035% Vantablack	<a href="http://www.independent.co.uk/news/science/blackest-is-the-new-black-scientists-have-developed-a-material-so-dark-that-you-cant-see-it-9602504.html">http://www.independent.co.uk/news/science/blackest-is-the-new-black-scientists-have-developed-a-material-so-dark-that-you-cant-see-it-9602504.html</a>	6	Antti Tulonen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/599541656830111/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/599541656830111/</a>	0
300	Simulated daylight	<a href="http://www.coelux.com/">http://www.coelux.com/</a> <a href="http://www.3ders.org/articles/20140427-make-your-own-3d-printed-microscopes-for-as-little-as-2-dollor.html">http://www.3ders.org/articles/20140427-make-your-own-3d-printed-microscopes-for-as-little-as-2-dollor.html</a>	6	Olli Orkoneva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/563303460453931/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/563303460453931/</a>	0
300	Smartphone & \$2 lens as microscope	<a href="http://www.extremetech.com/extreme/180728-graphene-spaser-brings-optical-computing-to-the-nano-scale">http://www.extremetech.com/extreme/180728-graphene-spaser-brings-optical-computing-to-the-nano-scale</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/557400274377583/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/557400274377583/</a>	0
300	Graphene nanolaser (spaser)	<a href="http://www.extremetech.com/extreme/180728-graphene-spaser-brings-optical-computing-to-the-nano-scale">http://www.extremetech.com/extreme/180728-graphene-spaser-brings-optical-computing-to-the-nano-scale</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/553690244748586/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/553690244748586/</a>	0
300	Photonic molecules	<a href="http://phys.org/news/2013-09-scientists-never-before-seen.html">http://phys.org/news/2013-09-scientists-never-before-seen.html</a>	6	Laura Tiilikainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/446983482085930/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/446983482085930/</a>	0
300	Miniaturised particle accelerator	<a href="http://phys.org/news/2013-09-chip.html">http://phys.org/news/2013-09-chip.html</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/447473032036975/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/447473032036975/</a>	0
300	Photonic link with processor	<a href="http://www.eurekalert.org/pub_releases/2015-12/uoc-edf121815.php">http://www.eurekalert.org/pub_releases/2015-12/uoc-edf121815.php</a> <a href="http://spectrum.ieee.org/tech-talk/semiconductors/optoelectronics/camera-that-tracks-hidden-moving-objects-could-aid-rescue">http://spectrum.ieee.org/tech-talk/semiconductors/optoelectronics/camera-that-tracks-hidden-moving-objects-could-aid-rescue</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/870419336409007/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/870419336409007/</a>	0
300	SPAD camera that sees around the corner	<a href="http://spectrum.ieee.org/tech-talk/semiconductors/optoelectronics/camera-that-tracks-hidden-moving-objects-could-aid-rescue">http://spectrum.ieee.org/tech-talk/semiconductors/optoelectronics/camera-that-tracks-hidden-moving-objects-could-aid-rescue</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/865410023576605/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/865410023576605/</a>	0
300	Visualisation of WLAN signal	<a href="http://www.theverge.com/2015/11/28/9811910/augmented-reality-app-lets-you-see-wireless-signals">http://www.theverge.com/2015/11/28/9811910/augmented-reality-app-lets-you-see-wireless-signals</a>	1	Janne Mähönen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/858939074223700/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/858939074223700/</a>	0
300	Perovskite thin sheet	<a href="http://www.eurekalert.org/pub_releases/2015-09/dbnl-adt092515.php">http://www.eurekalert.org/pub_releases/2015-09/dbnl-adt092515.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/83298876817720/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/83298876817720/</a>	0
300	Optics		1	Preliminary investigation – new		4
300	Single-atom optical switch fabricated	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/optoelectronics/worlds-first-singleatom-optical-switch-fabricated">http://spectrum.ieee.org/nanoclast/semiconductors/optoelectronics/worlds-first-singleatom-optical-switch-fabricated</a>	3	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/892020987582175/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/892020987582175/</a>	0
300	Nanometre-level graphene lens	<a href="http://www.gizmag.com/optical-lens-one-billionth-meter-thick/41588/">http://www.gizmag.com/optical-lens-one-billionth-meter-thick/41588/</a> <a href="http://www.colorado.edu/news/releases/2016/02/16/ultrafast-microscope-used-make-slow-motion-electron-movie">http://www.colorado.edu/news/releases/2016/02/16/ultrafast-microscope-used-make-slow-motion-electron-movie</a>	1	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891510490966558/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/891510490966558/</a>	0
300	Ultrafast microscope for atom-level imaging	<a href="http://www.gizmag.com/optical-lens-one-billionth-meter-thick/41588/">http://www.gizmag.com/optical-lens-one-billionth-meter-thick/41588/</a> <a href="http://www.colorado.edu/news/releases/2016/02/16/ultrafast-microscope-used-make-slow-motion-electron-movie">http://www.colorado.edu/news/releases/2016/02/16/ultrafast-microscope-used-make-slow-motion-electron-movie</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/900888600028747/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/900888600028747/</a>	0
300	Copper nanophotonics	<a href="http://www.eurekalert.org/pub_releases/2016-02/miop-ppa022516.php">http://www.eurekalert.org/pub_releases/2016-02/miop-ppa022516.php</a> <a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/capabilities-of-nanomaterials-in-textiles-continue-to-expand">http://spectrum.ieee.org/nanoclast/semiconductors/materials/capabilities-of-nanomaterials-in-textiles-continue-to-expand</a>	1	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/904502559667351/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/904502559667351/</a>	0
500	Nanomaterials for textiles	<a href="http://spectrum.ieee.org/nanoclast/semiconductors/materials/capabilities-of-nanomaterials-in-textiles-continue-to-expand">http://spectrum.ieee.org/nanoclast/semiconductors/materials/capabilities-of-nanomaterials-in-textiles-continue-to-expand</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/797617123689229/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/797617123689229/</a>	0
500	Flexible RAM memory	<a href="http://www.eurekalert.org/pub_releases/2015-06/tkai-akr061515.php">http://www.eurekalert.org/pub_releases/2015-06/tkai-akr061515.php</a> <a href="http://www.technologyreview.com/view/539626/how-next-generation-fabrics-will-keep-you-cool-in-summer-heat/">http://www.technologyreview.com/view/539626/how-next-generation-fabrics-will-keep-you-cool-in-summer-heat/</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/783922785058663/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/783922785058663/</a>	0
500	Heat-controlling textiles	<a href="http://www.technologyreview.com/view/539626/how-next-generation-fabrics-will-keep-you-cool-in-summer-heat/">http://www.technologyreview.com/view/539626/how-next-generation-fabrics-will-keep-you-cool-in-summer-heat/</a> <a href="http://spectrum.ieee.org/nanoclast/green-tech/conservation/graphene-heating-system-dramatically-reduces-home-energy-costs">http://spectrum.ieee.org/nanoclast/green-tech/conservation/graphene-heating-system-dramatically-reduces-home-energy-costs</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/787735298010745/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/787735298010745/</a>	0
500	Graphene radiator	<a href="http://spectrum.ieee.org/nanoclast/green-tech/conservation/graphene-heating-system-dramatically-reduces-home-energy-costs">http://spectrum.ieee.org/nanoclast/green-tech/conservation/graphene-heating-system-dramatically-reduces-home-energy-costs</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/777488192368789/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/777488192368789/</a>	0
500	Soft batteries made from wood pulp	<a href="http://www.eurekalert.org/pub_releases/2015-06/krio-tas060215.php">http://www.eurekalert.org/pub_releases/2015-06/krio-tas060215.php</a>	8	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/777071225743819/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/777071225743819/</a>	0

500	Foldable device (MS)	<a href="http://www.neowin.net/news/microsoft-is-serious-about-foldable-and-printable-electronics">http://www.neowin.net/news/microsoft-is-serious-about-foldable-and-printable-electronics</a>	6	Ensio Ruotsalainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/766522620132013/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/766522620132013/</a>	0
500	Lightweight sound-proofing metamaterial	<a href="http://scitation.aip.org/content/aip/journal/apl/106/17/10.1063/1.4919235">http://scitation.aip.org/content/aip/journal/apl/106/17/10.1063/1.4919235</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/760777194039889/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/760777194039889/</a>	0
500	Low-cost magnetic material	<a href="http://www.eurekalert.org/pub_releases/2015-04/dl-als042415.php">http://www.eurekalert.org/pub_releases/2015-04/dl-als042415.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/759313607519581/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/759313607519581/</a>	0
500	Silicon dioxide at room temperature	<a href="http://www.eurekalert.org/pub_releases/2015-04/uog-ucs042315.php">http://www.eurekalert.org/pub_releases/2015-04/uog-ucs042315.php</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/758148510969424/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/758148510969424/</a>	0
500	Metsä Group – review of new technology	<a href="http://biotuotehdas.fi/biotuotteet">http://biotuotehdas.fi/biotuotteet</a>	7	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/756595754458033/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/756595754458033/</a>	0
500	Wooden scyscraper to Vienna	<a href="http://www.popsi.com/next-futuristic-building-material-wood">http://www.popsi.com/next-futuristic-building-material-wood</a>	6	Antti Laitinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/728465293937746/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/728465293937746/</a>	0
500	Nanometal process VTT	<a href="http://www.tekniikkatalous.fi/innovaatiot/3+000+grammaa+paivassa++vtt+puskee+metallinanohiukkasia/a1053682">http://www.tekniikkatalous.fi/innovaatiot/3+000+grammaa+paivassa++vtt+puskee+metallinanohiukkasia/a1053682</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/738570489593893/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/738570489593893/</a>	0
500	Nano reinforcements, hybtonite	<a href="https://l.facebook.com/l.php?u=http%3A%2F%2Fwww.ess.fi%2Fuutiset%2Fkotimaa%2F2014%2F09%2F12%2Fuomalaisen-nanotekniikan-keksinnon-ymparilla-">https://l.facebook.com/l.php?u=http%3A%2F%2Fwww.ess.fi%2Fuutiset%2Fkotimaa%2F2014%2F09%2F12%2Fuomalaisen-nanotekniikan-keksinnon-ymparilla-</a> <a href="http://www.heisinki.fi/farmasia/uutiset/2014/Nanohiukkasten_tunkeutuminen_elimistoon_riippuu_hiukkasten_ominaisuuksista.html">http://www.heisinki.fi/farmasia/uutiset/2014/Nanohiukkasten_tunkeutuminen_elimistoon_riippuu_hiukkasten_ominaisuuksista.html</a>	6	Kari Vahtiala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/692561250861484/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/692561250861484/</a>	0
500	Dangers of carbon nanotubes	<a href="http://www.kurzweilai.net/robotic-fabric-could-bring-active-clothing-wearable-robots?utm_source=KurzweilAI+Weekly+Newsletter">http://www.kurzweilai.net/robotic-fabric-could-bring-active-clothing-wearable-robots?utm_source=KurzweilAI+Weekly+Newsletter</a>	6	Jouni Laveri	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/659615820822694/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/659615820822694/</a>	0
500	Soft robots	<a href="http://www.natureworldnews.com/articles/9010/20140912/using-graphene-spin-electrons-new-directions.htm">http://www.natureworldnews.com/articles/9010/20140912/using-graphene-spin-electrons-new-directions.htm</a>	6	Pekka Ketola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/640727616044848/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/640727616044848/</a>	0
500	Chargeless electric current in graphene	<a href="http://www.extremetech.com/extreme/183653-the-first-fully-2d-wonder-material-graphene-molybdenite-transistor-could-be-the-future-of-fast-electronics">http://www.extremetech.com/extreme/183653-the-first-fully-2d-wonder-material-graphene-molybdenite-transistor-could-be-the-future-of-fast-electronics</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/635048636612746/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/635048636612746/</a>	0
500	Graphene transistor	<a href="http://www.hs.fi/tiede/a1398344570326">http://www.hs.fi/tiede/a1398344570326</a>	6	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/578250605625883/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/578250605625883/</a>	0
500	Goods from biomaterials	<a href="http://www.sitra.fi/talous/teolliset-symbioosit">http://www.sitra.fi/talous/teolliset-symbioosit</a>	7	Olli Hietanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/559497454167865/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/559497454167865/</a>	0
500	Industrial symbioses	<a href="http://www.businessinsider.com/futuristic-construction-materials-2014-4">http://www.businessinsider.com/futuristic-construction-materials-2014-4</a>	7	Olli Hietanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/559560427494901/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/559560427494901/</a>	0
500	New materials	<a href="http://www.gizmag.com/2d-semiconductor-tin-monoxide/41843/">http://www.gizmag.com/2d-semiconductor-tin-monoxide/41843/</a>	6	Arvo Kukko	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/559024197548524/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/559024197548524/</a>	0
500	Review of bioeconomy	<a href="http://yle.fi/uutiset/suomalaistutkija_loysi_kauan_et_sityn_yksinapaisen_magneetin/7059297">http://yle.fi/uutiset/suomalaistutkija_loysi_kauan_et_sityn_yksinapaisen_magneetin/7059297</a>	7	Olli Hietanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/521294791321465/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/521294791321465/</a>	0
500	Unipolar magnet	<a href="http://www.mckinsey.com/insights/energy_resources/materials/reverse_the_curse_maximizing_the_potential_of_resource_driven_economies">http://www.mckinsey.com/insights/energy_resources/materials/reverse_the_curse_maximizing_the_potential_of_resource_driven_economies</a>	6	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/510379009079710/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/510379009079710/</a>	0
500	Report on the sufficiency of resources	<a href="http://gaiitz.com/the-tough-polylyne-family-has-a-new-heavyweight-champ/">http://gaiitz.com/the-tough-polylyne-family-has-a-new-heavyweight-champ/</a>	6	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/482807591836852/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/482807591836852/</a>	0
500	Carbyne – the toughest material	<a href="http://phys.org/news/2015-11-phase-carbon-diamond-room-temperature.html">http://phys.org/news/2015-11-phase-carbon-diamond-room-temperature.html</a>	6	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/448547161929562/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/448547161929562/</a>	0
500	Q-carbon, harder than diamond	<a href="https://www.facebook.com/suomentulevaisuus/videos/953278928054552/?fref=nf">https://www.facebook.com/suomentulevaisuus/videos/953278928054552/?fref=nf</a>	6	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859321457518795/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/859321457518795/</a>	0
500	IONCell method for treatment of wood fibres	<a href="http://www.gizmag.com/2d-semiconductor-tin-monoxide/41843/">http://www.gizmag.com/2d-semiconductor-tin-monoxide/41843/</a>	6	Petja Jäppinen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/899732170144390/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/899732170144390/</a>	0
500	Very fast semiconductor of 3D tin	<a href="http://news.nationalpost.com/news/world/ikea-fungus-mushrooms-for-packaging">http://news.nationalpost.com/news/world/ikea-fungus-mushrooms-for-packaging</a>	6	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/899097496874524/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/899097496874524/</a>	0
500	Mushrooms to replace polystyrene (decompose)	<a href="http://www.popsi.com/amazon-echo-first-artificial-intelligence-youll-want-home?dom=fb&amp;src=SOC">http://www.popsi.com/amazon-echo-first-artificial-intelligence-youll-want-home?dom=fb&amp;src=SOC</a>	6	Petri Sirviö	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/906578226126451/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/906578226126451/</a>	0
600	AI Amazon Echo	<a href="http://www.bloomberg.com/news/articles/2015-02-03/i-ll-be-back-the-return-of-artificial-intelligence">http://www.bloomberg.com/news/articles/2015-02-03/i-ll-be-back-the-return-of-artificial-intelligence</a>	2	Jouni Kari	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/789762901141318/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/789762901141318/</a>	0
600	AI startup financing on the increase	<a href="http://futureoflife.org/misc/open_letter">http://futureoflife.org/misc/open_letter</a>	2	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/714735441977398/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/714735441977398/</a>	0
600	Risks of AI	<a href="http://www.nature.com/news/game-theorists-crack-poker-1.16683">http://www.nature.com/news/game-theorists-crack-poker-1.16683</a>	2	Kaj Sotala	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/703223529795256/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/703223529795256/</a>	0
600	Problem-solving by AI without complete information	<a href="http://themindunleashed.org/2014/11/googles-deep-mind-plans-to-create-a-computer-able-to-program-itself.html">http://themindunleashed.org/2014/11/googles-deep-mind-plans-to-create-a-computer-able-to-program-itself.html</a>	2	Vilho Ahola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/702319853218957/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/702319853218957/</a>	0
600	Google Deep Mind	<a href="http://www.hs.fi/kuukausilite/%C3%84ly/hoi/a1396404764124">http://www.hs.fi/kuukausilite/%C3%84ly/hoi/a1396404764124</a>	2	Jarmo Heimo	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/664223587028584/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/664223587028584/</a>	0
600	Review of the threats of AI	<a href="http://www.newscientist.com/article/dn25068-wikipediaize-maths-proof-too-big-for-humans-to-check.html">http://www.newscientist.com/article/dn25068-wikipediaize-maths-proof-too-big-for-humans-to-check.html</a>	2	Kate Alhola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/546620745455536/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/546620745455536/</a>	0
600	AI solves a difficult mathematical problem	<a href="https://medium.com/backchannel/how-elon-musk-and-y-combinator-plan-to-stop-computers-from-taking-over-17e0e27dd02a">https://medium.com/backchannel/how-elon-musk-and-y-combinator-plan-to-stop-computers-from-taking-over-17e0e27dd02a</a>	2	Tatu Lund	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/525399450910999/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/525399450910999/</a>	0
600	Open AI, Musk		2	Aleksi Rossi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/864614016989539/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/864614016989539/</a>	0

600	AI		2	Preliminary investigation – new		5
600	AI review, several links	<a href="http://www.aaai.org/ojs/index.php/aimagazine/article/download/1877/1775">http://www.aaai.org/ojs/index.php/aimagazine/article/download/1877/1775</a>	2	Karoliina Salminen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875233852594222/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875233852594222/</a>	0
600	AI review 2, several links	<a href="https://www.facebook.com/notes/10151609046812712/">https://www.facebook.com/notes/10151609046812712/</a>	2	Karoliina Salminen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875239122593695/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875239122593695/</a>	0
600	Deep learning framework comparison	<a href="https://github.com/zer0n/deepframeworks/blob/master/README.md">https://github.com/zer0n/deepframeworks/blob/master/README.md</a>	2	Karoliina Salminen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875240345926906/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875240345926906/</a>	0
600	AI review 3, several links	<a href="https://www.facebook.com/notes/juan-carlos-kuri-pinto/deep-x/10153080971122712">https://www.facebook.com/notes/juan-carlos-kuri-pinto/deep-x/10153080971122712</a>	2	Karoliina Salminen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875239399260334/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875239399260334/</a>	0
600	Deep vision, AI, Deep Learning examples	<a href="https://github.com/kjw0612/awesome-deep-vision">https://github.com/kjw0612/awesome-deep-vision</a>	2	Kate Alhola	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875094489274825/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/875094489274825/</a>	0
600	Microsoft's AI platform open-sourced	<a href="http://techcrunch.com/2016/01/25/microsoft-moves-its-cntk-machine-learning-toolkit-to-github/">http://techcrunch.com/2016/01/25/microsoft-moves-its-cntk-machine-learning-toolkit-to-github/</a> <a href="http://singularityhub.com/2016/01/18/digital-diagnosis-intelligent-machines-do-a-better-job-than-humans/">http://singularityhub.com/2016/01/18/digital-diagnosis-intelligent-machines-do-a-better-job-than-humans/</a>	2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887664531351154/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887664531351154/</a>	0
600	Diagnosis robot for X-ray images, etc.	<a href="http://www.engadget.com/2016/02/07/low-power-neural-network-chip/">http://www.engadget.com/2016/02/07/low-power-neural-network-chip/</a>	2	Pekka Neva	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/884371621680445/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/884371621680445/</a>	0
600	Low-consumption AI processor for smartphones	<a href="http://www.engadget.com/2016/02/07/low-power-neural-network-chip/">http://www.engadget.com/2016/02/07/low-power-neural-network-chip/</a>	2	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/89456507328623/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/89456507328623/</a>	0
700	Significance of design	<a href="https://www.facebook.com/NowThisNews/videos/752323541524439/?fref=nf">https://www.facebook.com/NowThisNews/videos/752323541524439/?fref=nf</a> <a href="http://www.uusisuomi.fi/kulttuuri/76636-3d-tulostuksella-luotiin-huimaava-naky-avaa-isoksi-ja-nauti">http://www.uusisuomi.fi/kulttuuri/76636-3d-tulostuksella-luotiin-huimaava-naky-avaa-isoksi-ja-nauti</a>	9	Olli Hietanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/695584467225829/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/695584467225829/</a>	0
700	3D-printed kinetic art	<a href="http://www.hs.fi/kulttuuri/a1390984545889">http://www.hs.fi/kulttuuri/a1390984545889</a>	5	Olli Hietanen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706484376135838/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/706484376135838/</a>	0
700	Future of music	<a href="http://www.hs.fi/kulttuuri/a1390984545889">http://www.hs.fi/kulttuuri/a1390984545889</a>	2	Tatu Lund, Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/510327342418210/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/510327342418210/</a>	0
700	Digital art, digital experiences		9	Preliminary investigation – new		3
700	Quadcopters replace fireworks	<a href="https://www.facebook.com/thisisinsider/videos/1506168603023866/?fref=nf">https://www.facebook.com/thisisinsider/videos/1506168603023866/?fref=nf</a>	10	Pasi Laine	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887382594712681/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/887382594712681/</a>	0
700	Robots on stage	<a href="https://www.youtube.com/watch?v=EFqTgIXvF8">https://www.youtube.com/watch?v=EFqTgIXvF8</a> <a href="https://attachment.tbsbx.com/file_download.php?id=831243640220780&amp;eid=AsTpk648AvNI1YFGqQIhNODwy504XGDVXp_wJDQjKLUxWuTnKKpJds646cAYf">https://attachment.tbsbx.com/file_download.php?id=831243640220780&amp;eid=AsTpk648AvNI1YFGqQIhNODwy504XGDVXp_wJDQjKLUxWuTnKKpJds646cAYf</a> <a href="http://www.foresight.fi/2014/10/11/huomioita-ennakoivasta-teknologia-ja-markkinariskien-analysoinnista/">http://www.foresight.fi/2014/10/11/huomioita-ennakoivasta-teknologia-ja-markkinariskien-analysoinnista/</a>	10	Petri Sirviö	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/895065073944433/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/895065073944433/</a>	0
	Summary 6 July 2014		0	Risto Linturi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/595011737283103/">https://www.facebook.com/groups/TuVRa/dikaalit/595011737283103/</a>	0
	Evaluation of the business potential of technology	<a href="http://www.foresight.fi/2014/10/11/huomioita-ennakoivasta-teknologia-ja-markkinariskien-analysoinnista/">http://www.foresight.fi/2014/10/11/huomioita-ennakoivasta-teknologia-ja-markkinariskien-analysoinnista/</a>	0	Jari Kaivo-oja	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/649422445175365/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/649422445175365/</a>	0
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	Legislative aspects of the report		0	Jouni Särkijärvi	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/539669159484028/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/539669159484028/</a>	0
	Effects of digitalisation on society	<a href="http://www.wired.com/opinion/2013/11/software-is-reorganizing-the-world-and-cloud-formations-could-lead-to-physical-nations/">http://www.wired.com/opinion/2013/11/software-is-reorganizing-the-world-and-cloud-formations-could-lead-to-physical-nations/</a>	0	Jesse Soinenen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/543466542437623/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/543466542437623/</a>	0
	Google's goals	<a href="http://www.businessinsider.com/larry-page-at-ted-2014-3">http://www.businessinsider.com/larry-page-at-ted-2014-3</a>	0	Harri Vartiainen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/540017749449169/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/540017749449169/</a>	0
	Thirty-four French technologies	<a href="https://www.facebook.com/groups/TuVRadikaalit/permalink/445472008903744/">https://www.facebook.com/groups/TuVRadikaalit/permalink/445472008903744/</a>	0	Risto Linturi		0
	List of the dissolution of norms		0	Heikki Tamminen	<a href="https://www.facebook.com/groups/TuVRa/dikaalit/permalink/903707446413529/">https://www.facebook.com/groups/TuVRa/dikaalit/permalink/903707446413529/</a>	0



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