



*Foresight*

# *Towards a New Knowledge System*

Targeted scenario N°19

**Glimpses of the future  
from the BOHEMIA study**



## ***Towards a New Knowledge System - Targeted scenario N°19***

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EUROPEAN COMMISSION

# ***Towards a New Knowledge System***

## **Targeted scenario N°19**

***Glimpses of the future  
from the BOHEMIA study***

## **About BOHEMIA**

*BOHEMIA is a foresight study (contract N° Contract PP-03021-2015) designed specifically to support the preparation of the next framework programme.*

*The study put forward policy recommendations for the next framework programme, based on a foresight processes involving scenario development, a Delphi survey and an online consultation.*

*As part of its recommendations, the study identified 19 likely future scenarios with disruptive implications and associated priority directions for EU research and innovation.*

*The full range of the results of the study is available at <https://ec.europa.eu/research/foresight>*

Targeted scenario N° 19  
***Towards a New Knowledge System***

**Summary**

By 2040, ubiquitous digitalisation has transformed science, technology, research and education to a new integrated knowledge system. Abundant data, real-time and historical, are easily accessible through AI devices. Education makes extensive use of the digital tools. It empowers young and older people to make effective use of data, information and knowledge for social and economic ends. As knowledge becomes pervasive people lead more productive fulfilling lives. But established institutions are challenged to adapt.

**UN Sustainable Development Goals (SDGs) most relevant to this scenario:**



## **The scenario**

It is 2040. Open science, open innovation, and open education prevail across Europe, and in large parts of the world. At the core of Europe's new knowledge system are clusters of well-funded, internationally renowned (higher) education institutions and public research organizations in close partnerships with a broad variety of actors at the local, regional, national and European level. High levels of public investment have created a variety of open digital infrastructures to share information, data, knowledge and expertise across countries.

Innovation in industry is part of a process of co-creating knowledge linked to various global and local 'communities of practice' tackling, for instance, sustainable development issues. Globally and professionally managed human work clouds make up 40% or more of all teams in science and business. The ones that developed in Europe incorporate European values already in their design, creating a work environment that enables collaborative and open knowledge production. Experts, innovators, universities, industry, and many new actors – NGOs, foundations, individuals of all ages - work together in fast-changing networks to address local, regional, and global agendas.

The use of ubiquitous digitisation and data-intensive science in all aspects of life in Europe is supported by comprehensive data literacy. Primary and secondary education and lifelong learning have been completely transformed and have made an important contribution to bringing about a knowledge-society.

Innovation depends more than ever on the ability of schools and universities to endow students with the necessary digital, intellectual and behavioural skills needed to make use of the opportunities offered by the new knowledge system. This process needs to start early. Science communication together with simulation tools, virtual reality, and augmented reality make it possible for elementary school students to become highly skilled solvers of complex real world problems.

Generic technologies such as artificial intelligence and distributed ledger (blockchain) provide the new infrastructure for representing, accessing and using data, information and knowledge. These infrastructures were shaped by public investment in research and innovation from the beginning, and are thus designed in line with principles of openness and transparency. This strengthens their credibility and acceptance in society as instruments to handle even ethical controversies.

At societal level, conflicts and ethical controversies have become more common as knowledge based technologies expand to areas of human existence and activity previously considered 'untouchable'. New procedures for overcoming ethical and political dilemmas are put in place. Wide participation in decision-preparing and decision-making processes is facilitated by the digital knowledge infrastructures.

## **Relevance for Europe**

The open, collaborative knowledge system promises to be an important contributor to the European society and economy. For Industry and entrepreneurship, the integrated knowledge system brings new opportunities for diversifying and accelerating innovation. With innovation-related knowledge available to all actors, entrepreneurship will become an option for many.

The open knowledge system will create important sources of economic revenue through services related to knowledge. It will also increase efficiency of resource utilization in production, consumption and administration, and to enable a decentralized, circular economy where the added value remains in Europe.

## **Contribution towards the UN Sustainable Development Goals (SDGs)**

Despite the fact, that more than half of the private sector research takes place in countries that were characterized as emerging economies in 2016, the European knowledge production is successful in researching ways to sustainable futures and to steer innovation towards related SDGs, in particular (Goal 4) Quality Education, (Target 16.6) Develop effective, accountable and transparent institutions at all levels, and (Target 16.7) Ensure responsive, inclusive, participatory and representative decision-making at all levels.

## **Implications for EU policy**

The open knowledge system gives a new impetus to the European Research Area. EU support for digital infrastructure and framework conditions will enable the rapid transformation of knowledge production and education into a new and integrated knowledge system. A European knowledge cloud, incorporating European values and principles of openness, will spread the benefits of new knowledge across sectors and regions. This open infrastructure system will make it possible for producers, consumers, trade, citizens, scientists, policy makers and the relevant organizations to be on the same level of information and to have access to relevant data in real-time. It will also support the reorientation of education policy – primary, secondary, and tertiary – towards strengthening knowledge navigation rather than knowledge accumulation skills.

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### **Future Directions for EU R&I policy recommended by the public consultation**

- **Adapting educational techniques to online environments, and piloting various solutions (e.g., distributed online courses with tutoring, navigating through the stock of knowledge)**
  - **Understanding the neural basis of knowledge acquisition, and the relation of cognition to experience more generally**
  - **Devising intellectual property models and practices in open knowledge systems, and experimenting with new forms of IP sharing**
  - **Improving performance indicators in research, innovation and education institutions**
  - **Inquiry into knowledge-based industrial production and life-cycle processes and the development of innovative solutions**
  - **Exploring relevant ethical issues through experiments with new forms of decision-making**
  - **Designing and exploring alternative computing futures**
-

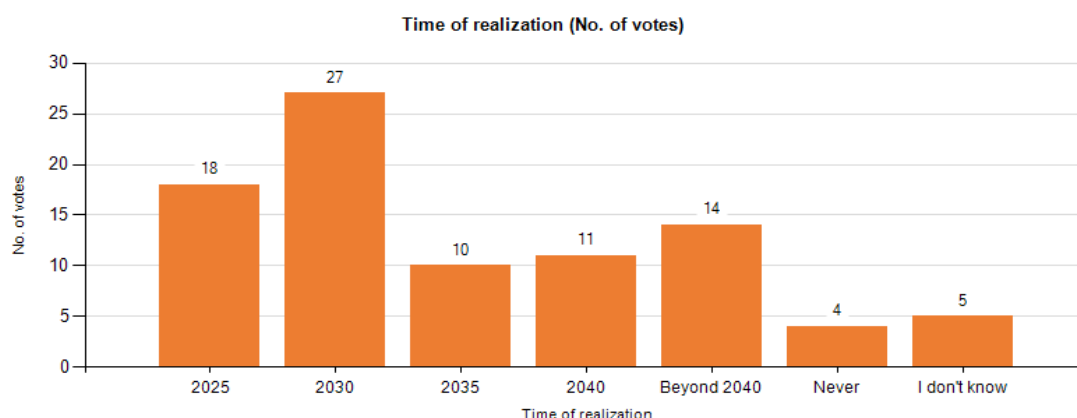
## **Annex: Relevant Data from the Delphi Survey**

The Delphi survey of the BOHEMIA study asked experts about the time of realization of 143 statements about the future, and about the relevance of Research and Innovation for that realization, or about the relevance of the realization for Research and Innovation policy. The experts were asked to justify their judgements with arguments. The whole data set has been published and can be found at: <https://ec.europa.eu/research/foresight>

This annex includes the parts of the data set that are relevant to this scenario.

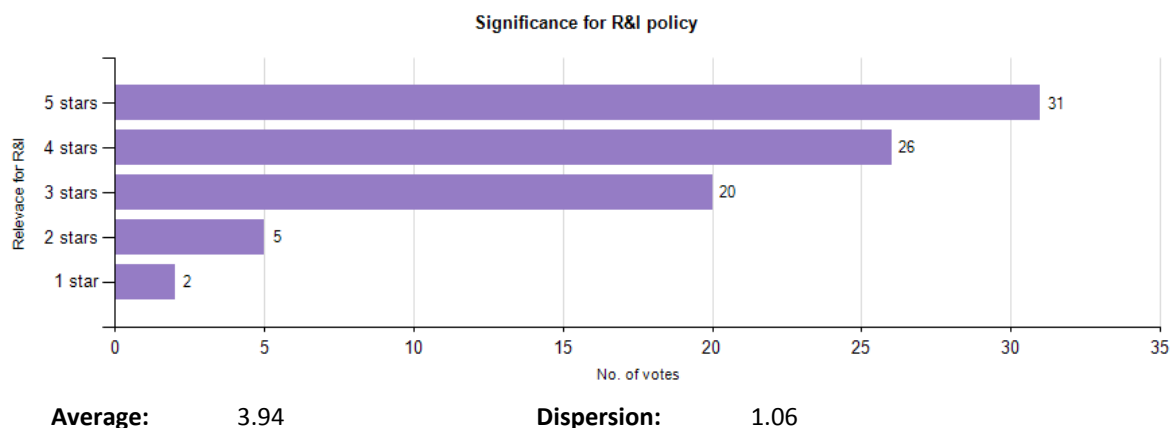


## More than 50% of all publicly funded schools in the EU have replaced the conventional disciplinary teaching methods with a problem-solving pedagogy and curricula



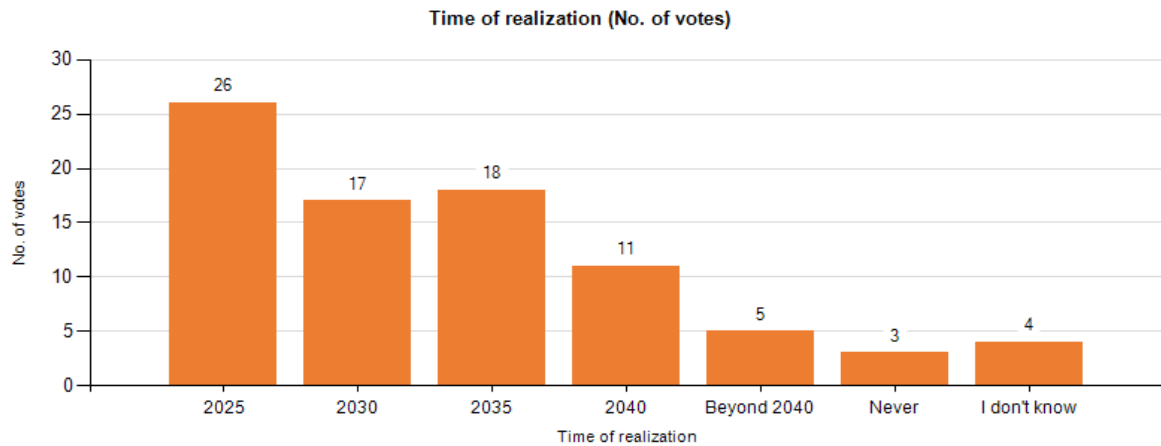
Number of respondents: 88

Arguments for time of realization	No. of votes
More pilots are needed in various EU regions to test the usefulness of this approach.	49
We will more likely face an increased interdisciplinarity, but not necessarily in a problem-solving approach.	47
Inertia in the public educational system will delay such a radical change.	38
A much better integration between research and education is needed.	30
It is not proven that a problem-solving pedagogy will automatically lead to better solving of societal problems.	25
For real problem-based education, infrastructure also needs to be adjusted.	18
School systems display very high inertia, in particular in Eastern and Southern Europe.	15
The challenge of evaluation will restrain the expansion of problem-solving pedagogy.	12
Such a radical change needs wider consensus and major investment in education at all levels including teachers education.	10
Problem-solving pedagogy and curricula need to be complemented by experience (3G learning), knowledge discovery, and talent detection.	9
How about: more than 50% of schools will have a more individually oriented curriculum, taking into account pre-existing student knowledge?	8
Each individual starts his life from zero. He has to get a chance to learn what already is known, before learning how to produce new knowledge. For this, inertia in the educational system is essential.	3
Computer programming at the early stage and use of serious games are among the elements needed for attractive and effective learning.	3
Problem-solving skills and skills relating to information searching and source criticism are more essential in today's and future world than formal knowledge.	2
Teachers in (higher) education should prepare for problem-solving teaching and learning. Gradual replacement of old-fashioned teachers by problem-solving teachers will delay the change.	1
The change starts from the Nordic countries and gradually other countries will follow.	1



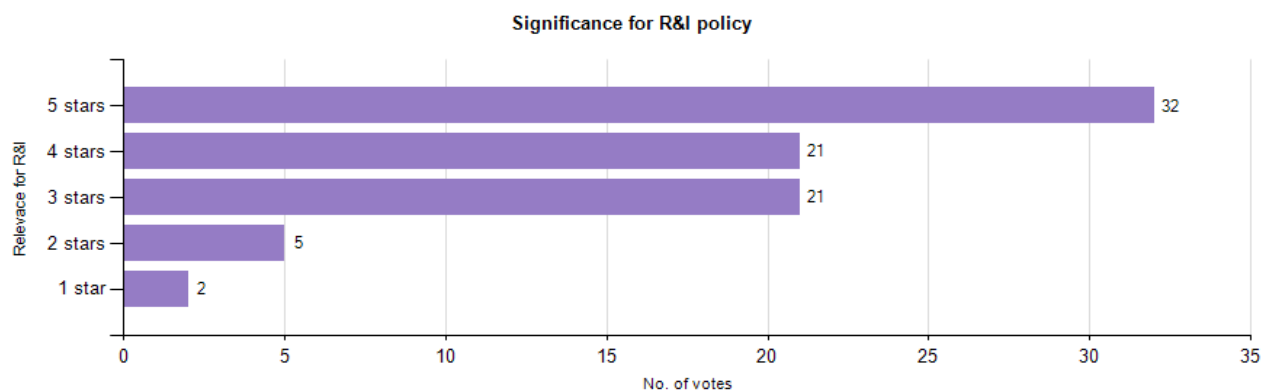
<b>Arguments regarding the significance for R&amp;I policy</b>	<b>No. of votes</b>
Future researchers need to learn problem-solving early in their lives - education policies and R&I policies overlap here.	59
Problem-solving is a core competence of the future researcher. Policies for better framework conditions in building up this competence are essential.	57
Co-creation between professional practice, education and research is needed	32
Research careers would rank higher among graduates options. In times of different options and a shrinking workforce there is a need to keep the system attractive for researchers.	27
Problem-based learning, taking into account transdisciplinarity is key to an open, curious and solid research mind.	25
R&I should provide easier access to the results of research in response to the increasing demand of the learners.	20
It is hard, and even vain, to teach problem solving to someone who does not know what a problem is, because he lacks the background domain knowledge.	10

## Educational systems in the EU give equal weight to competitive and collaborative learning practices



**Number of respondents:** 84

<b>Arguments for time of realization</b>	<b>No. of votes</b>
The ability to work in teams, deal with conflicts, and solve them - it is becoming more and more important. Social intelligence and emotional security are crucial dimensions. In future, we will learn more from each other and with each other.	78
Social intelligence will become crucial in the world of self-learning systems.	42
As of today, we have more competitive learning practices than collaborative ones.	33
Living systems are competitive by nature. Collaboration and interdisciplinarity are useful tools, which should not be understood as opposed to competitiveness.	24
It is crucial to detect talents and create the right environments for developing them.	15
Collaborative learning is already a frequent practice in EU educational systems.	10
Entrepreneurship should be added at the early stage.	9
Research teams and networks empowered with increasingly sophisticated collaborative tools are the driving force for knowledge creation and innovation.	7
How much balance is needed varies from field to field and even within fields over time.	7
This would require not only a paradigm shift but also very strong investment from MS in education, which is unlikely to happen under the current political trends.	3
It is necessary to involve much more the political decision-makers in all the countries.	1
There is probably more differences across the EU, and less willingness to adjust to common standards, in the area of education than in any other area.	1
Complex systems learning, and vertical leadership or multi-scale approach, will also be crucial for new talented people.	1

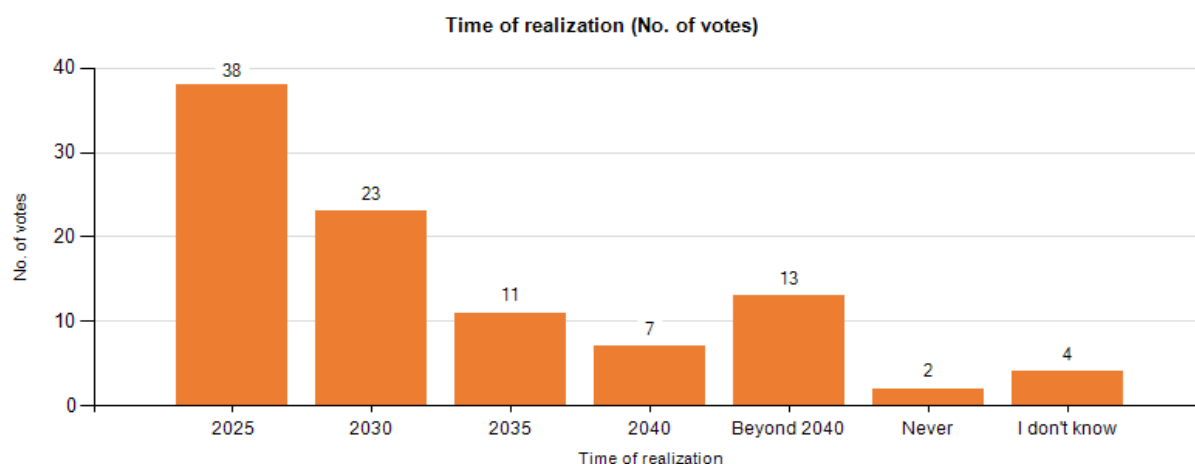


**Average:** 3.94

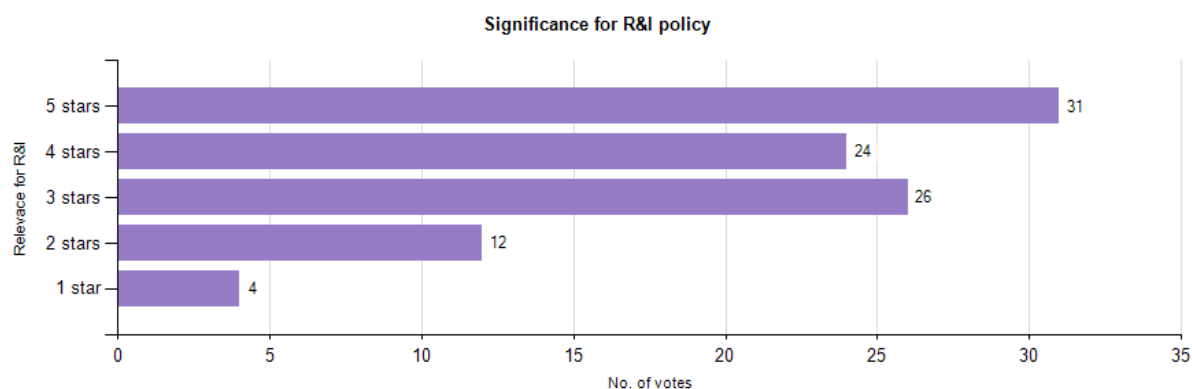
**Dispersion:** 1.11

<b>Arguments regarding the significance for R&amp;I policy</b>	<b>No. of votes</b>
Policies for collaborative research can only be successful if the education system prepares the researchers, who until now often work in competition or even alone, to be able to work collaboratively.	57
The researcher of the future needs to be very collaborative as more and more research is performed in teams - R&I policies have to back up education and training policies for high quality.	52
Education policies need to be changed from selective forms to more collaboration-fostering approaches.	27
Teachers and students need to get support about the process of collaborative working, coaching, training, learning and how they can optimally prepare for it. Guidance in the roles they'll take	21
R&I policies should include co-creation between public and private partners, but also between education, research and innovation	19
Education should focus on creating competent individuals, with technical knowledge as well as with social abilities. Excessive networking provides for bureaucracy and inefficiency.	17
The school/university evaluation and ranking systems need to consider these criteria.	12
EU policy is designed to support national action and help address common challenges, such as ageing societies, skills deficits in the workforce, technological developments and global competition. Collaborative aspects should be added to this list, too.	8
There is no significant link between the mode of education and R&I policy.	5

## More than 50% of European universities offer open online learning platforms free of charge



Arguments for time of realization	No. of votes
To learn free of charge would be a great opportunity for people who cannot afford university fees (in some countries) and allows them to have free access to (e.g. higher) education.	69
Online learning will be used more to supplement competencies as needed than to get formal degrees.	58
The question will arise what kind of value a degree from an "online university" represents: Is it comparable to a "normal" university degree? Will it be accepted by public and private sector employers?	42
An inflation of degrees can be expected, unless a thorough and internationally recognised accreditation system is established. Alternatively, universities maintain the monopoly on granting recognised degrees.	23
In 2015, there were 35 million students worldwide who registered for online MOOC (Massive Open Online Course) courses. The trend continues; further growth is expected for the years to come.	20
Due to "network effects" only a few early adopters will "clear the market". There is no need for every university to develop a MOOC-platform.	14
MOOCs should stick to online learning, without providing "online degrees". Universities could implement exam procedures (not online!) for MOOC graduates, in order to grant a recognized degree.	12
Online courses will be a central marketing instrument for universities which few can afford to miss.	5
MOOCs will only survive if employers attach value to them. And this will only be the case if there is co-creation, if MOOCs are based on instructional design principles.	5
Lists for subscribing in MOOCs are available online. Google and other large players are already entering the market of MOOCs.	5
Having serious competition among universities at worldwide level, offering free-of-charge MOOCs is not the best strategy for an institution to manage its financial sustainability.	4
But the number of universities will decline as market-based funding and competition for students forces mergers, acquisitions and closures.	3
Perhaps, but what's the quality of those platforms? The university education system has bigger problems to deal with.	1

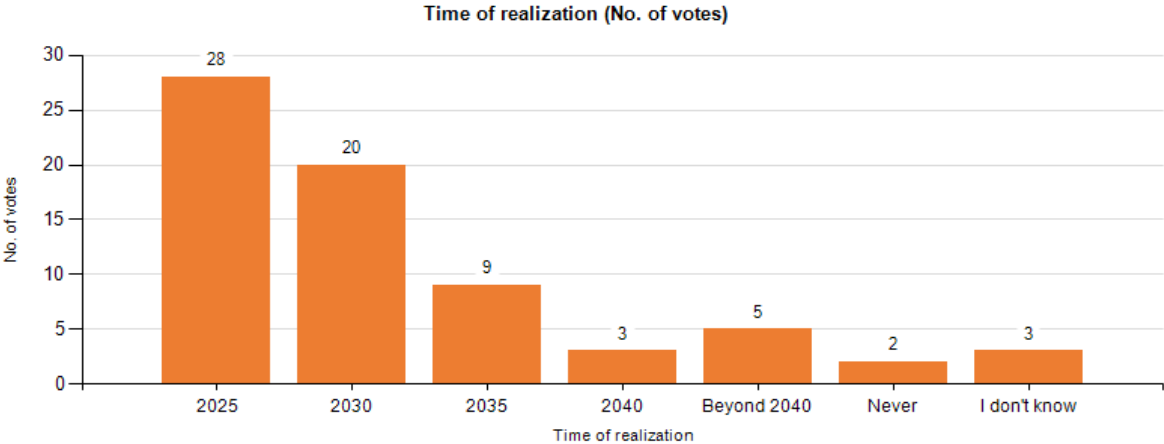


**Average:** 3.68

**Dispersion:** 1.35

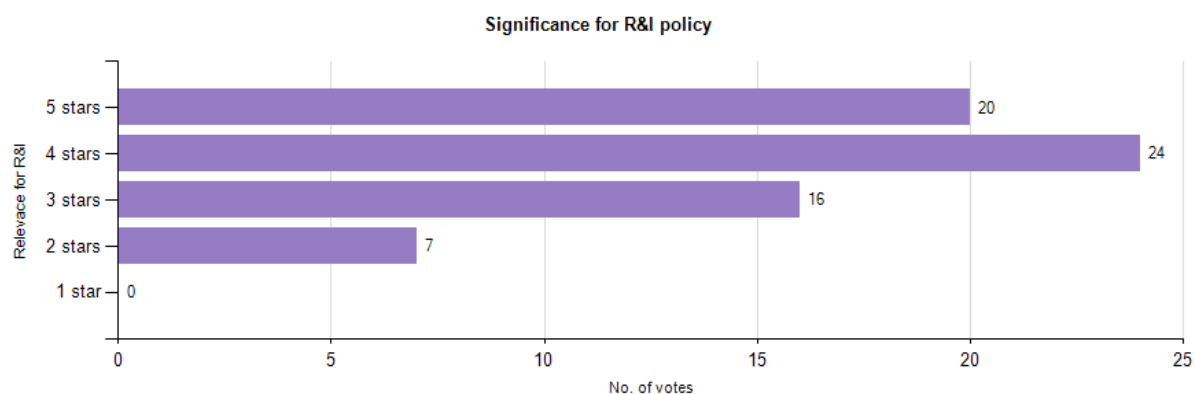
<b>Arguments regarding the significance for R&amp;I policy</b>	<b>No. of votes</b>
There are a lot more possibilities for life-long-learning and free access to education than we can currently imagine. Policy makers should be aware of the new developments.	78
Public universities and research and education facilities will be forced to go online, too, to be competitive and acquire students.	59
Experiences with decentralised MOOCs exist and demonstrate that there are huge new possibilities for different forms of learning, experimenting and being creative.	37
Truly innovative/useful research will still require personal training and specialized facilities (hence, traditional settings such as universities/institutes) in the foreseeable future, MOOCs or not.	22
Online education and MOOCs can be very useful for students that already have a degree from a traditional university. It is hard to convey the universitatmosphere and the value of university seminars	14
MOOCs will make many universities and education facilities obsolete, especially if they have concentrated mainly on teaching.	11
Some measure of regulation on the EU level might be required in terms of consumer protection.	5
Europe is much more involved in MOOCs compared to the US, policy strategies differ. Until now a centralised and industrial scenario is used to provide MOOC platforms to HEIs and society. This poses challenges in offering MOOCs.	4
The balance between number of universities/MOOCs and "market" needs will help to reduce unemployment.	1

**Data literacy (personal privacy, handling data etc.) is taught in all primary schools in the EU**



**Number of respondents:** 69

Arguments for time of realization	No. of votes
The nature of "facts", "data", and "sources of knowledge" is becoming very quickly an item of fundamental public debate that needs to be addressed in education as part of teaching critical thinking.	64
The mission of schools is not per se the teaching of data privacy but how data privacy links up to a life in civil society, freedom and democracy.	40
The fact that most adults have no clear idea of it will hamper its teaching in schools.	14
There are already training courses in data literacy targeting educators specifically.	11
The educational system is very resistant to change, so this will take (too) long.	9
As people get more and more immersed in electronic and virtual media, individual concern for data privacy will be seen as a thing of the past.	9
As generations as well as learning and work environments change, data literacy will be acquired naturally by most individuals - almost everybody will be data literate at a basic level - with no need for formal education.	7



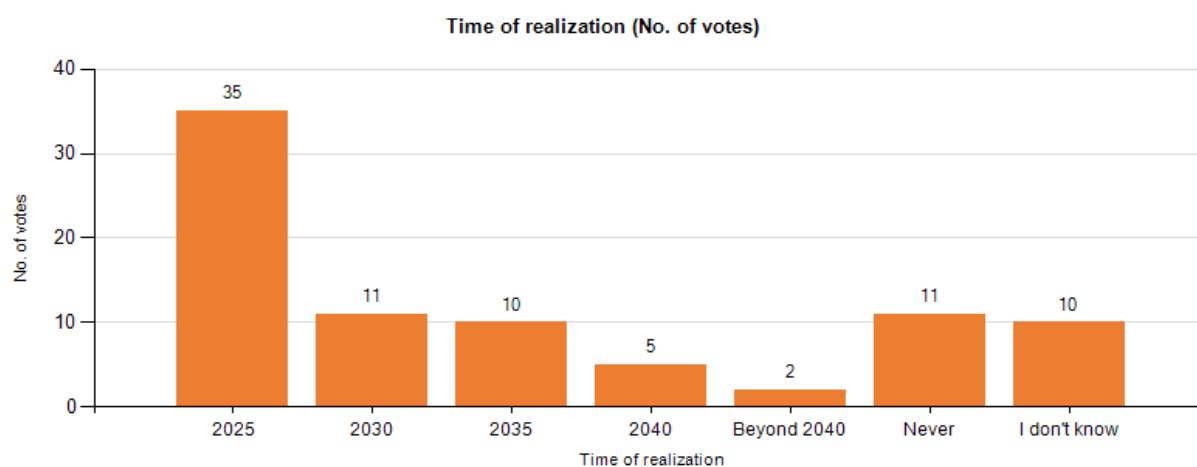
**Average:** 3.85

**Dispersion:** 0.94

<b>Arguments regarding the significance for R&amp;I policy</b>	<b>No. of votes</b>
Data literacy will become crucial as we get surrounded by sensors - education and training programmes are essential.	56
Data literacy will facilitate the uptake of citizen-science at a large scale.	36
Understanding the usages of data is key to governing societies. Data privacy and willingness to share specific data is part of the process.	31
All researchers will be quite adept at handling data. Education policy has to change.	12
This is a matter of education policy more than of R&I policy, even if "usability" will have to be part of Technology design.	4

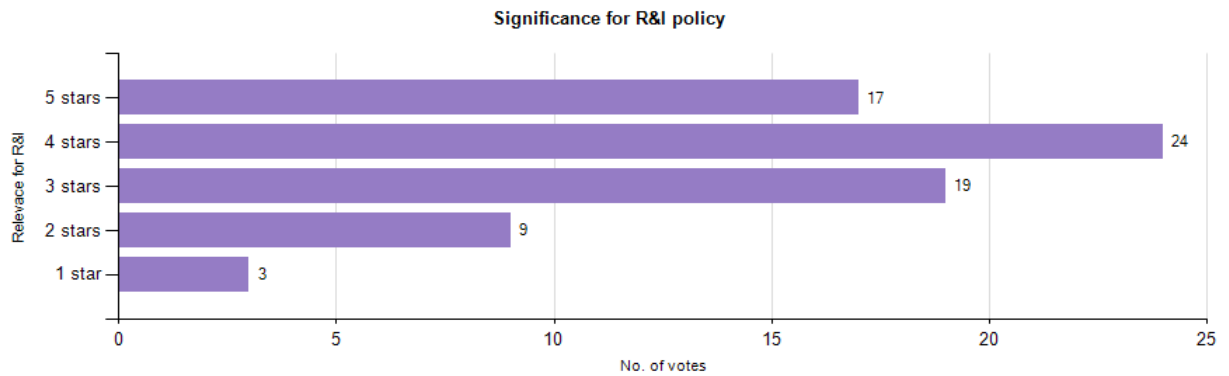


**Value and ethical conflicts relating to science and technology multiply to the extent that formal processes of ethical approval are established for every new EU research funded project**



**Number of respondents:** 83

<b>Arguments for time of realization</b>	<b>No. of votes</b>
Formal processes of ethical approval are already in place for every single project. Public policy debates will concentrate on the extent of grey areas and the positioning of red lines.	56
Ethical approval processes will not be sufficient for addressing ethical conflicts relating to science and technology, which can be much broader than individual research projects.	39
Ethical approval might become important, however, what is ethical will become more and more contested with AI and synbiochem on the rise.	25
Formal ethical processes already exist at project level. The key issue for the future is whether they are monitored and whether there are consequences from their (insufficient) implementation.	17
Isn't this already the case today? No doubt this can be built upon incrementally with political will.	14
Examples of today's socially relevant problem areas of research ethics are the areas of animal experiments or human experiments with subjects, stem cell research, genetic engineering, research on armament purposes, resource consumption.	14
Never, otherwise research in areas with strong conflicts about values and ethics (AI or Synthetic Biology) will take place outside Europe.	7
There will always be research areas which do not raise ethical issues, and freedom of research just means that the default position is no formal approval required.	4

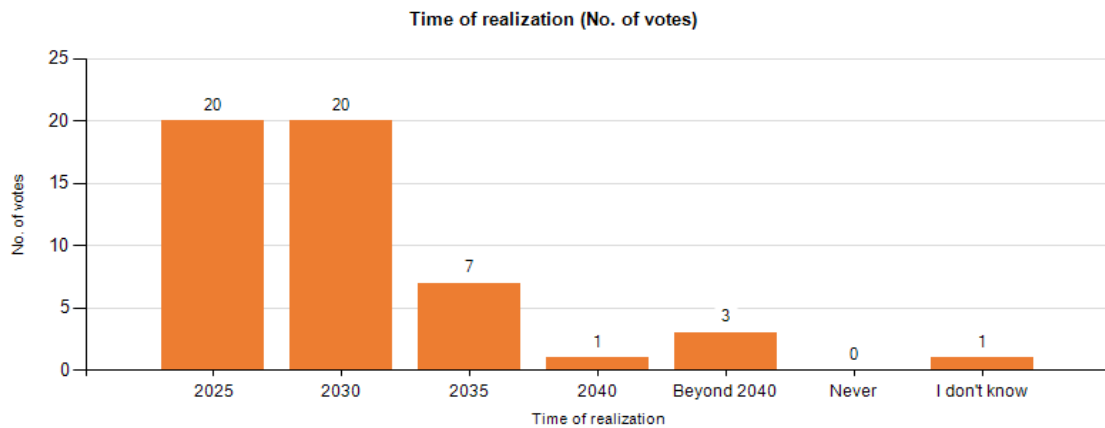


**Average:** 3.60

**Dispersion:** 1.19

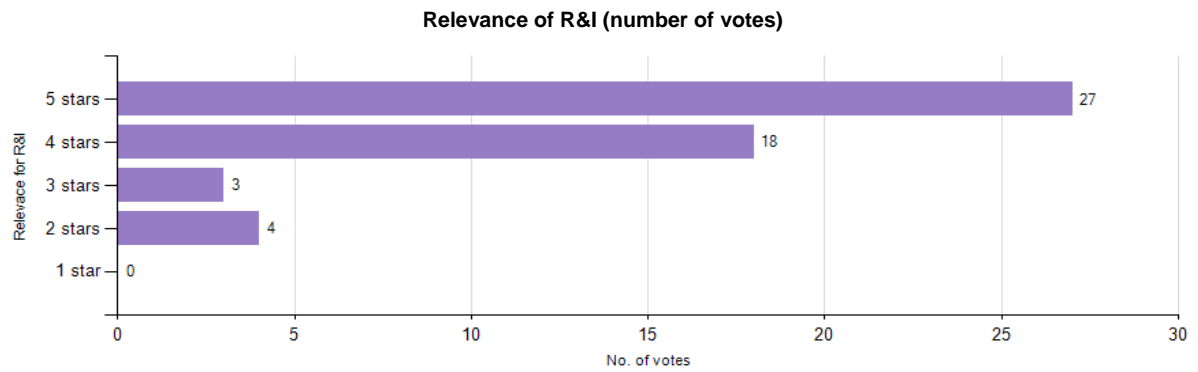
<b>Arguments regarding the significance for R&amp;I policy</b>	<b>No. of votes</b>
Ethical consideration and discussions concerning ethical implications of emerging technologies should be broadened, as how we approach the regulation of emerging technologies will inevitably have wide implications on our societies.	53
Will be very much needed in some areas such as biology or health and is impossible without policies.	46
Formal EU processes need to set in place the right conditions for the public debates in Europe and invite the other parts of the World to take part to these debates.	19
This is based on the hope that you (policy-making) can control everything in research, but you can't.	13
Formal EU processes need to regulate these conflicts.	11
The debate on RRI is polluted by the mixing of two different processes, basic research (free or oriented) & innovation. Without distinguishing both processes, it is impossible to answer this question.	5

## The majority of the EU population use integrated Artificial Intelligence devices and machines in their daily lives



Number of respondents: 52

Arguments regarding the time of realization	No. of votes
AI technologies will be used to improve analysis and prediction in devices used daily, without being recognised as such by the users (e.g. navigation devices, smart home controllers, smart cars etc.).	48
Online services (e.g. Google Translate) already employ self-learning AI.	34
AI (or "synthetic intelligence") will be utilized by most of the pervasive large-scale services (finance, media, social networks, e-commerce), so that people interact with it, for the most part unknowingly, all the time.	31
Self-driving cars, trucks and busses will be prevalent by 2030 implying daily contact for almost the entire population. Fraud protection in financial systems based on blockchain will be pervasive.	14
In practice, there are no real AI machines in our daily lives. Service robots like vacuum cleaner robots are not intelligent.	7
AI has been in development for a long time and we still have problems with language recognition.	6
It will take time until real AI will be in our households, but if this happens, they might be treated like family members (see Aibo and other pets).	3
We do it already today. When my TomTom with HD traffic sees a traffic jam, I follow its advice for a detour.	1
People will use AI Technology quite frequently if it comes to data related services, e.g. via Internet, but there will be no intelligent machines (robots) in their daily life.	1

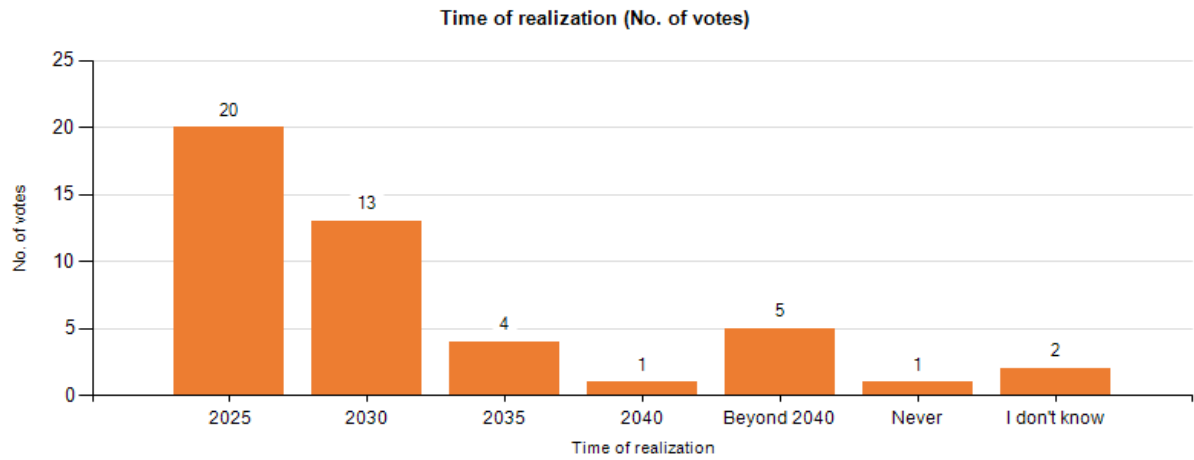


**Average:** 4.31

**Dispersion:** 0.77

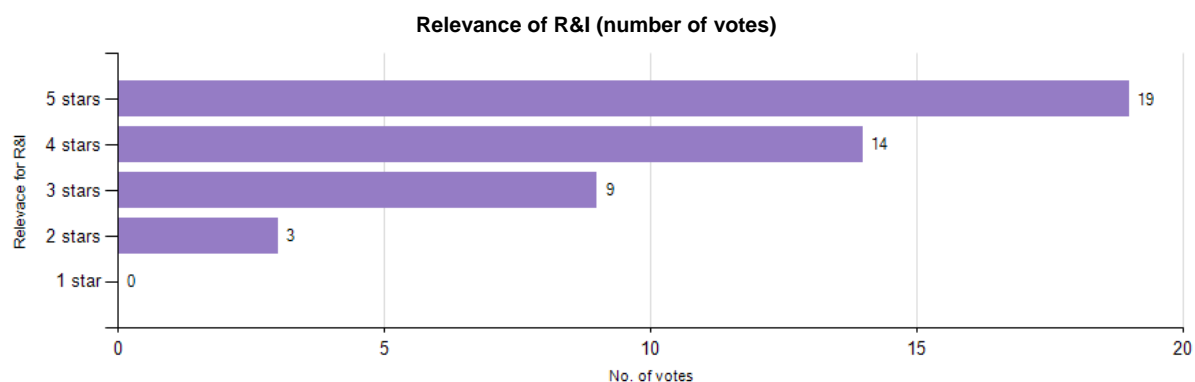
Arguments regarding the relevance of R&I	No. of votes
To make the machines around us really "intelligent" requires a lot more research.	40
Research in ethics and regulation is needed to address issues of responsibility and agency.	33
Research on how humans can learn and interact further with AI is needed	15
When a diffused presence of AI will become apparent the main problems will become social acceptance linked to privacy and security concerns	10
Liability, accountability and other security considerations need to be carefully and thoroughly examined.	8
Use it or lose it. Pervasive AI raises the need for research in retention of human capabilities as thinking and other skills may be less needed to get through the day.	5
Deep learning has already turned a corner technologically. It's not genuine AI, but it's good enough, so more budget is needed for understanding social and societal impact.	5
Also in future AI will need large computing power, therefore an efficient information transmission without losing discriminative characteristics is needed. Still an open research field	4
Some data needs to be processed in server farms, requiring heavy software and hardware improvements. EU should strengthen both.	3

## Artificial Intelligence is used in systems that support policy-makers' decisions across the EU



**Number of respondents:** 46

<b>Arguments regarding the time of realization</b>	<b>No. of votes</b>
Artificial intelligence is already used and will be used to support decisions, but not as a substitute for human decision-makers.	38
Artificial Intelligence - sophisticated models, or models developed by learning machines - are already used on a routine basis in all sorts of decisions.	33
Any policy decision can be supported by AI if fed with carefully selected data and criteria.	19
AI is used in elections and that use will grow and poses dangers for democratic governance as information bubbles are created to manipulate decision-making.	10
Siri, Google Assistant, Alexa, Cortana: individuals will naturally move from personal assistants to assistants in public decision-making.	7
Decision-makers will never defer to robots (especially when they don't like the latter's decisions).	4

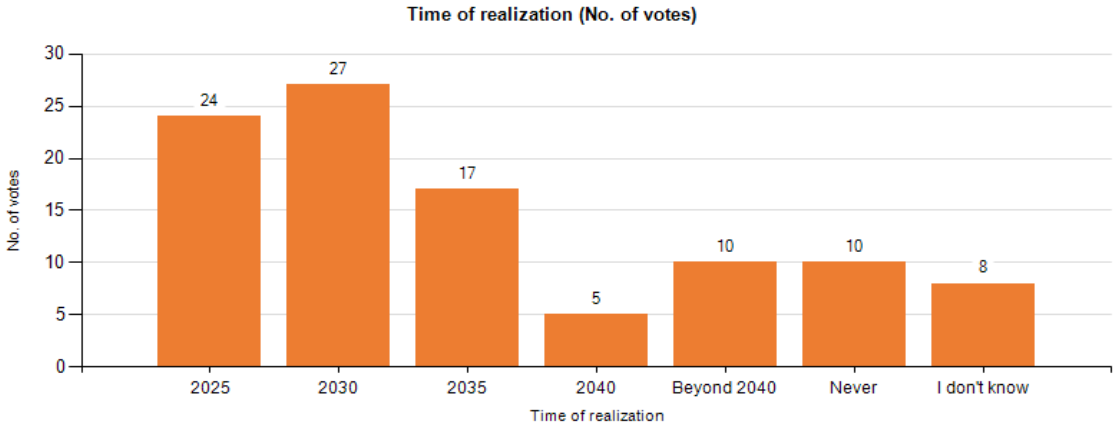


**Average:** 4.09

**Dispersion:** 0.87

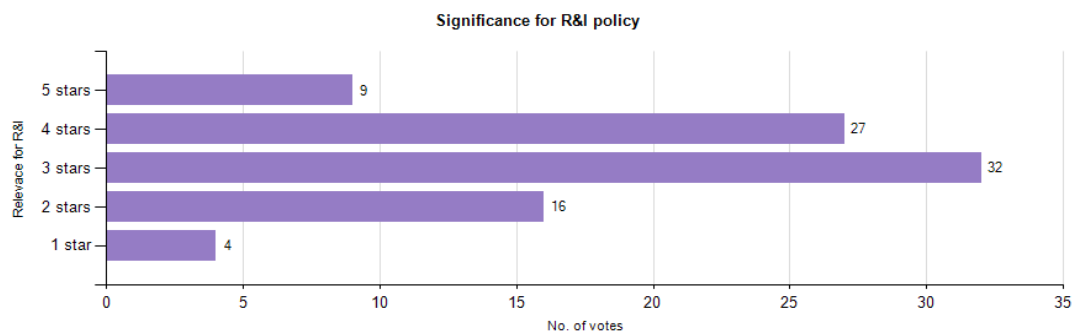
<b>Arguments regarding the relevance of R&amp;I</b>	<b>No. of votes</b>
We need to understand the blind spots of algorithmic decision-making in specific decisional contexts.	38
Research is needed to identify the elements of the decision process under the control of AI so that humans have the potential to review decisions on demand and understand drivers influencing the AI.	21
Scientists have only now begun to look into whether, how, and when humans trust robots' advice; more research is needed.	18
Also the basic R&I is needed. The algorithms and practices are developing fast and these competences are critical in global competition.	10
Security concerns over data abuse/misuse and other aspects of adversarial machine learning and AI need to be researched.	8
Decision making process will become to require AI tools, because they will become to be not able to decide without them.	2

**Co-creation (companies and customers jointly developing a product) has become the most prevalent form of innovation by manufacturers**



**Number of respondents:** 98

<b>Arguments for time of realization</b>	<b>No. of votes</b>
Co-creation between companies and customers is already the case in many domains but co-creation between companies and citizens is not. Non-customers influencing companies will take time.	57
This idea is old but the methods to bring them together and make them work for a longer time are still underdeveloped.	47
Co-creation is also about collaboration between businesses, governments, individuals and education.	41
If we broaden the co-creation process to include user-data gathering and analysis by businesses, then this statement seems not so far off.	34
It is still a long way until it is the most prevalent form of innovating, there have been a lot of attempts, but it is difficult to keep customers interested in participation.	12
A user-driven approach to innovation becomes more prevalent, with customisation of needs as the driver.	11
Co-creation will become a reality in manufacturing, and decentralization in any sector is clearly needed (health, food etc.).	8
Why should citizens or the customers be motivated to take part in co-creation? They just want to buy a product.	7
It takes much too long to agree on the desired design parameters as coupled with the necessary technology and production methods.	4
The business model for co-creation (i.e. revenue generation to justify the customers' conscious contribution) is not robust, hence, it will be only apply narrowly in niche markets.	4
For many SMEs, innovation is customer-driven anyway. Manufacturing innovation in the B2B sector thus is already relying widely on some kind of co-creation.	3
Without any change of our society's organization, that means that customers will pay twice for their product, first by their work to develop it and then by buying it.	2
This would put the customer in a very committed position, limiting their individual liberties on the market, and driving society towards an excessively feudal-like structure	1



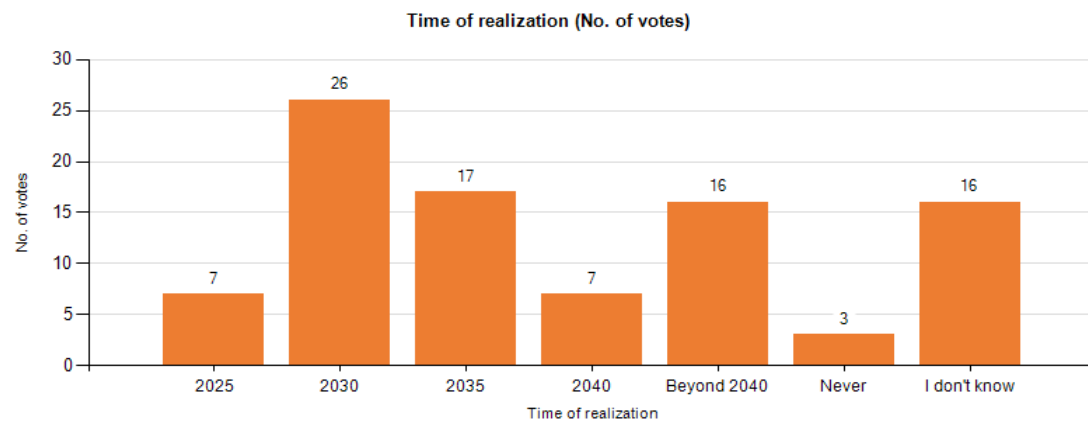
**Average:** 3.24

**Dispersion:** 1.01

<b>Arguments regarding the significance for R&amp;I policy</b>	<b>No. of votes</b>
Co-Creation is much more than that - it means all stakeholders.	54
Policy needs to raise the awareness for more customer-centric developments according to the needs of the people and society as such, and lessen the influence of the technicians.	50
An atmosphere for "joining forces" can be supported - by programmes and by political will.	33
Platforms for bringing citizens/ consumers and producers together need to be installed and funded to activate the Prosumer movements.	25
The maker movement needs support and publicity.	8
Citizens, customers and manufacturers do know their needs and business opportunities. If there is real value in co-creation policy-makers better trust people to make best use of it without intervention.	5
Co-creation needs new monitoring system to control the process.	3

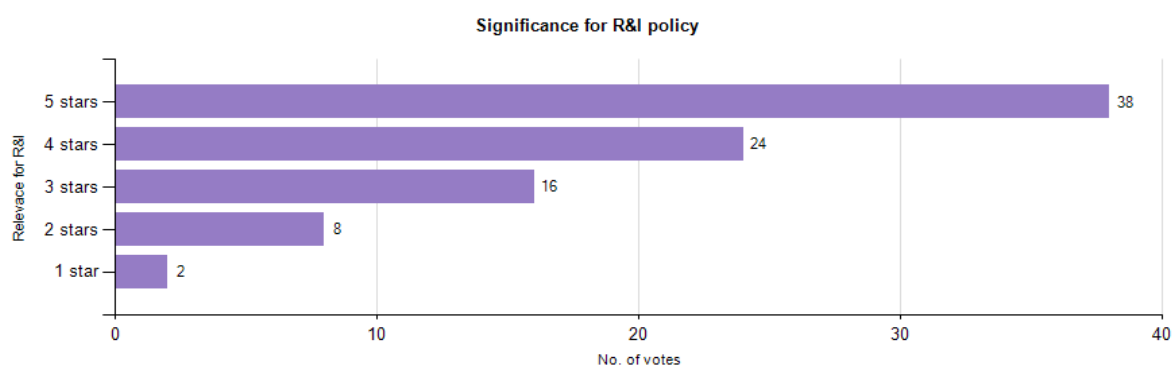


## More than half of the private sector research takes place in the emerging economies of 2016



**Number of respondents:** 91

<b>Arguments for time of realization</b>	<b>No. of votes</b>
Look at the demographic patterns. As emerging economies grow and invest more in R&I they will have a massive pool of people ready to get involved in R&I.	66
Emerging countries like South Korea, China or India currently invest heavily in R&I - and when they earn enough money, the companies invest in research to secure the future	60
As the emerging countries South Korea, Taiwan, China, Singapore, Malaysia etc. have good education systems and very good scientists, they have more capacities.	41
Developing and "emerging" countries need a long time span to shift from just copying, OEM or basic economic considerations to R&I industries and economies. Initial investments are typically spent on projects that generate immediate returns.	14
Changes that involve educating new generations of people always take longer than expected.	11
Scientist wages increase with time but remain low in emerging economies when compared to their peers in industrialized countries - therefore it is cheaper to hire them in their home nation.	8
Depends on EU framework conditions. Companies are off-shoring R&D capacities to get closer to resources or markets but there is no drive to move out of EU just because.	1
Sorry, hardly any of the comments above is relevant for this statement.	1

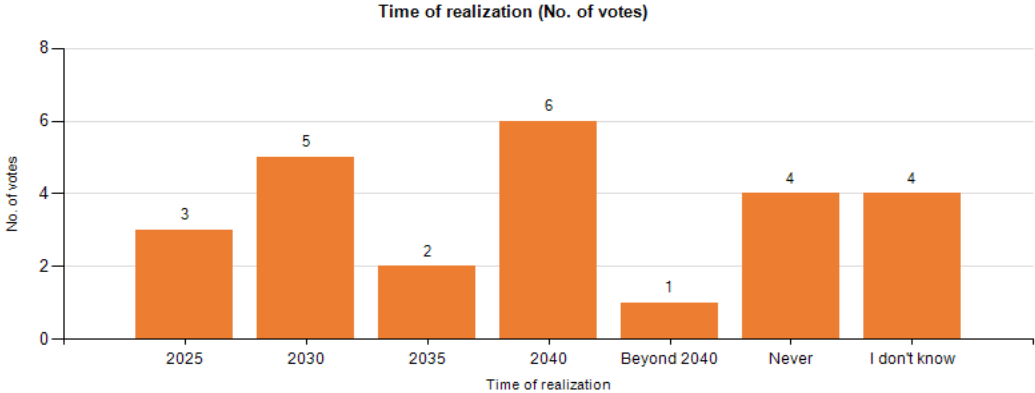


**Average:** 4

**Dispersion:** 1.18

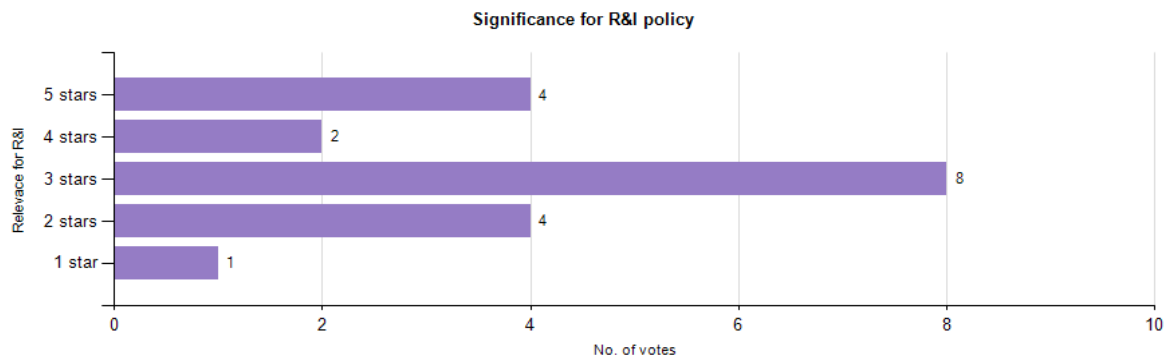
<b>Arguments regarding the significance for R&amp;I policy</b>	<b>No. of votes</b>
The EU also needs high funding for research in the future - and funding needs to be sufficient to attract R&I companies.	63
If more and more excellent research is done outside of Europe, it becomes more and more important for Europe to cooperate with the rest of the world.	57
The framework conditions for R&I in the EU need to be kept supportive, and investors need to be attracted and invited.	52
It is almost unavoidable given demographics. The question is whether the EU can stay a leader with its proportionally much smaller resources at hand.	25
It will become challenging for Europe to be home to leading companies. The EU will face choices: dependence or autonomy; R&I to be able to choices or as a traditional cultural pursuit et al.	18
With the development of the education system and the markets in emerging countries companies of developed countries are going to increase their investment in R&D in these locations.	4
EU research is still of high quality. Innovation is the problem: it is inhibited by fragmented legislation and risk reluctant investors. Appropriate incentives for industrial EU policy is priority	1

**Globally and professionally managed human work clouds make up 40% or more of all teams in science and business**



**Number of respondents:** 23

Arguments for time of realization	No. of votes
We do not want human work clouds, we need safety, security and a stable life - to establish a family is impossible with this lifestyle. Hopefully, the 40% will never happen.	16
Human work-clouds are easier and more flexible to organize and to handle for the employers.	9
This is just a catchphrase to define precarious lives.	8
Properly used, human work-clouds allow for a better work-life balance.	8
Work clouds provide a suitable way to mix competencies with higher efficiency and to fulfil employees' needs for personal development	6
We already know from observations that some of these catchy concepts are extremely short-lived.	4
The share of 40% is too high as there will be ever more tasks that can't be done "in the cloud". Standardized work will be automated anyway.	3



**Average:** 3.21

**Dispersion:** 1.33

<b>Arguments regarding the significance for R&amp;I policy</b>	<b>No. of votes</b>
Legal questions arise from this topic: when should an independent worker actually be classed as an employee?	14
Research upon work-life balance in case of human work clouds is key to understand how such working-lifestyle can be managed in a such a way that increasing quality of life is not hampered.	9
Regulation is needed: Who is allowed to manage human work clouds?	7
Problems need to be address when they arise. Anticipated problems are endless.	4

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