Eurobarometer Qualitative Study

PUBLIC OPINION ON FUTURE INNOVATIONS, SCIENCE AND TECHNOLOGY

National Report

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Malta

Qualitative study – TNS Qual+

Eurobarometer

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Public opinion on future innovations, science and technology: results of focus groups in selected Member States

National Report

Malta

Conducted by TNS Qual+ at the request of
the European Commission,
Directorate-General for Research and Innovation

Survey co-ordinated by the European Commission,
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A. EXECUTIVE SUMMARY

General perceptions about scientific and technological innovations

General associations related to scientific innovation

- Overall the general associations were: 'advancement', 'the future', 'changes', 'inventions', 'safety', 'medical care', 'more access to information', 'access to communication', 'isolation' and 'lack of face to face interaction'.
- The younger participants were more concerned about the effects of science and technology on the environment, whereas, the older participants were more worried about how technology is affecting society, the family unit and children.
- The older participants tended to focus more on 'regression' and things getting worse, whereas the younger participants tended more to link science and technology with 'progress' and things getting better.

The most important scientific and technological innovations observed over recent years included:

- **Health / medical treatment**
    - The size of medical instruments is smaller and procedures less intrusive, there has been progress in medical equipment (CT scans, MRIs, digital X-rays, the use of lasers), more precise operating methods (improved eye laser operations, hip and knee replacements, heart transplants, incisions are smaller, keyhole operations) and more local health services are available.
- **Education / knowledge**
    - Use of interactive devices (e.g. tablets), online search engines/archives and e-Books
- **Living conditions/housing**
    - Sophisticated cameras and alarms, home appliances, lifts, solar panels/solar water heaters, double glazed windows and safer building materials.
- **Transport**
    - More environmentally friendly cars (less emissions, hybrid cars), safer cars (airbags/body of car is more malleable) and aeroplanes, navigation systems such as GPS, tracking systems, faster modes of transport and more sophisticated security equipment at airports.
- **Work**
    - Computers and other machines which have simplified work processes and made work less laborious.
- **Environmental protection & Energy**
    - More renewable energy sources (solar panels, wind turbines/wind farms), more environmentally friendly modes of transport (such as hybrid cars), more energy efficient light bulbs and appliances.
- **Personal data (+ data security)**
    - Chips in identity cards and passports.
- **Others**
    - Communication: Internet, video conferencing (such as Skype), live streaming, email and satellites;
    - Banking: the ability to transfer money across the globe, credit cards and ATMs;
    - Computers, laptops, mobile phones, smart phones, switch from analogue to digital technology and flat screen/3D televisions.

Spontaneous projections on tomorrows' scientific and technological innovations

The scientific innovations expected to be part of peoples' daily life in 2030 and their possible impact included:

- **Robots**: One of the first innovations many participants mentioned was robots. Participants expected that robots will be used in domestic work such as cleaning.
- **Environment:** People mentioned the following environment related innovations: control over the weather, creation of artificial green spaces and more eco-friendly houses and buildings. Such innovations would result in a cleaner environment.
- **Transport:** innovations/technology expected in relation to transport included: electric cars with automated parking systems, faster modes of transport which will result in less travel time. Cars and driving will also be safer and more environmentally friendly.
- **Education:** Participants mentioned that children will not go to school anymore as they will attend a virtual school where they will taught online. The participants were concerned regarding the lack of face to face interaction amongst children and how it would affect their development.
- **Health:** It will become easier to reproduce certain body parts rather than having to wait for an organ transplant.

Expected innovations in selected areas

- **Homes and living**
  - Use of robots for domestic work
  - Interactive walls instead of televisions
- **Health and healthcare**
  - Reproduction of certain body parts and organs
  - Cloning
- **Communications**
  - Technology that tracks eye movement
  - Virtual projections
- **Environment**
  - Artificial green spaces
  - Control of weather
  - Eco-friendly houses and buildings
  - More man-made construction materials

Reactions to future scientific and technological innovations in selected areas

Homes and living (assessment of the scenario and its innovative aspects)

The first general reaction was related to robots. The older participants felt that these would provide more convenience, however, they would also minimise our face to face interaction, make us lazier and more dependent on technology. The younger participants were slightly more positive and talked in the following terms: 'pampering', 'comfort' and 'efficiency'. However, these participants also mentioned negative aspects such as 'boring', 'static' and 'lack of control'.

Positive aspects included reduced housework, video messaging via Pra (younger participants), solar panels/alternative energy, smart meters, the ability to monitor the use of electricity, electricity consumption at off-peak hours.

Negative aspects were that robots will be too expensive to purchase and maintain for most people, concerns about the storage of data on companies' data servers, the lack of control in your own home, lack of security and laziness.

The participants felt that the scenario would be more acceptable if the data were stored on a personal server rather than online. Furthermore, they felt that even though the invention of robots was realistic, the use of robots in households was less realistic as it would not be affordable. Most participants also felt that 2030 is too soon for robot innovations to become a reality as certain cultural changes need to take place.

Health and healthcare (assessment of the scenario and its innovative aspects)

Most participants' first reaction was related to virtual consultations. Participants felt that medical issues, bad news and diagnoses should be handled face to face. However, virtual consultations with their doctor for minor conditions would be acceptable.

Positive aspects were seen to be an improvement in health prevention and monitoring of health; the leaflet with relevant consumer products as it provides people with guidance and advice on what to buy; stem cells which participants felt could help save lives. Other positives included cost, convenience, less bureaucracy and the use of data for research.

Negative aspects included virtual interaction with doctors rather than face to face personal contact, the lack of privacy, the reliability of tests/risk of misdiagnosis and the role of supermarkets in healthcare for which participants expressed concerns about confidentiality and marketing of certain products.

Overall the participants had mixed feelings whether such a scenario was realistic. Participants questioned whether such an investment in healthcare would be possible by 2030. However, they felt that such a scenario would be accepted by the majority of people. The least acceptable aspects would be virtual consultations and the role of supermarkets in healthcare.

Ubiquitous communication and interaction (assessment of the scenario and its innovative aspects)

The participants' first reaction was the lack of privacy and freedom and that the scenario is 'too intrusive' as there would be 'too much scrutiny'. The hologram was perceived as being convenient for long distance communication; however, some participants felt that it would reduce the importance of seeing people in real life as we would be happy with seeing them on hologram.

Positive aspects were seen to be traffic cameras which would provide more security and more crime control, virtual meetings as there would be no need to travel for work which was viewed as both more environmentally friendly and efficient, and improved communication with friends and family who live abroad.

Negative aspects included technology related to tracking and surveillance and its impact on civil liberty. Regarding data to change the store layout and placement of goods, participants were sceptical about the use of data to change the perspective. Finally, participants were negative about not knowing how personal data is being used and lack of face to face contact.

The participants felt that the scenario was realistic and would be accepted by the majority of people although the hologram was perceived as being the least realistic aspect. It was generally felt that the scenario might be difficult to implement due to data protection laws. However, they also felt it would be more acceptable if they had more control over the type of data that is recorded, facial recognition and other tracking technologies.

Environment (assessment of the scenario and its innovative aspects)

The participants had mixed reactions; some participants thought that it was an 'ideal' and 'exciting' scenario, while others felt that it was 'almost too perfect' and like a 'fairy-tale'.

In general, the participants agreed that we need these types of innovations in order to preserve the planet.

The positive aspects were recycling, a cleaner environment, crops which are free of chemicals and pesticides, better use of water, eco-friendly homes and bio fuel.

For negative aspects people felt that buildings and architecture would have no character and that solar panels and wind farms would disrupt the view. Regarding the reuse of low-grade waste water, participants were concerned about the safety and quality of such water, considered it too difficult to manage, and thought there might be unknown effects and dangers. They questioned the role of businesses in the implementation of these innovations.

The participants felt that the scenario was realistic, although they doubted whether all the innovations would be implemented by 2030. Furthermore, they felt that the reuse of low-grade waste water and storage of CO_2 would be unacceptable for the majority of people. It was widely felt that there would have to be a change of mentality so that people start thinking more ecologically. Such a scenario would also require a high level of discipline and might be too demanding for people.

B. OBJECTIVES AND METHODOLOGY

Objectives

The aim of this qualitative study was to get a better understanding of European opinion on the subject of innovations brought about by science and technology in society. More precisely, its main objective was to explore reactions to some specific innovations that might be a part of everyday life for citizens in Europe in 15 years' time in four different areas.

Four areas/scenarios were tested:

- The house of the future (Homes and living),
- Health and healthcare,
- Communications (Ubiquitous communication and interaction),
- The environment.

Methodology and sampling

Fieldwork consisted of a series of 6 focus groups, each approximately two hour and a half in length, conducted in each of the following 16 Member States: France, Denmark, Germany, Estonia, Greece, Ireland, Italy, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Finland, United Kingdom and the Czech Republic.

Participant profile

The table below presents the composition of groups:

Group	Description
1	18-34 years old who finished their education between 17 and 22
2	20-34 years old who finished their education between 20 and 25
3	35-64 years old who finished their education before 18
4	35-64 years old who finished their education before 18
5	35-64 years old who finished their education after 18
6	35-64 years old who finished their education after 18

The detailed participant profiles and group composition, as well as details on the fieldwork dates are described in the technical report.

National context

In 2014, the Cabinet endorsed Malta's new National Research and Innovation Strategy 2020. Malta also has a strong IT and gaming industry. Furthermore, Malta has a high percentage of households that have an internet connection.

I. GENERAL PERCEPTIONS ABOUT SCIENTIFIC AND TECHNOLOGICAL INNOVATIONS

This chapter focuses on the participants' general view on scientific and technological innovations in order to get an overall grasp of their opinion on this subject. Firstly, what **ideas, feelings and associations** come to their mind when thinking about these innovations? What **positive and negative aspects** do they tend to associate with innovations brought about by science and technology? Secondly, **looking back on recent years, which innovations do they think have had the most impact on society and why?** What **changes** did these scientific and technological innovations bring?

1.1 General associations linked to the notion of scientific innovation

Overall the general associations related to scientific innovation were expressed in terms of 'advancement', 'the future', 'changes', 'new opportunities, ideas and way of thinking', 'inventions', 'safety', 'medical care', 'more access to research and information' , 'isolation' and 'access to communication versus lack of face to face interaction'.

The younger participants were more concerned about the effects of science and technology on the environment, whereas, the older participants were more worried about how technology is affecting social relations and the family unit and children. The older participants tended to focus more on 'regression' and the potential for things to get worse, whereas, the younger participants tended more to link science and technology with 'progress' and things improving.

However, older participants who had a higher educational background felt that we have control over the way we use science and technology and that it is up to the individual to 'switch off'.

Positive connotations associated with scientific and technological innovations:

- Living a better and easier life with more comfort and convenience (such as mobile phones, new appliances and internet banking).

    "Development of new products that make our lives easier and more comfortable." (Malta, Group 6)

- Progress and continuous advancement, finding new solutions.

    "Shifts in the way of thinking. In the past they used to believe that the world was flat but science taught us that the world is actually round." (Malta, Group 1)

- Easier access to communication and cheaper communication;

    "It is easier to speak to someone who lives abroad, which is very special for those parents who have children living abroad... you can see your relatives via Skype... you can feel close to them ... you can spend hours talking to them at no cost."(Malta, Group 3)

"In 1962, to make a telephone call my grandmother I would travel to another village to use a telegram. But today, technology is so advanced that you only need to click on your mobile or computer to speak to someone living miles away." (Malta, Group 3)

• Gadgets/mobiles/laptops.

"Nowadays, if I leave home without a key I am not worried, but if I leave without my mobile (phone), I will have to return home. Nowadays, nearly everyone has access to technology... even my 7-year-old son has a tablet and his own laptop." (Malta, Group 3)

• Fast paced research and continuous developments.
• Efficiency and speed: faster modes of communication and transport.
• Medical advancements and better health care, longer lives, new cures, improvements in diagnosis, stem cells.
• New niches of work such as the videogames industry
• Improvement and simplification in work processes (emails, computers).

Negative connotations associated with scientific and technological innovations:

• Loss of human contact and lack of face to face interaction.

"We're more interested in what's happening in the virtual world of Facebook." (Malta, Group 1)

"It's convenient that you withdraw money from a machine, but staff numbers have been reduced. It's nice that you can perhaps go and talk to a person....a machine bothers me... even talking to an answering machine, it's like you're talking to a robot" (Malta, Group 3)

• Barriers to communication and concerns about how technology affects the family.

"You speak to my daughter, with her Apple in her hand and she ignores you. We eat with the laptop. We sleep with the laptop." (Malta, Group 3)

• The effect of technology on young people's development; children are playing less outside; using technology as a 'babysitter'.

"Nowadays there are more children who have problems in speech development and their communication skills are limited. We are not talking enough to our children. Even in class there is an interactive white board so verbal communication is being replaced with visual communication."(Malta, Group 5)

"Children are exposed to certain material on the internet which they are able to view without the consent of the parents." (Malta, Group 3)

"There is a new trend where young people go out on a date and text each other instead of talking because they do not know how to look at each other and say 'I like you, you're nice'." (Malta, Group 5)

- Less patience and expecting to have everything available instantly.

    "The benchmark is always getting higher – whereas in the past we were happy with just having access to different websites, nowadays we get frustrated if the page does not load in 3 seconds." (Malta, Group 1)

- Faster pace of life, more anxiety and 'chaos'; having to continuously adapt to new changes.

- Becoming lazier and more dependent on technology.

    "With progress comes regression. Technology is making us lazy because whereas in the past you went out to meet your friends, now you spend time on Facebook and do not meet." (Malta, Group 3)

    "Technology is making us lazy... in the past we used to calculate a sum mentally, nowadays even for a simple sum we use a calculator." (Malta, Group 6)

- We need more money to maintain our lifestyles; waste of resources (such as throwing away a good mobile to buy a newer version).

    "Today something comes out and tomorrow it is old." (Malta, Group 3)

- Workers being replaced by machines; losing particular skills such as masonry.

    "Whereas previously things were made by people, now they are being made by machines, robots. So humans are losing work." (Malta, Group 3)

- Employers have higher expectations of workers; work is more competitive and demanding. Older workers might not be able to 'keep up' with the continuous changes.

    "We are like machines, permanently at the office, always contactable and we have limited time for ourselves." (Malta, Group 6)

- Lack of privacy; use of social media in recruitment and work.

    "Today we have become too 'open' with technology....through Facebook, you know exactly where everybody went, what they ate and so on... I think it is too much of an invasion of our privacy. We get to know everything." (Malta, Group 3)

    "People can always find you... you're always 'connected'." (Malta, Group 1)

- Cybercrime, the increase in fraud, hacking, scams, identity theft and cyber bullying.

- Fear that certain innovations might have negative effects or unknown side effects on humans.

    "I was watching a YouTube channel and a professor was saying that 'the closer you put the mobile near your ear, the more you are 'cooking' your brain as it emits more radiation." (Malta, Group 5)

- The effect of technology on the environment; global warming, exhaust fumes, depletion of trees, destroying nature, lack of natural food, pesticides, exposure to chemicals, testing on animals.

> *"In order for us to be comfortable, we are destroying our natural resources." (Malta, Group 1)*

> *"You will find tomatoes all year round but they are not natural and do not taste as good as they used to." (Malta, Group 1)*

  ➢ Increasing the gap between rich and poor countries.

> *"Most medicine is available to the western world only." (Malta, Group 1)*

> *"We never stop and think about the worker behind these advances... there are a lot of people who are suffering in order to make these advances happen." (Malta, Group 1)*

- Advancements in technology related to weapons of war.

- Risk of losing particular languages and dialects as the world becomes more streamlined.

1.2 The most important scientific and technological innovations observed over recent years

The most important scientific and technological innovations over the last 15 years that the participants referred to are listed below by categories.

Health/medical treatment
- Medical equipment and surgical instruments are becoming smaller and procedures less intrusive which is more convenient for the patients and gives them more freedom;

> *"I suffer from sleep apnea, nowadays with just a small chip, the doctor can tell me, 'on that date you slept at a certain time, woke up at a certain time and had twelve attacks' So from a chip, without wires or anything - just a mask that I sleep with - I can go to hospital where the doctor puts the chip in a computer and reads the data." (Malta, Group 3)*

- Medical equipment such as CT scans, MRIs, digital X-rays, the use of lasers;
- Higher quality of operating methods: improved eye operations with lasers, hip and knee replacements and heart transplants. Incisions are smaller; keyhole operations;
- More health services are available locally.

> *"In the past you had to go abroad for certain operations, whereas nowadays operations such as heart surgery are done locally" (Malta, Group 4)*

Positive impacts:
- Increased life expectancy;
- New medicines and remedies;
- Higher rate of successful operations and fewer mistakes;

- Organised database systems and less probability that personal files are misplaced.

Education and knowledge
- Use of interactive devices at school such as interactive-boards and tablets
- Online search engines, archives and e-Books.

Positive impacts:
- Children are more knowledgeable;
- Interactive learning;
- Research and information costs less;
- Easier access to information; it's easier to find sources;
- Unlimited access to a number of articles and journals on any specific subject and books can be downloaded from the internet;
- More up to date information and real time updates;
- Efficiency - immediate answers by searching online which saves time.

> *"You do not have to spend hours looking at encyclopaedias or books to find the information you need. A search on PDF documents is also easier than having to search through a whole book." (Malta, Group 1)*

Negative impacts:
- Difficult to know whether the information you find on the internet is correct;
- Children might have too much access to information. The internet becomes their 'babysitter'.

Living conditions/housing
- New technology for security cameras and alarms;
- Home appliances such as washing-machines, microwaves and other kitchen appliances;
- Lifts and stair lifts;
- Solar panels and solar water heaters. Houses have better insulation (such as double glazing);
- Building materials are safer.

Positive impacts:
- Environmentally friendly appliances provide cheaper energy and reduce environmental pollution;
- Home appliances and lifts are more affordable and provide more convenience. Furthermore, whereas in the past the elderly used to sell their houses to move into one-floored houses, nowadays, they can use a stair-lift.

> *"Microwaves changed the way we cook" (Malta, Group 5)*

Negative impacts:
- Appliances have a shorter life-span, resources are wasted

> *"Everything is disposable... it is no longer worth fixing an appliance as it costs less to buy a new one" (Malta, Group 5)*

> *"I bought a fridge 20 years ago and when it had problems the technician told me that it was 'built to last', nowadays things are made to last 5 to 6 years and then you throw them away." (Malta, Group 5)*

Transport
- Cars are more environmentally friendly (less emissions, hybrid cars); they pollute less;
- Cars are also safer and quieter (airbags / body of car is more malleable);
- Navigation systems such as GPS are useful for tourists travelling by car;
- Tracking systems on employees' (such as sales persons) cars;
- Courier services are more accessible and it is easier to track packages;
- Trains and other modes of transport are faster which allows us to travel long distances in a very short time;
- Aeroplanes are more comfortable, safer and faster.
- More sophisticated security equipment at airports;
- Some participants were sceptical about aeroplanes being piloted by computers rather than human pilots. These participants feared that a computerised system can be hacked and used for terrorism;
- Others felt safer as a computerised system was less likely to make any errors.

Employment and jobs
- The younger participants tended more to mention that advances in technology and science created more jobs and opportunities such as the rise of the gaming industry and the financial sector (online investments);
- However many older participants felt that certain skills and crafts were being lost as more and more work is being done machines
-
   "Machines have replaced a number of people, one machine instead of 15 people" (Malta, Group 6)

- Participants also mentioned that agricultural jobs are easier and more hygienic as a number of processes which are now automated and which reduce the farmer's manual work.
- Another aspect mentioned was that there are less chances of making a mistake at work as processes have been simplified through technology.

   "I used to work at a bank. Nowadays, they have computers and calculators which do the graphs for you... before for example we used to have a manual adding machine and huge data processing machines." (Malta, group 3)

Environmental protection & Energy
- Increased environmental consciousness has resulted in the creation of more renewable energy sources such as solar panels, wind turbines and wind farms. Furthermore, new modes of transport are more environmentally friendly (such as hybrid cars);
- At home people are using more energy efficient light bulbs and appliances which are safer and reduce the cost of energy;
- Participants also mentioned equipment used in agriculture to monitor the contamination of land.

Personal data (+ data security)
- Use of chips in identity cards and passports

Negative impacts:
➢ The risk of cybercrime has increased, especially since people are shopping and banking online more;

> *"the more you give you out your personal data to different websites, the higher the risk of cybercrime".*

➢ Easier access to personal data;
➢ Easier to track the whereabouts of someone.

Modes of communication
- Internet and Video conferencing (such as Skype), Live streaming, Email and satellites

Positive impacts:
➢ Satellite TV provides 24/7 news coverage;
➢ More efficient and cheaper communication;

> *"Before, to send a letter, you had to go to register it at the post office at a cost... today if I want to speak to a foreign company, I look up their email address and send them an email. There and then, he could be at his computer and reply straight away. Whereas before you had to go back to the post office for their reply" (Malta, Group 3)*

➢ More access to communicate with different individuals, companies and organisations all over the world which allows for more democratic engagement

> *"If you send an email to the president they will reply. Before we would not have imagined that we could communicate with the president or prime minister of Malta" (Malta, Group 3)*

➢ The world is a smaller place, people have the opportunity to experience different cultures and there are fewer barriers to experience new opportunities;
➢ Access to knowledge and services in the comfort of your home or anywhere using internet from smart phones;
➢ More online shopping which provides competitive prices.

Negative impacts:
➢ Children are less active as they are playing less outside;
➢ Less social interaction and social skills;

> *"Children nowadays lack human interaction and do not know how to express themselves and interact with other people" (Malta, Group 4)*

➢ Lack of privacy as people can be tracked through mobiles and other devices. On the other hand, tracking is also used by law enforcement which ensures more security for citizens.
➢ Drugs are being sold online which provides easy and discreet delivery to users.

Banking
- Ability to transfer money across the globe, Credit cards and ATMs.

Positive impact – more convenience and efficiency (less queues)

Other technological innovations
- Computers, laptops, 3D printing, Mobile phones, smartphones, digital photography, switch from analogue to digital technology, flat screen/3D televisions

Positive impacts:
➢ Technology is more affordable;
➢ Smart phones can be used for multiple purposes.

II. SPONTANEOUS PROJECTIONS ON TOMORROWS SCIENTIFIC AND TECHNOLOGICAL INNOVATIONS

This chapter focuses on participants' spontaneous predictions about the scientific and technological innovations that could be part of daily life in 2030, which changes are seen as beneficial and those seen as more negative or undesirable. Finally, it looks at the scientific innovations in four selected areas:

- How living at home will be different in the future;
- how people will take care of their health;
- how people will interact with each other and with machines;
- and how people will protect the environment in 2030.

2.1 The scientific innovations expected to be part of peoples' daily life in 2030 and their possible impact

One of the first innovations the participants mentioned was robots. Participants expected that robots will be used in domestic work such as cleaning. Most participants also mentioned that most activities will be automated, which will create a lazier society.

Other innovations mentioned included an "interactive wall" instead of televisions, technology which will track eye movement (will be used in marketing and law enforcement) and virtual equipment.

Environment: Innovation and technology related to the environment included weather control, for example, artificial rain will be available 'on demand', the creation of artificial green spaces and more eco-friendly houses and buildings. Building materials will increasingly be man-made as the natural resources will be limited and such materials will be smarter, for example 'dust free'.

Transport: Participants also expected to see more innovation in transport, such as electric cars and cars with automated parking systems. In general, modes of transport will be faster which will result in reduced travel time. Cars and driving will also be safer; cars will brake automatically when required and will have safety measures in case drivers fall asleep whilst driving. Cars will also be environmentally friendly. The lack of fuel will create innovations in the way trains operate (such as magnetic levitation trains). Others mentioned that we will start investing in small helicopters as we will have too many cars on the road and more traffic and congestion.

> *"The car will drive itself... you will just get in and say you want to go to Mellieha and it will take you there." (Malta, Group 3)*

> *"I read that in the future, aeroplanes will not have any windows instead these will be transparent all around, so you have a 360 degree view from the air. It will feel like you are suspended in the air." (Malta, Group 3)*

Education: Participants also mentioned that the education system will change; children will not go to school anymore as they will attend a virtual school online where they will be taught. However, the education system will be more demanding and competitive as we will have higher expectations of children. Others mentioned that children will be unable to work in groups as they will lack the social interaction of traditional schools. On the other hand, a number of participants also mentioned that children will be more intelligent as they will have more access to knowledge and information.

Health: Participants expected to see more improvements in healthcare. Similar to the idea of replacing objects rather than fixing them, it will become easier to reproduce certain body parts rather than having to wait for an organ transplant. Even child birth will be 'replaced' as there will be more people opting for cloning. Our lifespan will also be extended by further innovations and better medical care. There will be cures and remedies for diseases which are currently fatal, and early diagnosis and prevention will be improved. Most participants hoped that there will be a cure for cancer. However, some participants questioned the quality of life of those who will live longer.

> *"You will live longer but would be more dependent on medicine – your quality of life decreases" (Malta, Group 2)*

> *"Hopefully they will find a cure for diseases which affect people all around the world, such as cancer and AIDS" (Malta, Group 3)*

Participants mentioned that one of the negative impacts related to scientific innovations would be less face to face interaction.

> *"We would not be talking to each other anymore. No more physical contact." (Malta, Group 4)*

Participants also felt that life will be more fast paced, which will create more pressure and anxiety and leave less time for leisure. Individuals will be more selfish and unable to enjoy the moment as they will continuously be thinking about what they want to gain next. The lack of social interaction might also create new mental health problems such as depression and addiction. A decrease in physical activities will also lead to more diseases and conditions like obesity.

Another negative impact mentioned was that there will more surveillance of citizens which will affect their privacy and freedom.

> *"I think we will get to a stage where we will have less freedom due to lack of privacy. In the future, each person will have a chip which will track their activities and whereabouts. More surveillance cameras will be introduced, especially in working environments, so that businessmen can track their workers." (Malta, Group 4)*

Furthermore, the participants imagined that future societies will be so dependent on technology that if anything goes wrong (such as a power cut) there will be negative impacts which will affect a large number of people. One impact may be loss of personal data such as medical files.

A number of participants mentioned that resources will be wasted and there will be a lack of investment in quality as we will no longer value quality products. The aesthetic value of products may also be replaced with functionality. Overall these participants felt that the world will become more homogenous and streamlined, people will become more similar which will result in loss of cultures, traditions, languages and dialects.

Participants also expected huge technological advancements in weapons used for wars and in the way the military operates.

2.2   Expected innovations in selected areas

Homes and living

- Use of robots in domestic work
- Interactive wall instead of televisions

Health and healthcare

- Reproduction of certain body parts / organs
- Cloning

Ubiquitous communication and interaction

- Technology that tracks eye movement
- Virtual projections

Environment

- Artificial green spaces
- Control of weather
- Eco-friendly houses / buildings
- More man-made construction material

III. REACTIONS TO FUTURE SCIENTIFIC AND TECHNOLOGICAL INNOVATIONS IN SELECTED AREAS

The main objective of the study was to explore reactions to some specific innovations that might be a part of everyday life for citizens in Europe in 15 years' time in four different areas.

- The house of the future (homes and living);
- Health and healthcare;
- Communications (ubiquitous communication and interaction);
- The environment.

A scenario related to each theme and introducing possible innovations was presented during the focus-groups.

This chapter focuses on participants' reactions to the four scenarios.

3.1 Homes and living

The first general reaction was related to robots; the older participants felt that these will provide more convenience, however, they will also minimise our face to face interaction, make us lazier and more dependent on technology. On the positive side, these participants felt that the robot will make life easier and will solve a lot of disputes over housework.

When asked to describe their general feelings about the scenario, the younger participants were slightly more positive and talked in the following terms: 'pampering', 'comfort' 'efficiency', 'life will be easier'. However, these participants also mentioned negative aspects: it would be 'boring', 'monotonous', 'static' and with a 'lack of control'. PRA was also described as 'cold'.

> *"Your life depends on a robot" (Malta, Group 2)*

> *"You cannot change the way you do things as everything is programmed" (Malta, Group 2)*

> *"I do not trust such technology… what if he starts crashing your home?" (Malta, Group 2)*

Participants also mentioned that if everything is done by robots, we will lose contact with the external world and will be confined to our home and workplace (if this is not a virtual workplace as well).

> *"We will continue losing human contact" (Malta, Group 4)*

Another concern was data protection and security.

> *"If someone hacks the robot's system they will know when you are not at home and can break in your house" (Malta, Group 2)*
> *"If you have control on which data is stored, how and where … it would be more acceptable… the issue depends on who has access to your data" (Malta, Group 2)*

Furthermore, a number of participants mentioned that the robot will probably be too expensive and will add more expenses as it will be 'another thing we have to maintain'. Some participants also mentioned that since houses are becoming smaller people might not have enough space to keep the robot.

- **Positive aspects:**
  - ➢ Reduces housework;
  - ➢ Video message via PRA (younger participants);
  - ➢ Solar panels and alternative energy;
  - ➢ Smart meters;
  - ➢ Ability to monitor the use of electricity;
  - ➢ Consumption of electricity at off-peak times.

- **Negative aspects:**
  - ➢ Robot automatically ordering the grocery shopping and having less control;
  - ➢ Delivery by the supermarket drone and the subsequent lack of human interaction;
  - ➢ Storage of data on companies' data servers;
  - ➢ Lack of control in your own home.

    "I would feel like the robot is ruling my world, it is too intrusive and life would be too dull. I like waking up at my own pace… these things make us lazy" (Malta, Group 6)

  - ➢ Too much programming and lack of change;
  - ➢ Lack of security;
  - ➢ Laziness and lack of thinking.

The participants felt that certain aspects of the scenario were already being implemented, such as smart meters, solar panels and reduced electricity consumption. Furthermore, most participants felt that these innovations were the most useful.

The older participants felt that the robot would only be useful for cleaning, although, they still doubted whether it would be practical. Overall, the older participants were more likely to say that robots will not be accepted by the majority of people and that they would be expensive to purchase and maintain.

The aspects which the participants were most concerned about were that everything will be automatic, it will limit them to their home, prevent them from trying new things and that they will need to deal with robots rather than people.

The younger participants felt that the scenario would be more acceptable if the data were to be stored on a personal server rather than online.

The participants felt that even though the invention of robots is realistic, the use of robots in households is less realistic as it will not be affordable and have too many functions. Most participants also felt that 2030 is too close for robot innovations to take place as certain cultural changes need to take place beforehand.

The majority of participants were familiar with the different aspects described in the scenario.

- **Overall Ranking:**

1. Smart meters connected to a smart power grid
   Participants felt that such an innovation is energy efficient and would be useful as the energy which continues to be generated during night is not wasted. Participants also felt that it would be a good incentive to start doing certain household chores (such as washing clothes) at night.

2. Personalised assistance in executing 'household chores
   Some participants doubted the quality of work the robot would do; however, overall the participants' reaction to this aspect was positive as it would reduce their workload which would give them more free time.

3. Coated glass that automatically darkens to block excess sunlight
   Participants felt that such an innovation is environmentally friendly; however, they also felt that they should be able to control their own environment.

4. Smart fridge that warns you when you run out of food
   The younger participants were more positive regarding this aspect as they felt that such an innovation would provide them with more convenience and would serve as a 'reminder'. However, the participants mentioned that they would want the option of deciding which brands and products they wanted to purchase and when the order is placed.

5. Personal assistant
   Participants felt that this would not be useful as their smart phones, tablets and laptops already fulfil such functions. Furthermore, they felt that such personal assistance would be 'too intrusive'.

6. Home delivery of goods by drones
   Participants felt it would be useful for elderly or sick people who have physical limitations. The participants also mentioned that such an innovation might not be very useful as it is similar to shopping online from a supermarket where the order is also delivered at home. Another aspect mentioned by the older participants was that such drones would replace workers at the supermarket. Furthermore, some participants felt that shopping for groceries should be an 'experience' in itself.

   "Grocery shopping gives me the opportunity to spend time with my partner" (Malta, Group 4)

   "What I eat depends on my mood and shopping for food allows me to try new types of food and recipes" (Malta, Group 2)

7. Keeps a complete memory/recording of home events
   Participants were concerned that such data may be misused. Participants also mentioned issues related to privacy and security.

8. All data stored in the Robot's memory is kept on-line at the company's data servers
   Participants felt that such personal data should not be kept by a private company as it breaches their privacy. Furthermore, the participants were concerned about the security of the data.

3.2   Health and healthcare

Most participants' first reaction was related to virtual consultations. The participants felt that medical issues, bad news and diagnoses should be handled face to face as a doctor would have a friendlier approach. Participants also had certain reservations about the role of supermarkets in healthcare as they felt that it would be too intrusive.

- **Positive aspects:**
  - Monitoring of conditions, prevention, early diagnosis;

    "Prevention is better than cure" (Malta, Group 2)

  - Leaflet with relevant consumer products as it provides guidance and advice on what to buy;
  - Stem cells which participants felt could help to save lives. However, they were also concerned about the cost and whether it would be affordable for 'common' people;
  - Convenience, less bureaucracy, more efficient healthcare systems;

    "It is more convenient and everything can be done immediately from home. I can put my mind at rest straight away." (Malta, Group 2)

    "We're going to eliminate going to the hospital and waiting in the queues; less waiting time." (Malta, Group 4)

  - National health records;
  - Use of data for research;
  - Virtual consultations with their doctor for minor conditions.

- **Negative aspects:**
  - Virtual interaction with doctors instead of face to face consultations;

    "The human 'feeling' will decrease. When you speak to the doctor face-to-face, if you are anxious about your condition they will calm you down.... not everybody handles things the same way" (Malta, group 4)

    "I think health is something very personal and cannot be treated in this way; you always have to talk to someone personally. Even if these tests are 100% reliable, this is not the best way." (Malta, Group 4)

    "The doctor might miss certain vital signs for diagnosis as they cannot physically feel your body" (Malta, Group 2)

    "I am conscious about data protection… what if the doctor is calling me in a public place? My issues will definitely not remain private" (Malta, Group 6)

  - Lack of privacy

    "I do not like the idea of receiving a message from the supermarket after having checked your shopping profile. I do not like the fact that someone is delving into my personal life and telling me what I should or shouldn't buy." (Malta, Group 4)

> Marketing;
>
> *"I think that people can be manipulated with this chip. Since someone developed it to sell a specific product, it will alert you in order to increase the sales of a certain product." (Malta, Group 4)*
>
> *"Supermarkets might target you according to what they want to sell" (Malta, Group 2)*
> *"I do not like that they give you a leaflet with the list of things that you can buy as this is part of a marketing campaign. It is pushing and pushing the consumers…" (Malta, Group 6)*

> Reliability of tests and risk of misdiagnosis;
>
> *"It might not work correctly and might prescribe the wrong medicine or products" (Malta, Group 4)*
>
> *"If the chip told me I have diabetes, the following day I would still go to the doctor to see if it's correct" (Malta, Group 4)*
>
> *"I would not like to have the results over the counter… it's like buying chewing gum. I woud have some trust issues regarding the reliability of the result" (Malta, Group 6)*

> Confidentiality and role of supermarkets in healthcare;
>
> *"When I go to the supermarket, I buy items for all the family, so if I buy sweets for my little daughter it will tell me that since I have diabetes I should not buy this and should do a diabetes test" (Malta, Group 2)*
>
> *"I do not like the fact that the blood test results should be retrieved from the counter. I feel that this is confidential information that should not be provided over the counter." (Malta, Group 4)*
>
> *"I didn't like the fact that this would be done in the supermarket since health issues don't have anything to do with the supermarket. (Malta, Group 6)*

The most useful aspects were seen to be that tests can be conducted from home, early prevention, provision of more information and the fact that doctors would have access to the personal medical history of all citizens.

Overall the participants had mixed feelings whether such a scenario was realistic. The participants felt that the online tests were realistic, while, the provision of results over the counter was unrealistic. Participants felt that even though biochips are realistic (mentioned chips used for pets) these might cause legal complications.

Participants questioned whether such an investment in healthcare would be possible before 2030. The participants also doubted whether it would be possible to build an online database of all people before 2030.

However, the participants felt that such a scenario would be accepted by the majority of people, although some participants mentioned that it might be difficult for the elderly to comprehend.

The least acceptable aspect was virtual consultation. The scenario would be more acceptable if diagnosis is provided face to face by a doctor, especially in cases where the diagnosis is negative. It would also be more acceptable if the doctor suggests the biochip rather than the supermarket. Furthermore, the scenario would be more acceptable if such innovations are approved by the health authorities.

The participants were surprised about the role of supermarkets in healthcare; that certain tests could provide a map of their genetic information and the use of biochips in healthcare.

- **Overall Ranking:**
  1. Centralised health data records ('National health record') and the use of health data by researchers
     Participants felt that such a system would contribute to research advancements as it would be easier to identify certain links and to trace diseases and conditions.

  2. Stem cell therapy (for organ repair)
     Such an innovation would make it possible to cure certain diseases and extend lives.

  3. Wearable biochips for health monitoring and diagnosis
     Most participants perceived these as positive, especially to monitor certain health conditions. However, participants felt that these should be provided by a clinic rather than a pharmacy in a supermarket. Others felt that the chip in physically too intrusive.

  4. Dietary advice to prevent disease
     Most participants felt that this was positive. However, a number of participants were concerned about providing their data to supermarkets.

  5. 'Over the counter' genetic tests
     Participants agreed with the concept, however, they felt that such tests should be provided by a personal doctor or clinic.

  6. Medical consultations done at home ('tele-medicine')
     The participants had mixed feelings about this depending on the case and type of diagnosis.

3.3 Communications (Ubiquitous communication and interaction)

The participants' first reaction was to the 'lack of privacy and freedom' and that the scenario is 'too intrusive' as there would be 'too much scrutiny'. The participants also criticised the 'tracking' aspect of the scenario.

The hologram was perceived as being convenient for long distance communication, however, some participants felt that it would reduce the importance of seeing people in real life as we would be happy with seeing them on hologram.

- **Positive aspects:**
  - ➢ Traffic cameras provide more security and crime control;

    "I think the traffic part and cameras are very good as you will save money on insurance and traffic can be better controlled. Tracking people would help to reduce crime." (Malta, Group 1)

  - ➢ Virtual meetings as there would be no need to travel for work;
  - ➢ Interactive communication with friends and family that live abroad.

- **Negative aspects:**
  - ➢ Authorities knowing your whereabouts;
  - ➢ Data to change the store layout and placement of goods. Participants were sceptical about the use of data to change perspective;

    "The adverts will be individually targeted so that they will control what the person will be doing… it is brain washing" (Malta, Group 5)

  - ➢ Not knowing how their personal data is being used;
  - ➢ Lack of face to face contact;
  - ➢ Tracking and surveillance;

    "I would feel that I am being watched all the time" (Malta, Group 3)

The participants felt that such a scenario was realistic and most aspects were already being shown in television shows and films. Participants mentioned that innovations such as facial recognition and tracking cameras are already available. The hologram was perceived as being the least realistic.

Participants felt that the scenario would be useful for businesses, pedestrians and those who drive safely. The participants were not surprised by the scenario and felt that even though in the beginning it might not be accepted by all people, in time the scenario would become more acceptable.

Aspects related to crime control were the most acceptable whereas the supermarket aspect were the least acceptable.   Furthermore, the participants felt that the scenario would be more acceptable if it is marketed in a good way.

"People who create such things will pitch these ideas as 'needs' - for example pitching ideas under the impression of personal security" (Malta, Group 1)

Participants felt that the scenario might be difficult to implement due to data protection laws. However, they also felt that if they have more control over the type of data that is recorded, facial recognition and other tracking technologies, it would be more acceptable. Furthermore, the participants mentioned that face recognition would be more acceptable if the data recorded at the supermarkets is erased once the customer leaves the outlet.

- **Overall Ranking:**
    1. Virtual reality at work
       Participants felt that it would be helpful, especially if employees are sick or cannot attend. The participants also mentioned that it could be used as a family friendly measure.

    2. Virtual reality in public places
       The participants felt that such an innovation would be useful for customer care and in places such as banks where people might need more guidance and in museums.

    3. Virtual reality in education
       Participants felt that such an innovation was positive, however, they also felt that courses would be more expensive and users would require a more powerful internet connection.

    4. Virtual reality at home
       Holographic calling – Such an innovation would be convenient for long distance communication with family and friends who live abroad. However, most participants felt that video conferencing is already sufficient.

    5. Ubiquitous tracking of machines and people with satellites, trackers and cameras
       Participants felt that this was positive as it would reduce accidents and prevent crime, however, they did not like the fact that they could be tracked easily at any time.

    6. Facial recognition technology
       The participants felt that it depends on where it is used, for example, it would be acceptable at airports but not at shops or banks.

    7. Data collection about personal preferences, used by companies
       Most participants felt that personal data should not be given to companies.

3.4   Environment

The participants had mixed reactions. Some participants thought that it was an 'ideal' and 'exciting' scenario, while, others felt that it was 'almost too perfect' and like a 'fairytale'.

In general, the participants agreed that we need these types of innovations in order to preserve the planet.

A number of participants felt that the scenario was realistic. However, they also felt that it was far-fetched, especially for Malta.

- **Positive aspects:**
  - ➢ Recycling;
  - ➢ Cleaner environment;

  > *"A better world, better quality of life, cleaner air" (Malta, Group 5)*

  - ➢ Crops which are free of chemicals and pesticides;
  - ➢ Better use of water;
  - ➢ Eco-friendly homes;
  - ➢ Bio fuel.

- **Negative aspects:**
  - Buildings and architecture would have no character and lack individualisation;
  - Solar panels and wind farms would be an 'eye sore'
  - Reuse of low-grade waste water: participants were concerned about the safety and quality of such water;

  > *"We used to buy vegetables from a certain place which used second class water and the quality and taste of the vegetables was not very good" (Malta, Group 5)*

  > *"I am sceptical about disinfecting water to be reused in the home." (Malta, Group 3)*

  - Too difficult to manage;

  > *"Seems positive on paper but when people have so many restrictions, limitations and rules - it becomes impossible to manage... I cannot imagine a village in Malta like this." (Malta, Group 1)*

  - Possible unknown effects and dangers;

  > *"We are playing with nature too much … we are not leaving nature to do its job… it is like having a game where you keep cheating, someday you are going to lose." (Malta, Group 1)*

  - The role of businesses;

  > *"Who is going to benefit from this scenario? If businesses are not going to profit, will it actually be implemented? Such a level of perfection cannot be achieved as there will always be some businessman thinking how can I make money out of this?" (Malta, Group 1)*

The participants felt that the scenario was realistic, although they doubted whether all the innovations would be implemented before 2030. The majority felt that the innovations related to alternative energy and recycling were the most useful and achievable, while the reuse of low-grade waste water and storage of CO2 was seen to be the least acceptable aspect for many people.

There was a general perception that there has to be a change of mentality where people start thinking in a more 'green' way. Such a scenario would also require a high level of discipline and might be too demanding for people.

Most participants were unfamiliar with the geo-engineering innovations and the monitoring of fields.

Other suggestions for innovations in the same area included: a tablet which you put in the garbage to disintegrate the waste; use of drones in transport; more artificial greenery; use of solar energy paint; use of electric and hybrid cars.

- **Overall Ranking:**
  1. Energy efficiency
     Participants felt that such innovations were positive as they are environmentally friendly and provide cheaper energy.

  2. Most energy is derived from renewable energy like solar panels and wind farms
     Participants were generally positive regarding these innovations. However, some participants felt that the noise from the wind farms might cause psychological problems.

  3. Recycling of materials and natural resources
     The participants felt that this aspect was very positive, however, there has to be more education and awareness about the importance of recycling.

  4. Waste recycling
     The participants were generally positive about this. However, they were sceptical about the reuse of lower quality water.

  5. Conversion of waste into value-added by products
     The participants felt that such a system would be efficient and useful to reuse natural resources.

  6. New farming management practices in agriculture
     Overall participants were positive, however, some participants felt that nature should not be tampered with.

  7. Carbon Ocean fertilisation
     Most participants did not understand this innovation. However, a number of participants expressed concern regarding the way this would affect the ocean habitat and whether it would be harmful to fish.

  8. Underground CO2 storage
     The participants felt that the innovation was positive as it would reduce the level of CO2 in the atmosphere. However, they also expressed concerns regarding the safety of an underground CO2 storage.

IV. CONCLUSION

The majority of participants felt that the discussion did not change their mind about innovation. However, some participants mentioned that the discussion helped them evaluate their thoughts about scientific and technological innovations. Others mentioned that the discussion had triggered new thoughts about issues of privacy and security in scientific innovations. Some participants also mentioned that they were more open to changes in the health sector. Finally, many believed that such changes were inevitable and eventually everyone would need to adapt to such innovations.