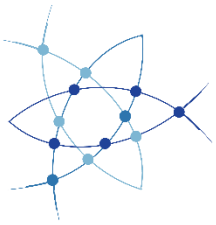

PRO-RES

PROmoting ethics and integrity in non-medical RESearch

Deliverable Title: Report on the interview outcomes with experts from science, policy making and from Research Ethics Committees.

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Executive Summary

As part of WP5 activities, the National Technical University of Athens (NTUA) conducted a series of interviews within 2019 regarding current research trends and strategies in the non-medical field covered by the project, as well as stimulating approaches on possible ethical issues and risks which are expected to arise in the near future following the progress of the respective scientific fields.

This report presents the results and the analysis of the conclusions deriving from these interviews. The interviewees' list included three types of stakeholders, namely research experts, research integrity experts (members of Research Ethics and Deontology Committees /RECs), and policy makers. The background of the interviewees varied and covers a range of disciplines in the non-medical fields of research.

The thematic findings of the interviewees' input analysis cover the following topics and will be used for the development of the PRO-RES framework while enhancing its sustainability:

1. The latest scientific developments in the interviewee's areas of expertise, any foreseen, yet unachieved technologies in the same field, and potential ethical issues related to these technologies.
2. The dual use issue: possible connection of these scientific developments/upcoming technologies with military applications, and the treatment of the dual use issue as an ethical issue.
3. Assessment of the current guidelines for ethical self-assessment (H2020 funding scheme) regarding their sufficiency to address the aforementioned potential ethical issues.
4. Identification of significant differences between the European research environment and the non-European ones regarding the aforementioned potential scientific developments.
5. The importance of revision of curricula with the inclusion of RE & RI modules.

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1. About PRO-RES

PRO-RES (PROmoting integrity in the use of RESearch results - in evidence-based policy: a focus on non-medical research) aims to produce a guidance framework helping to deliver Responsible Research and Innovation (RRI). PRO-RES is a Horizon 2020 project coordinated by the European Science Foundation (ESF), involving 14 different partners across Europe. The main aim of the project is to encourage policymakers and their advisors to seek evidence for their decisions from research that has been conducted ethically and with integrity.

The guidance framework includes the following elements:

1) A statement – The Accord – which lays out the principles for ethical research which we hope all stakeholders can sign up to.
2) The Accord is supplemented with a Toolbox for policy makers and advisors to help them identify ethical evidence for their decision-making processes.
3) Additional supportive resources that complement the Accord and the Toolbox are provided on the PRO-RES website (http://prores-project.eu/) and include Foundational Statements on the values, principles and standards behind ethical research, a Glossary of Terms and Concepts and a pool of supplementary information such as on other existing Ethics Codes and Guidelines, available Education/Training on ethical research practice, illustrative Case Examples, a List of Ethics/Integrity Advisors, and much more.

The entire framework aims to:

- cover the wide spectrum of non-medical research and
- offer practical solutions for all stakeholders, that will comply with the highest standards of research ethics and integrity.

In terms of post-2020 European strategic funding policy, this offers a strong and sustainable contribution to RRI via a comprehensive ethics and integrity framework, similar to Oviedo/ Helsinki, which will have been constructed in negotiation with relevant stakeholders.

1.1 About WP5 'Sustainability of the framework /Road-mapping'

Research, technology and policy are not static, but, in certain areas, they advance quite rapidly. Hence any guidance framework created to support these fields of knowledge and action needs to be both sustainable, but, also, flexible enough to meet anticipated future needs; it needs to be adaptable by design. As the PRO-RES framework will be covering the non-medical scientific field, which is wide and non-uniform, it is important to identify the particularities of the various sub-fields and take into consideration the cross-correlation of interests, needs and approaches to issues related to ethical frameworks for different scientific communities.

In this context, WP5 has been aiming at maximizing the potential sustainability of the PRO-RES framework and at developing the necessary conditions for this framework to remain updated and in use after the end of the project. It includes roadmapping activities and interaction with different types of interested stakeholders that will boost visibility of the project and provide valuable input regarding current research strategies while envisaging incipient ethical risks.

More particularly, sustainability is considered as substantive and technical. Substantive sustainability of the PRO-RES framework will essentially be based on its ability to grasp current trends on the non-medical fields covered by the project, encounter incipient risks and codify possible measures, that should be proposed pre-emptively, or suggested procedures that will aid the continuous updating of PRO-RES framework. To that direction, roadmapping has been applied so as to smoothly integrate the above considerations effectively into the PRO-RES activities.

1.1 About D5.1 Report on the interview outcomes with experts from science, policy making and from Research Ethics Committees

This report presents the results and the analysis of the conclusions deriving from the series of interviews conducted and transcribed by Panagiotis Kavouras, Eleni Spyrakou and

Vassilis Markakis of the National Technical University of Athens (NTUA) within 2019. The interviewees' list included three types of stakeholders, namely research experts, research integrity experts (members of Research Ethics and Deontology Committees /RECs), and policy makers. The background of the interviewees varied and covers a range of disciplines in the non-medical fields of research.

The interviews provided input regarding current research trends and strategies in the non-medical field covered by the project, as well as stimulating approaches on possible ethical issues and risks which are expected to arise in the near future following the progress of the respective scientific fields.

2. Expert interviews

2.1 Introduction- Aim of the interviews

One of the main tasks of WP5, namely Task 5.2 *'Substantive sustainability through roadmapping procedures'*, has been the horizon scanning module of PRO-RES, identifying current research trends in the non-medical field while envisaging incipient ethical risks, as described above. This task is fulfilled by organizing a series of interviews with the aim to additionally identify current RE&RI challenges within the non-medical field under examination, and scan current RE&RI strategies on a global scale. The conclusions from these interviews will feed into the work of the project in developing the guidance framework on RE&RI.

2.1 Study design and description of the study

In order to get an insight into experts' opinions and experiences on the very recent developments in their areas of expertise, we used a qualitative approach and conducted on-line interviews. The interviews were structured in the sense that a set of specific questions was sent to the interviewees in advance, and the interview followed the questions' order. However, the interviews can, also, be considered as semi-structured since there were

occasions in which the discussion was enriched with additional questions, following the flow of the interaction among the interlocutors.

The interviewees had the opportunity to present the latest developments in their field in a concise manner, as well as to express their considerations regarding the corresponding ethical implications, and their opinions on how these issues are currently addressed and resolved. Furthermore, the interviews explored the participants' experiences and views regarding the way different research environments within Europe, but, also, outside Europe (USA, China) deal with RE & RI challenges.

2.2 Study population and sample size

As far as the study population is concerned, the method of heterogeneous stratified purposive sampling –although the samples was small in numbers-, was used in order to conduct the interviews with participants from different domains and research environments. The aim was to include stakeholders across various scientific disciplines within the non-medical fields, as well as stakeholders from different countries in order to ensure diversity. The participants recruited are divided in the following categories: research experts with administration experience (n=8), members of Research Ethics Committees (n=7), policy makers (n=4). The research areas covered by the selected participants are the following:

- Covert research, surveillance and privacy
- Technological innovation (cutting edge research like nanotechnology, biotech etc.)
- Data Science;
- RRI and Ethical Frameworks
- Ethical Frameworks and Research Funding Organizations

2.3 Recruitment strategy

Participants were identified via personal contacts and the project's consortium. More particularly, NTUA asked from PRO-RES beneficiaries for contacts from experts in the disciplines PRO-RES is focusing on, and made an initial contact by sending an invitation asking their permission to send them PRO-RES informative material and the interview's questionnaire (**Appendices A and B**). This questionnaire was created by NTUA with the collaboration of the project's coordinator and the Academy of Social Sciences (AcSS) team. In case of positive response by the aforementioned contacts, the interview was planned, according to their availability.

2.4 Conducting the interviews

The interviews were conducted online, using the Skype platform. All interviews were recorded, whether audio-recorded or audiovisual-recorded, based on the consent obtained by the participants before the recording. In particular, every interviewee was asked two questions at the beginning of the interview: 1. whether they consent on us recording the interview, and 2. whether they consent on their having their names appeared on the list of interviewees, but without any direct correlation to their responses. Once they provided us with their consent, we would start recording and we would repeat these two questions in order to record their consent. Additionally, the interviewees were informed that the recordings would be stored in NTUA's secure storing system until the finalization of this report and then they would be destroyed.

Out of nineteen interviews in total, eighteen were conducted in English and one in Greek, following the standardized questionnaire.

2.5 Analysis

The recordings of the interviews were transcribed verbatim. The transcription of the interviews was sent to some of the interviewees, who had asked to see the transcription of

their interview, in order to make comments/revision if needed. This was agreed at the end of their interview, namely whether they would like to review the transcription or not.

The obtained qualitative data were analysed following the thematic analysis approach based on the identification of the important topics within data, in accordance with the interview's questionnaire circulated to the interviewees in advance.

Prior to the analysis, we proceeded with the anonymization of the data obtained. Each interviewee(*I*) was given a number from 1 to 19 randomly (*I1, I2 etc.*), and the transcription of each interview followed the same naming. The only part of this report which contains personal data of the participants is in the following **Table 1.,** in which only the necessary information is stated, following the data minimization principle. Table 1 includes the names of the interviewees, their major occupations on which their selection as interviewees was based, and the country in which they are occupied with these occupations.

3. Results

3.1 Participants

A total of 19 individual stakeholders participated in the interviews. Their affiliations at the time of the workshop (**2019**) is shown in the following table.

stakeholder	#	Name	Participate due to his position in 2019 as
Research experts with administration experience	1	Éva Valsami Jones	Univesity of Birmingham, Member of the coordination team of Nanosafety Cluster, United Kingdom
	2	Raquel Miriam Santos	Institute of Science and Innovation in Mechanical and Industrial Engineering, Portugal
	3	Georgios Nounesis	Director of national center for scientific research "Demokritos", Greece
	4	Bojan Boscovic	Cambridge Nanomaterials Technology Ltd, United Kingdom
	5	Pietro Asinari	Heat and Mass Transfer, Multi-scale Modeling Lab, Politecnico di Torino, Italy
	6	Agustín Chiminelli	Instituto Tecnológico de Aragón, Spain
	7	Jonathan Parker	Director of the Centre for Social Work and Social Policy, University of Bournemouth, United Kingdom
	8	Kevin MacNish	Ethics of surveillance, security and technology, University of Twente, the Netherlands
REC members	9	Sarah Wolfensohn	Professor, School of Veterinary Medicine, University of Surrey, United Kingdom
	10	Elmar Doppelfeld	President of the European Network of Research Ethics Committees - EUREC, Germany
	11	Loreta Tauginienė	Office for Ombudsperson for Academic Ethics and Procedures, Lithuania
	12	Katrina Bramstedt	Secretary General, Luxembourg Agency for Research Integrity, Luxembourg
	13	Michalis Kritikos	Scientific Foresight Unit (STOA)-European Parliament Research Service (EPRS) - Research Ethics expert, Belgium
	14	Giovanni Comandé	Professor of Private Comparative Law, Scuola Superiore Sant'Anna, Italy – External scientific and ethical expert evaluator for EC Researchers
	15	Eugenijus Gefenas	Associate professor, director of the Department of Medical History and Ethics, Medical Faculty, Vilnius University, Lithuania. Director of the Lithuanian Bioethics Committee.
Policy makers	16	Cinzia Caporale	Head of the Ethics and Integrity Interdepartmental Center, CNR, Italy
	17	Laura Bandura-Morgan	Coordinator for Life Sciences, National Science Centre, Poland
	18	Julian Kinderlerer	European Group on Ethics in Science and New Technologies (EGE)
	19	Siret Rutiku	Estonia Research Council, Head of Department of

			Research Funding, Estonia

Table 1.

3.2. Thematic findings

Following the standardized questionnaire used for the interviews, the thematic findings can be grouped as follows:

1. Report on any latest scientific developments in the interviewee's areas of expertise, any foreseen, yet unachieved technologies in the same field, and potential ethical issues related to these technologies (*Questions 1, 2 and 3*).
2. The dual use issue: possible connection of these scientific developments/upcoming technologies with military applications, and the treatment of the dual use issue as an ethical issue (*Questions 4 and 5*).
3. Assessment of the current guidelines for ethical self-assessment (H2020 funding scheme) regarding their sufficiency to address the aforementioned potential ethical issues (*Question 6*).
4. Identification of significant differences between the European research environment and the non-European ones regarding the aforementioned potential scientific developments (*Question 7*).
5. The importance of revision of curricula with the inclusion of RE & RI modules. (*Question 8*).

It has to be noted that *Question 8* was not included in the questionnaire as circulated to the interviewees. It was discussed with twelve out of nineteen interviewees, based on their expertise and the development of the discussion.

3.2.1 Latest scientific developments – foreseen yet unachieved technologies – related potential ethical issues

The first three questions that the interviewees were asked to respond to had to do with any latest scientific developments in their areas of expertise, any foreseen, yet unachieved technologies in the same field, and potential ethical issues related to these technologies. The aim of these questions was the horizon scanning that would identify current research trends in the non-medical field, and scan current research strategies on a global scale, while envisaging incipient ethical risks. This input is essential so as the framework developed by the PRO-RES project to anticipate future ethical challenges, and to achieve sustainability.

In the following **Table 2.,** the responses given by the interviewees are grouped according to the types of technologies mentioned and their ensuing ethical challenges. In the list of technologies, there are both emerging and converging technologies.

Technology	Consequences - Ethical challenges
1. Nanotechnology	Safety (health and environment), handling of materials, nano-divide, materials by design, ethics dumping
2. Materials Science, materials engineering, materials modeling	
3. Molecular biology	Big data, personal data, targeted therapies, rare diseases therapies
4. Genetics -human genome modification – genetic engineering	
5. Biotechnology, CRISPR (clustered regularly interspaced short palindromic repeats)	
6. Artificial Intelligence	Decision making: self-determination and free will data mining techniques for AI, ethics washing
7. Organ donation and transplantation, technology for IVF	Differences regarding organ types: e.x. uterus transplantation (research) is not allowed in some countries. Dual Use issues
8. Technologies involving handling of data: e.x. additive manufacturing, MbD	Datasets creating discriminatory routes, reverse engineering, copyrights/patents, text matching techniques for plagiarism violate the contracts between authors and repositories
9. Blockchain technology – Data analytics	
10. Electronics – Communication systems (telephone systems, copper base lines)	As physical location might not be identified this affects emergency services
11. Profiling – surveillance – facial recognition	Privacy and security, Individual security-group security, control of data
12. Nuclear technology and data	Use and storage of energy
13. Hydrogen technologies	

14. Quantum technologies – 2nd Quantum Revolution – Quantum computing	Creation of even bigger databases
15. Oil extruding from stones for electricity	Environmental issues
16. Covert research – subject-specific research	Retrospective consent, biomedical approach to ethics (Biomedical Ethics and its translation over into Humanities and Social Sciences), the morality of individual researchers
17. Citizen Science	Ensuring research ethics, data collection and analysis
18. Animal welfare	Synthesis of genetic material, implanting tracking devices without standard procedures, clinical research in veterinary practice, euthanasia
19. Agriculture – new crops - GMF	

Table 2.

Regarding **nanotechnology and materials science**, the latest scientific developments concern the manufacturing of new materials (e.g. with the use of nanoparticles) that can improve the performance of existing devices, opening in this way new possibilities. In terms of foreseen yet unachieved technologies it was mentioned the manufacturing of better materials with higher energy densities resulting, for instance, to better batteries and better storage energy (supercapacitors and new generation batteries). The main ethical issue arising by the use of NMs mainly concerns the safe handling of such materials. Nanosafety is not only scientific but also a public concern. So, from the ethical point of view it is very important for each scientist to ensure that these aspects are not underestimated in any way. There is particular focus on issues of health safety and environmental safety, as further guidance about the properties that these materials will develop is needed.

The latest scientific developments have been focused on the incorporation of carbon-based nanomaterials into traditional carbon fibre reinforced (CFRP) composites in order to add new functionalities or smart properties, enhanced mechanical performance and lifetime. There are still some constraints that limit the further advancement of nanotechnology and its applications. More specifically, there is a lack of regulations and proper guidance regarding the transportation, handling, disposal and accidental releases of nanomaterials, leading to raising concerns on the impact that nanotechnology could have on human health and the environment. For this reason, it is important to establish strategic collaborations between

different stakeholders in the field of nanotechnology. A possible regulatory framework could include, also, guidance on ethical issues that are raised by the use of nanotechnology. In the case of nanomaterials, the market is growing but the public acceptance is restricted due to the lack of specific regulations. One potential ethical issue is that the development of such advanced materials may be used for less appropriate applications (i.e. military applications). Another issue is that despite that most of the technology in this field is produced in EU companies and institutions, it is transferred to non-EU organizations, where regulations are less strict regarding the handling of nanomaterials. It is important to ensure an efficient know-how transfer (through the creation of start-ups, or the establishment of innovation hubs, etc.).

Another development in the **materials engineering** field is the improvement of the current experimental characterization methods (for example, novel mechanical tests with SEM), which is quite an important step. Another scientific development in the **materials modeling** field is the multiscale analysis of the materials, which is used for the description of the materials structures in lower scales. Moreover, Data analysis and Optimization Methods are used more and more to allow us get optimum solutions and explore new materials better than the past. One foreseen technology in Materials Science there is the so called «**Materials by Design**», meaning the designing of new materials (atom by atom) taking in account beforehand the responses and functions that we want them to have. This technology is currently limited by the manufacturing processes and characterization techniques and prediction capabilities with current models. There is a good progress (new characterization and modeling techniques), but it will take several years to reach such a technology.

Concerning Materials by Design, we could say that there is an incipient danger for «nano-divide» (inequalities between rich and poor countries) to be increased. It is clear that this gap exists between rich and poor countries, and it is mainly due to the big differences in the technological means that there are available in higher income countries. However, there are technological developments that are based on computational methodologies, and could serve as a good opportunity for less developed countries to bridge the gap. Most of the research concerns general use developments (materials developments) that do not raise ethical

issues. However, each technology can possibly raise ethical issues, depending on who is using it and for what reason. This is expected to stand also for the future technologies (MbD).

In the field of nanotechnology, as already mentioned, the forthcoming big research ideas are looking into novel material properties that haven't been predicted yet, coupling it with computational modeling and big data. As regards to nanosafety, modeling and big data is a major target for the next 5-10 years. Moreover, there is a huge scientific interest on materials below the scale 10nm and thus, for relevant technical developments and characterization instrumentation for such lower scales.

In the field of **molecular biology**, the latest scientific developments concern the **Artificial Intelligence** and the **modification of human genome**. Several concerns have been raised due to the human genome structure, as well as the sharing of personal data, since even in cases where personal data is anonymised, several elements like the origin of the donor or the modification of the genome can reveal who the donor is. This means that big digital data is not actually secured and could be potentially shared with third parties; for example, insurance companies that will use such data to modify their contracts with patients. Additionally, **CRISPR**, which is, also, related to **biotechnology**, is an important scientific development, related, also, to whole genome databases, gene therapies, cancer immunotherapies, rare diseases therapies etc.

Interventions on human germ cell lines is so far mostly not accepted, and is considered one of the most common ethical issues arising. However, there is an ongoing debate regarding legal and ethical conditions that would allow and justify such interventions. Another common issue concerns the use of artificial Intelligence in medicine, e.g. in radiology which could change basically the work of radiologists. There are similar efforts in other fields of medicine. AI raises many important and complex ethical issues in many levels and we will need to be innovative even on the level of ethics. For instance, AI involves matters of decision making that raise further ethical issues. Consent does not exhaust all possibilities regarding self-determination and free will. As one of the interviewees pointed out, the ethical issues must be discussed from the very beginning, "by design".

Another research field which raises many ethical challenges is the field of **Transplantation Medicine and organ donation**. Although this field is primarily medical, there are, also, non-medical aspects involved, and challenges that affect other technologies and research practices, such as the use of the various data collected and dual use issues. There are challenges in how to do research and effectively involve all the stakeholders that are really vital to the performance of organ donation and transplantation. This particular field of Medicine is very interesting because there are many stakeholders involved: living donors, deceased donors, the families of the donors, the organ recipients, transplant teams, organ donation teams, and procurement teams that go out to the field and actually retreat the organs. So when you do research you are trying to take into account the needs of all of those people, and it's very difficult. The people that are frequently marginalised are the families of the actual organ donors; so it is important involve them in the actual research process in an appropriate way and take into account their feelings and their needs, so that organ donation and transplantation are optimised and more lives are saved.

Furthermore, there particular types of transplantation, such us uterus transplantation, that raise further ethical challenges. There are different approaches to this particular type of transplantation by different countries, depending mostly on religious restrictions. Some countries are reluctant or openly negative, refusing to even consider a research protocol for uterus transplantation, some others are willing to approve this type of studies and practice, like Sweden and the United States. The same variety of responses applies, also, to technologies related to IVF. Additionally, some of these technologies could have a dual use, so, although they are technically developed for a specific reason, they have a secondary use, and that alternate function is ethically problematic.

Another, recent development with ethical challenges is the synthesis of genetic material. Nowadays the cost of making a gene or a virus has come down from about 10.000$ per base to 10 cents a base. As an interviewee put it, '*That means that you can probably virtually synthesize a dangerous virus in your kitchen. What are the ethical implications in that? How do we control it? Should we control it? Should government have control of gene synthesis,*

let alone gene editing, because of the implications of people making things which might be used to harm other people deliberately? So that is another area of scientific development simply because the cost has come down.'

One key element from the ethical point of view for the latest as well as the unforeseen scientific developments is **the handling of data** and the way they relate to various scientific disciplines. With the development of modern technology, researchers obtain more and more data which are mostly stored in digital platforms. In this sense, such data are potentially available to third parties that could use or even abuse these data. One scientific field that is directly affected by this is **additive manufacturing**, which involves by its nature handling of data. Another issue that is relevant to handling of data and it is applicable to all technologies is the issue of **reverse engineering**. It is relatively easy for someone to copy a product through reverse engineering, if all relevant data are available, even at an early TRL stage, before the product goes to market. So, the actual manufacturer would not have any benefit, not even being in position to argue on whose was the idea in the first place. For this reason, European Commission needs to pay attention on this in order to protect the European Industry.

At this point, it is, also, relevant to refer to the discussion about **patenting** and strategies for covert research, and to the extent that these are capable to compensate for this open access policy. In fact, as I3 mentioned, it is not clear how efficient the patenting process is. '*Recently, there has been a dispute between EU and China regarding EU patents that China has copied. In general, the strategy of big countries such as USA and China is that they have a huge internal big market, so it is difficult for someone to pursue any damages from such countries. A strong, international law for patents needs to be established. '*

The uses of **data mining techniques** in several domains and on the development of AI are strictly connected in the coming evolution. The developments of AI tools mostly rely on large datasets and there is a need to ascertain that these datasets are legally and ethically compiled and used. They should be processed in a correct way, namely at two different levels. The first level is the technical level, which means to have protocols to ensure and rely on the good faith of the researchers, but with protocols that ensure the data and datasets are not

artificially manipulated, so to get better results. Because this might create a number of problems, for instance increase the risks of obtaining discriminatory results and discriminatory tools. Or, even worse, wrong results. So, there is still a concern that is still underestimated on what are the implications on the **quality of the datasets** used for specific purposes and their implication. I7 gave an example: *'if the dataset gets the information of data to develop an AI which suggests the best course of treatment for a specific illness, and all the data have come from top tier research hospitals, so the best ones. Of course the procedure that the machine will be learning will be the best course under those conditions, in the best hospital, maybe with the highest quality of machines, with top experts in the world. So, when the results are going to assist regular doctors in doing their diagnosis and decide their course of action will be deployed outside those environments: with regular doctors, very good doctors, but in very different environment. With different, for instance, economical strains for available machineries - available and affordable for patients drugs. The results can be a disaster because there will be a push for highly effective-highly cost procedures that might not be the case to be performed at that kind of local hospitals*.' This is just an example showing the implications which are far reaching economical, not only ethical in terms that are intertwined. The second level is strictly ethical and legal; the datasets by themselves can create, for a number of technical discriminatory results or, even, wrong - for instance, creating false positives. Another example, not health related, was given again by I7. '*Let's assume that by using AI tools, we want to develop an AI that is capable to find from materials that is online whether or not children, for instance, that are involved in abusive situations. Think, for instance, child pornography. This AI will produce an output that will mostly be a black box, that even the researcher will not be able how it works. It might be capable of giving indications on how effective it is to give among different materials these results. Yet, since we do not know how it works, openly to the risks of false positives and creating troubles for other people*'. Both examples lead to a key issue, that is an emerging issue, already but very rarely discussed in the literature: how we can produce trustworthy AI and especially an AI and algorithms that can be explained? Ethical issues related to health and not in health, which is the focus of the PRO-RES project, are somehow fading away and that is per se and important issue to take into account.

If we move to the field of **electronics**, the developments are very fast, and it is not always very easy to predict them. For instance, some years ago we would not have predicted that the **telephone system** would dispense entirely with copper base lines. Nowadays, for instance in South Africa, the telecom system is predicted to shift entirely to wireless base their responding to the telephone call. This affects emergencies services and how that works, as it seems that the emergency services will not be necessarily able to find you. And that is an issue in emergency cases (accidents, falling ill in the street etc.), compared to the use of land lines. So the implications and the changes in electronic communication systems have been incredibly big and we have not thought out the issues that might arise resulting from that.

Smart information systems, the use of personal data and big data, and developments on technologies related to **automation, facial recognition and profiling** raise issues about **privacy and surveillance**. There is a privacy concern in the use of data analytics, as people start to be profiled, not on the basis of their activities, but on the basis that they fit a particular profile which has been developed through statistical analysis rather than a short of a psychological profiling or something like that. It is simply a matter of what a computer says: "this person has an 80% chance of being a target category, therefore we should target this person". So individual security as well as group security becomes a concern, because the control of personal data or control of any data, become central. Who gets to control data, what they get to do with it, and questions like that are quite important because this is going to indicate areas where there can be tremendous imbalances and where people and groups can be harmed through the **inappropriate control and use of data**.

Additionally, **quantum computing** and the consequent developments will also raise ethical questions that need to be taken into consideration already. It is like a Pandora Box, and things will develop in an even faster mode. **Quantum Technologies** (aka the 2nd Quantum Revolution) are around the corner, since quantum computing is already accessible to many scientists, and will lead to further developments. The creation of even more and bigger whole genome databases all over the world, whether on international or global level, is, also, a fact. These enormous databases will play an important role in various types of therapies (targeted

therapies etc.). The ethics that relate to these big databases are not so strictly guided so far, compared to clinical research.

Another area of technologies that is characterized by significant developments has to do with **energy, its use and storage**. Hydrogen and automated electric vehicles (in other words, hydrogen as a completely clean combustible and autonomous movement), nuclear fusion in combination with big data analytics, as well as the materials that have to do with nuclear fusion, are all examples of fast progress. The scientific developments that have to do with the **hydrogen as an alternative combustible**, its use and storage, are very important, as we are moving really fast towards these kinds of applications. Relevant is, also, the discussion on the technology related to **oil extruding** from stones, which is the most important resource for electricity for many countries. This practice is considered very unfriendly for the environment.

In Social Sciences, **covert research** is a very important and much neglected aspect of research. With the rise of biomedical approaches to ethics and the focus on **informed consent**, covert research in the Social Sciences has been deemed to be inappropriate or unethical because of its hidden nature. However when you are researching human situations, on the human condition, you need to have the capacity to observe and enter into the worlds of potential research participants, but to everyday human ways of acting and behaving that cannot always start within informed consent or even any overt understanding that people are being involved at that time in the research project. Of course, an ethical perspective is mandatory in order to carry out covert research, and that lies with the integral morality of the individual researchers. Whilst covert research can proceed as a hidden form of research, there are often times at the end of that or during the process that you can make yourself known and you can gain a kind of retrospective consent, subsequent to the research being conducted. So you can be open in that way, but not always. For example, in the cases of research on right-wing groups that were rising in Britain, researchers engaged with their processes and their meetings in order to gain an understanding of what was motivating this resurgence in right wing thinking. If they asked to undertake that research they would have been refused. But we know that the threat and popularity of these groups is something that we need to know about.

And the only way, therefore, we can do that is to engage with the groups on a covert level, and see what they are doing on a day to day basis by engaging with them and be part of that group and to take that information outside. Within that, of course, people still, when the research is written up, when the research is published, no one's name needs to be disclosed. The details of the group certainly, but no one needs to be recognized or identified within that research. So there is a morality there, but there is an importance because there are some things that are so hidden that we cannot research them in any other way, than getting in as though we were part of these groups.

There is still a battle with the development of the research ethic that allows in Social Sciences to research appropriately. The speedy rise of Biomedical Ethics and its translation over into Humanities and Social Sciences has been so quick that what researchers are trying to do in terms of studying the human condition is ignored. It is those kinds of developments that we need to do horizon scanning, and how we integrate what we are being forced to integrate rather than developing a solid research ethic. There are cases that proper research is prevented, and researchers cannot gather data, for example, in relation to people with dementia, in relation to people with a range of disabilities, especially intellectual disabilities, and so people who need a voice are prevented from being included. What is needed is to find the **correct methodologies** in order research ethics protocols to be much more inclusive.

Another recent scientific development concerns **citizen science**, science that is conducted by people with no research/educational background, in collaboration with scientists (for example, for data collection and analysis). However, there is a debate on how to ensure research ethics in this kind of research.

Another scientific development that also raises ethical issues is the use of blockchain technologies that could lead to research misconduct. There are several efforts within the academic community on the development of technologies that may adapt useful elements from well-known criminalistic techniques in order to deal with issues, such as the contract cheating. Nowadays, in order to detect phenomena like plagiarism, academics perform text matching, using publications that are stored in several repositories. However, the authors of such

publications sign a kind of a contract with the respective repositories, which in a way is violated during the text matching, since the publications that are used are also saved to the repository of the software that performs the text matching.'

One interviewee, also, referred to **the technology of tracking** the activities and **behaviour of animals**, for example by using drones, as a major scientific development. This development is also linked with the collection of data that sometimes involves human data (e.g owners of animals). There are no actual foreseen technologies but mostly ethical aspects like **animal welfare**. For example, whether or not implanting such tracking devices in animals and if yes, by which techniques. It is common practice for researchers to implant such devices without following standard procedures set by European Commission. The most appropriate way for implanting tracking devices is to anesthetize the animal. However, this requires specific license that is time and budget consuming, leading researchers to follow alternative, but questionable, methods. Not to mention that such devices can be easily found online, meaning that can be used not only by experienced and well trained scientists, but also by civilians. Another ethical aspect is clinical research in **veterinary practice** which raises lot of questions. Lots of animals are referred for further treatment and special surgeries. However, many veterinarians avoid proceeding to euthanasia, even in cases that this is unavoidable, since they feel that following this path means that they have failed, without taking into consideration the animal welfare. Instead, they follow practices that are ethically questionable, many times driven by profit. It is also worth to mention that suicide rates in this profession are high, meaning that mental health in this profession is an issue. '

Relevant is, also, the discussion on the **production of new crops and food**, in all sorts of ways; for example, **crops** that are **genetically modified** by using gene editing. We must be aware that the implications of that ethically are significant. As one interviewee pointed out, '*If they are regulated in the same way as we started regulating in 1990, then we will limit the ability of universities and small companies to develop new crops because of the cost of all testing that is required, and we will knowingly only allow big companies to be involved, which is an ethical issue. Should we be doing all this concept "humans playing God"? We are producing*

all sorts of new foods, including foods which, for example are models of animals, "animal food", food derived from animals. So, for instance, we can make a steak in the laboratory. Should we? What are the issues there? This cultural appropriation, this appropriation which has been talked about in some areas, that's a possibility of saying "if you make a steak, what are the issues in relation to using animals, what are the relationships to animals?". This is, also, related to discussions with vegans, regarding eating meat. For example, in 1900 there were hundreds of millions, probably, of horses around, because there weren't many cars. Today there are hardly any horses. Is that what we want? Because if we stop eating let's say beef, the majority of cows that we currently produce may disappear or we will have to kill all the male animals because we continue to produce milk, but we do not need the males. So we will kill them at an early stage in their life, because we cannot afford to keep them. So we have to be aware of each of these choices. So the issue of genetic modification, in whatever way, of plants, animals, humans is a main one.' The same concerns apply to the **use of gene drive to insects**, for instance, in order to reduce the mosquitos' populations. The ethical issue of using modern genetics in relation to almost anything we do is massive and it is increasing rapidly because things are getting easier to do.

A final, general comment regarding the foreseen, yet unachieved technologies is that they concern mostly the national bioethics bodies and ethics councils, and not so much Research Ethics committees, as such committees review mostly submitted applications, since in such applications the demonstrated technologies are presently available. Since PRO-RES project will develop not just an ethics framework but also a framework that will help policy makers to take decisions connected with scientific knowledge, it is important to approach policy makers appropriately and bridge the gap between scientists and policy makers in a EU level. For this reason, it is important Research Ethics and Research Integrity communities to start interacting, and policy makers be part of this dialogue.

3.2.2 The dual use issue

Questions no 4 and 5 of the interview's questionnaire refer to the so-called 'dual use issue', namely the potential use of scientific results and products for both civilian and military applications. In particular, the questions had to do with whether it would be possible the scientific developments/upcoming technologies already discussed in the previous questions to be both of civilian and military use -following the mainstream definition of dual use-, and whether this dual use issue should be treated as an ethical issue.

Almost all the interviewees, -eighteen out of nineteen- gave positive responses while recognising the complexities and the importance of this issue. It is worth mentioning that the only interviewee (*I1)* who responded in a different manner, in fact gave a different perspective of the matter while recognizing its significance by noting the following:

'*Any kind of knowledge can be used for both civilian and military applications. For example, as far as someone understands the mechanisms of toxicity, he can use this knowledge in order to increase toxicity, while in principle scientists try to drive the development of advanced materials in order to reduce the toxicity. This is a possible dual use.'*

Furthermore, regarding the treatment of the dual use issue as an ethical issue, the same interviewee added:

'No, in the sense that dual use comes afterwards. Once the scientific community succeeds in understanding something, moves to specific applications using this knowledge and this is when the ethical checks are needed. The scientific process itself is driven by the increment of knowledge. So, typically, the perception about the possible ethical implications is not that high during the quest for knowledge.'

On the other hand, as already mentioned, the majority of the interviewees consider this issue as serious and with important consequences. For example, *I5* replied that:

'This is a very important and complicated issue. Cutting edge technologies can have dual use implications. Researchers are usually not aware of the dual use implications in their research, despite the fact that they are aware of the theoretical problem of the interconnectedness between the civilian and military oriented research. The way that ethical clearance/authorization is granted for projects with potential dual use implications does not help researchers to identify them, since they are oriented in just ticking boxes, i.e. they do not get deep in the actual context of the research. A cultural shift is needed, in order to find the appropriate tool to discern dual use implications and recommend the appropriate actions, with regard to disciplines like Physics and Agriculture, just to mention some areas with dual use implications.'

To the same direction, *I9* supported that:

'In principle, it is very difficult to avoid dual use in research and thus the monitoring of dual use research should be very strict. The dual use analysis of a research and possible relevant scenarios should be seriously taken into account.'

In fact, the general consensus among the interviewees on this issue seems to be that scientists and the societies making use of the scientific results and products face the responsibility of their choices, whether military or not, as anything new might be used for military purposes. Every scientist, every researcher, after the first couple of successful results, can understand and foresee to which direction his/her research is heading. Nuclear power, for example, set these possibilities in a very clear way. Like in many scientific breakthroughs, the initial research was actually made for something else. There are cases of military research within which there could be found something very useful in civilian environment and vice versa. In fact, quite a lot of innovations in society derive from military research and which, at first, were kept classified. The example of nuclear energy, again, is prominent, as it was used by the military for the development of the nuclear bomb, while nowadays it is mostly used in civilian applications as an energy source. The point is that it is not about the research results, but how we use them, and how we can avoid or minimize the misuse. If a dual use item raises ethical

concerns it depends on the purpose that will serve and not on its nature. This is why the whole society needs to respond to these questions, it is not only a matter for the scientists.

Furthermore, it is acknowledged that, most of the time, the majority of researchers works unstoppably, without necessarily reflecting on the ethical implications of their research, the risks-benefits, values, and principles involved. Framing the dual use implications of a research project within Ethics could help scientists to think farther of a common checklist, to think about things from a different perspective, through that ethics lens.

The aforementioned quiet shift from the common 'civilian versus military' distinction regarding the dual use issue to the good/beneficial versus bad/harmful' juxtaposition was, also, given in a more emphatic way by *I12*, who indicated the following:

'If something starts as an ethical issue, I can't see how it would cease to be an ethical issue. Take the example of slavery. It starts as an ethical issue, but just because we outlawed slavery, this does not mean that it ceases to be an ethical issue. Another aspect, which is more fundamentally an ethical aspect, is how we define 'dual use'. So the moment you phrase it in terms of civilian and military applications, which is a common approach to dual use, I think that is slightly an incorrect one – at least as I interpret dual use. The literal application of dual use is often when civilian technology gets used for the military and vice versa, but I think that the spirit of the dual use ethical concern is really that something, which is produced for good ends, is being now used for bad ends. My putting it in a clearer moral light like that is that helps to clear up some of the confusions, such as what happens when the military use their guns for peace keeping or to protect refugees from wild animals. Questions like that, for instance, demonstrate some of the problems with putting it in a civilian versus a military capacity. Also, obviously civilians can use good technology for bad ends as well (see the example of taking the kitchen knife and stabbing people with it). So just to put something in terms of military versus civilian, to me that bespeaks of where it starts getting into legal speak and that is when you then start to have reams and reams of legal documentation, because then you have to define exactly what is meant by 'military', in every possible context, and you end up losing this deeper ethical concern. What you are really after is trying to ensure that good technology is not used to bad ends.'

In that perspective, even the term 'dual use' might not be the ideal, as it seems that it does not entail the full range of possible meanings. As *I12* suggested:

'I would almost be in favour of dropping any reference to the term 'dual use', because people now have such a fixed idea, in fact different fixed ideas from each other, that it is not a particularly helpful term any more. So I would be inclined to look at something phrasing in a way of "alternative use" or "do you think that this product can be used for ends other that those intended by the design?", something along these lines. Or "could it be used in a way other than the intended by design which might, in some way, be harmful to individuals or society?". Something like that. Then, of course, you can cynically say that someone creating a knife might have a problem there. I am not sure there is a perfect solution to this, but something along those lines which returns to the spirit of the dual use concern, rather than this more legalistic, exhaustive break down of what classes as dual use and what does not. It would be a more helpful way forward from an ethical perspective.'

To the follow-up question that '*There are scientists who say that they cannot anticipate the full range of possible, good or bad, uses and consequences of their research results. They produce knowledge and certain results, but once their research is completed, there is a piece of knowledge which "has its own life". What is your comment on this?*', the same interviewee (*I12*) answered the following:

'*This is avoiding personal responsibility for one's own actions. I do not believe that is true at all. If scientists are working on a weapon system, they can say "we are producing knowledge but it is not our responsibility", and then someone goes and makes this weapon system real. This is completely false, namely that they don't have responsibility for that. I accept, though, that in some level, when talking about a very abstract, theoretical physics level, then it is fair enough to say that you are really producing something that could be used for good or ill. So there are cases that this is true. But the more applied you get the more personal responsibility you hold. Everybody has responsibility to think through the consequences of their actions. And when you can see a possible negative outcome of your actions that affects people for the worst, then you have a responsibility to try to mitigate against that bad outcome occurring.'*

3.2.3 Assessment of the current guidelines for ethical self-assessment (H2020 funding scheme)

The interviewees were asked to express their opinion on whether they consider the current guidelines for ethical self-assessment, within the H2020 funding scheme, sufficient enough to address such potential ethical issues as those identified in the course of the interviews. Their responses were in a sense 'divided' as there was a balance between the 'yes' and 'no' options. As a matter of fact, nine interviewees responded affirmatively, with a positive position towards the current guidelines – albeit leaving room for improvement-, whereas ten interviewees responded negatively, with a critical position regarding these guidelines. The common conclusion, however, was that the ongoing developments in the majority of scientific research fields demands regular updates of the guidelines, and even the positive responses were actually expressed in a "yes, but…' manner.

The positive responses referred to the guidelines as '*toward a good direction'* and *that 'they can be considered as quite good' (I5),* that *'they distillate a lot of work from a number of people'* (I7). *'In general, the guidelines are adequate as they include typical and basic questions. By that way they could lead researchers to consider possible ethical implications raised by their research. However, the final decision on the ethical clearance of the research should not be up to the researchers.' (I8)*

As I13 mentioned, *'There is a rapid, impressive adaptation of the research community on the matters that have to do with ethics, but, of course, there is room for further improvement. There is great interest and willingness on a European level to deal with these issues. There will be further developments, this is an on-going procedure, and even this interview shows this tendency for change and improvement. For now, I consider the guidelines sufficient, but it is very important that Europe (Commission, Horizon funding schemes) does not remain still in these matters, but investigates further possibilities and improvements.'*

I9 pointed out that the guidelines for ethical assessment are very useful, but if we take, also, into account the Research Integrity element, the guidelines become insufficient since they are mostly oriented to the field of traditional Research Ethics. Additionally, I17 suggested the possibility of updating the self-declaration form even during the project progression, and

expressed the view that '*the tick box format is not always sufficient since for some issues it is not easy to use a simple statement of "yes" or "no" and an open space to provide clearer explanations is needed.'*

I11 referred, in short, to the Horizon 2020 document 'How to Complete your Ethics Self-Assessment', which states that research must comply with ethical principles and applicable international, EU and national law (in particular, Regulation (EC) No 428/200960). For research that may affect military ethics standards i.e., if the research may be concerned by international non-proliferation laws or international humanitarian laws on military ethics (e.g. pathogen-related research, development of autonomous robotics, drones and certain laser technologies, etc.), it must comply with the international legislation in this area (in particular, the Biological and Toxin Weapons Convention). Researchers are advised to appoint an independent ethics adviser or ethics board, with relevant ethics and security expertise, to carry out a risk-benefit analysis of the intended research and to suggest appropriate safeguards to cover security risks (during, and beyond, the lifetime of the project) and training for researchers. The same interviewee further added that '*due to their broad scope, I think that the current guidelines are adequate. However, the rapid development of AI and its dual nature that is bringing enormous risks to the future of humanity may question the adequacy of these guidelines. AI development may trigger the need for auditing, mapping, governing and preventing the relevant risks and uncertainties.'*

On the other hand, the negative responses focused mostly on the 'allegation' that the current guidelines do not cover actually all disciplines; they cannot be discipline-related. As I1 put it *'these guidelines mainly concern to bio-related issues, despite that there are several ethical issues that may be raised from all kind of technologies, depending on how they are used. The updating of these guidelines becomes more imperative taking in account the fact that most of the scientists are not strong enough on assessing ethical issues. All scientists should question themselves on how their work could possibly raise ethical issues upon application. There is always the matter of individual responsibility.'* To the same direction I3 added that while several ethical issues are already covered for medical and social sciences, it seems that issues related to

engineering and natural sciences are neglected. '*Usually when a researcher applies for funding in the abovementioned fields, ethical issues are treated as non-relevant, which is not correct. We need not only to develop concise guidelines but also to train researchers and familiarize with relevant ethical aspects on their research field.'*

Another 'allegation' about the current guidelines for ethical self-assessment is that, in fact, they are treated by the majority of the researchers as a checklist. Most of the researchers fill the respective form in a mechanical way (because they are obliged), without taking deeper consideration in each ethical aspect. (*I16*) As I4 presented it schematically, *'I don't think that's enough! Because, again, anybody is just rushing through and they don't want to stop, they don't want any YESs, so they just going to tick 'NO', 'NO', 'NO' and move on. It doesn't cause them το actually reflect and really think. It's not good enough.'* In the same spirit, I10 mentioned that *'we are asking people to tick boxes and the boxes they have ticked are often wrong',* and this is so because many of the questions are on issues that have arisen in the past, rather than issues which might be prospective. Also, they are fairly limited in their scope. The same interviewee suggested asking researchers/applicants to have at their disposal the necessary paperwork and to be prepared to be audited, in order to limit bureaucratic obstacles. *'I think probably the way you do it is to get people to get things and keep it, and we do a certain number of audits every year of projects, but that is another issue. I do not like ticking boxes, I much prefer more comment based ethical analysis for all these reasons. So the answer on whether the system of ethical assessments works is that, in most instances, it depends on the subject area: in Medicine, yes; in Psychology, probably not; in Social Science, almost certainly not; in the Arts and Humanities, definitely not-they do not even know where they are starting from and they get it wrong. So the answer is no, it does not work, except in the Medical Sciences where they are used to be asked the questions. Whether the answers are honest, it is another matter, but they are used in responding to the questions.'*

I12, also, gave a response along these lines. '*No, the guidelines are not sufficient. But it will be interesting when they change in the case of Horizon Europe. {…] Some researchers respond 'no' to everything on this self-assessment because they are genuinely unaware of what*

they are doing. Some of them respond 'no' because they are cynical and they say "the Commission will come back and tell us what the ethical problems are". And some of them are tactical in saying "let's spend all of our focus, all of our time on developing the scientific assessment because this is what gets us accepted or not, on the scientific aspect of the application, and let's not worry about the ethical self- assessment because that will then come into play once we have been successful or not". […] So, we have three different reasons why the self-assessment framework is often not filled out as competently as it might be. And then, on the side of ethics assessors, you have people who are more sympathetic to the applicants and say "they are just too busy, they did not have the time to fill this out" and so, when they see something that is poorly filled out, they work through it as charitably as they can. And you have, also, other ethics assessors that say "either these people are clueless or they are lazy, either way they need to be taught what ethics is", and so they have a tendency to make the ethics requirements quite punitive in response, in order that the applicant really has to sit up and take notice. In recent years, there is a move of trying stopping people from being punitive in that way. With time, the self-assessment has been getting better.'

I14, also, added that there certainly needs to be in every project an independent ethical scrutinizer, perhaps someone from a different university or from a different discipline who then is drafted in that work and scrutinizes and reports back to the EU on the ethical practice and the ways things have been considered and dealt with. At the same time, the guidelines need to be as facilitative as possible. '*We need to try and get in a position in the EU where we are facilitating research as far as we can and that we are taking on board what individual researchers are saying about their research and the ethical scrutiny behind it, but it needs, also, then to have another layer of independent scrutiny by the evaluators of all projects and that demands really a disciplinary-specific guidance as well as global guidance.'* […] *Many of the disciplinary specific guidelines could come from European disciplinary professional bodies, and, on a global level, if there is an acknowledgement that the researchers are connecting with their European and international professional bodies and the guidelines that are set out in terms of ethics there, then that almost covers it.'*

Furthermore, what was broadly acknowledged was the matter of ethical awareness by researchers, as many interviewees said that scientists do not worry about ethical issues that their research may raise and this is mostly due to lack of awareness. '*A reassessment of the self-assessment sheet is imperative in order to raise additional ethical issues. Most scientists avoid spending time for ethical paperwork in order to focus on their research. In general, a cultural change on how we treat ethical issues is needed, especially since science becomes interdisciplinary and we see the possibility of applications of our work that we never anticipated.'* (*I18*) However, it was, also, acknowledged that despite that most of the researchers do not identify any ethical issues during the self-assessment procedure, the truth is that we can always find ways to use any technology in an unethical way. In this sense, the self-assessment procedure is quite important since it raises concerns among researchers regarding the personal responsibility and the impacts of someone's research. '*However, it is not sufficient the ethics assessment procedure to be relied only on the researchers, since researchers are not always aware of all the possible applications that their results could have. The establishment of an external body that would analyse and identify possible ethical issues of an application seems imperative.'* (*I6*)

Based on the interviewees' responses, the matter of personal awareness regarding the ethical implications of one's research and the broader research environment in which such awareness can be cultivated and promoted, seem to be of significant importance in order such guidelines to be applied in a fruitful and honest way.

3.2.4 Differences between the European research environment and the non-European ones

The last question in the interview's questionnaire was on whether they interviewees identified any significant differences between the European research environment and the non-European one (in the USA, or in China, for example) regarding these potential scientific developments which had already been discussed in the previous questions. All interviewees

identified relevant differences in the various research environments, whether they had experienced them themselves while working outside Europe or they were aware of them through their interaction with other researchers with similar experiences.

Their responses varied in terms of the most prominent differences and focal points of the discussion. The main non-European research environments which they referred to were China and the USA, but there were, also, some references to Russia, Canada, Australia, Japan, South Korea, South East Asia (particularly, Malaysia and Myanmar) and South Africa. A list of topics on which differences can be identified is:

- The ethical reflection as general mentality and the presence or absence of interest in ethics;
- Different ethical and legal starting points;
- Publishing pressure;
- Intellectual Property (IP) rights;
- The approach to the dual use issue;
- Clinical research;
- Environmental issues;
- Contract restrictions versus academic/research freedom;
- Differences in the way Research Ethics Committees (RECs) and Institutional Review Boards (IRBs) operate;
- Personal privacy, surveillance and data analytics;
- Adaptability of the researchers;
- Animal welfare and the involvement of citizens in research
- Local differences among European countries and heterogeneity;

Following the interviewees' responses, in the following paragraphs we present the differences between the European research environment and those environments of other regions, based on the abovementioned identified points of comparison.

One major issue is the general **mentality of ethical reflection** and a genuine interest on research ethics that we can identify in the various research environments. In some environments this mentality is more developed and elaborated than in others, it is more central in everyday research practice. To that respect, the EU and the USA, but, also, Australia and Canada, are considered more advanced compared to China. Based on her working experience I4 put it as follows: *'In China they have no transparency. They allow no audits, independent audits of their systems. So it's just really – I got to say it- a shame. And I've tried myself to teach research ethics and research integrity to the Chinese and it is extremely difficult: a) they are not interested and, b) they basically say "who cares?", "why does this matter?", "we have our own set of codes". […]I hate to be so frank, but this is really the way it is, and this is what they have told me themselves in classes. So, they really have a very cold and callous nature to themselves about ethics. […] in other countries like Australia, United States, and Canada, they do indeed have ethics on their rater. Somewhere more regulated than others, somewhere more conservative than others, but they definitely have somewhat of a moral compass, and they are concerned of their own image as a country, they are concerned about protecting their citizens, they are concerned about their intellectual property. But they do want to see ethical reflection and values and principles running in tandem with the development of technology. And I truly believe that, but you can't say that for all countries. You really can't say that for China.'*

To the same direction, I7 stressed that the main difference is **the different starting points in terms of ethical and legal principles**. Research environments are different from a cultural point. First of all the ethical points of reference are different. This does not necessarily mean that there are in contradiction, but they have different departing points. *'So, Europe might try to find the centre stage and propose avenues, general principles that can be accepted across the board in these different research environments. So we have different departure points, different cultural, political and legal attitudes. That has a lot of implications. So, let's put it this way the American ethical principles have different points of departures, sometimes using the same language, but different points of departure that we have in Europe. We are not sure what is actual the ethical framework, I am not an expert on that in Russia or in China. But, certainly, the constraints in terms of regulatory constraints on controls, on links between*

funding and ethical constraints live in very different regulatory frameworks, in all these systems. In this landscape in which we clearly have different continents, different worlds and these worlds are actually competing in doing research, there is only one way forward: Either we are able to propose European standards, attitudes, environments, checks and balances as a model and, at least, attract other countries, e.g. Latin America, Africa and other Asian or we run the risk our ethical research model will begin loosing, in competitive terms. That may be a risk, because we may arrive last in research and when being last in research we will surrender our ethical principles. But that will be too late. So, strategically, in might be useful to first try to set the score and propose a viable effective ethical framework that can be shared, so basically leveling the playing field with all these players as much as it is possible and, on the other hand, being aware that this strategy might not work in the short run at least. And being ready to know the differences and eventually act fast on specific domains on which for instance reflection of not to re-open ethical issues requires an earlier discussion, not delayed ones, for political or other reasons.'

Regarding the **pressure to produce results and publish** them, the European research environment seems to be less aggressive compared to the USA and, even more, to China. As I1 mentioned: *'There are huge differences between EC and US. This gap is even bigger with China. In China there is a huge pressure on young researchers on publishing and producing results. This pressure has negative impact not only on a scientist as a person but also on the ethics of science. Publishing under pressure could lead to negative results that could be circulated among the scientific community, leading to waste of money and working hours. In US, this pressure is not that high since scientists have a huge science market and they always have the chance to fit into the scientific community. In EU, the situation is much more heterogeneous, differing from country to country.'* Relevant to this issue are, also, the approaches regarding the **protection and promotion of Intellectual Property (IP) rights**. As I18 pointed out: *'EU and US are a bit close as regards on how they address ethical questions. More concerns are raised in countries like India or China where the IP rights are considered differently than Europe, having as a result that good ideas (even ideas that can be protected by patent) get repeated, as soon as all information is published.'*

Another major issue that is dealt with in different ways by different research environments is that of **dual use**. In the USA, dual use issues are in many cases envisaged quite strictly and they are regulated by the Law. I2 mentioned that '*Studies that raise serious ethical concerns (e.g., studies on embryos) are prohibited by law. Any breach of such laws may even end up in imprisonment. On the other hand, the situation in EU and China is quite different. In Poland for example, such studies are also prohibited not by law, but due to religious beliefs. In China, such studies are conducted without any control, unless this is necessary (e.g., in cases that there is a leak to the press).'* To the same direction, I11 added that the main difference between the USA and the EU approaches is that in the USA, the dual use dilemma has traditionally been conceptualized within a security framework and consequently primarily engaged the security community. In the EU, the scope of the discussion has been broader by employing wider definitions and placing special emphasis on the ethical dimension of dual use/misuse. This is point is, also, in accordance with the responses given by some interviewees το the question about the dual use issue. *'In any case, it is important to recognize that key decisions posed by dual use research are inherently ethical in nature. In the EU, special emphasis is paid on the responsibilities of the actors in question, for example, to what extent a scientist would be responsible if her research is used to cause harm, on the plausibility of a risk-benefit analysis and the relevant value conflicts.'*(I11)

Another issue that was raised by some interviewees as significant in comparing the various research environments was the status and way of conducting **clinical research**. As I13 pointed out: *'As far as China is concerned, there are huge differences in clinical research, in bioethics etc. This is already known, and it is clear that there is no particular hesitation in cases in which they consider that they have to disregard certain guidelines for the sake of progress and big developments. China is a scientific region with its own purposes and plans, not so worried about the research ethics part, compared to other societies. Maybe this is due to a general philosophy which easily can translate consent into principle. Self-determination seems to be less important. In the USA these issues which are not related to clinical research (non-clinical) are not so important, compared to the way Europe is concerned. Europe seems to be*

more advanced. However, I believe that the American ecosystem will eventually follow closely this direction.'

At this point, it should be mentioned that most of the interviewees made a reference to the differences regarding the way various **environmental issues** are treated within different countries and research environments. They all seem to agree that Europe is in a better position compared to the USA and, even more, compared to China, in this matter, following stricter policies. Although, the ethical considerations with regard to the environment, its abuse and its protection, are within those that are set from the very beginning in every discussion about the ethical challenges of emerging technologies, they are not elaborated significantly. A possible explanation of this observation would be that environmental issues are nowadays primarily regulated by hard law and are, also, correlated with health and safety issues. Nevertheless, the ethical implications of the effects that different types of research and technologies have on the environment still remain. Further, however analysis of the matter is not within the scope of this report.

Another difference between the European and non-European research environments has to do with the way researchers and scientists work as professionals in research organizations and the extent of 'academic' **freedom** they do or they do not enjoy. As I5 highlighted *'A significant difference, with regards to USA and China, is that in those countries the researchers/scientists have a **modus operandi that is based strictly on their contract**. In this respect they have a narrow space to do their work and, more significantly, they might suffer from legal penalties if there is any kind of breach of their contractual obligations. European research institutes have their own shortcomings, but we can be proud that researchers working in Europe enjoy more freedom when doing research and a better protection of their rights as researchers.'* This interviewee further added that in Europe we have the willingness to foster Research Integrity by cultivating a culture of good ways to conduct research, e.g. by trying to clean the literature from flawed results. In other regions they just punish the scientist who has committed research misconduct. In this way other scientists who would like to make an allegation are being discouraged, since a colleague of them might even lose her/his position.

Furthermore, it should be taken into account that the legalistic approach may be not useful to directly confront research misconduct, since the time of justice and the time of research are completely different, with the former be much longer that the latter. Additionally, by punishing the individual and by not trying to settle a proper research ethos, we foster more subtle research misconduct. An example given by I5 is the case of CNR, where there is interest to have "clean" results of the projects funded, without seeking punishment individuals.

One important point of comparison of research environments has to do with **the way RECs and IRBs operate**. As I8 concisely described the status of these committees in Europe and the USA, *'Many states have established Research Ethics Committees, but their legal status and their responsibilities vary between countries. Often the independence of Research Ethics Committees is guaranteed by internal legislation even if these bodies are attached to Ministries, Universities or other institutions. In some countries, e.g. in the United States the so called "Private Research Ethics Committees" are admitted to assess research projects. Their work is normally supervised by State's authorities. Depending on internal legislation the vote of a Research Ethics Committee may be considered as an approval in the legal sense or only as an advice to the researcher. Ethical assessments of a research project may lead to different votes – in the same state or within a region like Europe.'* As far as Russia is concerned, I9 reported that '*the available information about the structure and operation of the national RECs is very limited and we do not know if it is reliable'*. Regarding China, the same interviewee added that structural fundamental differences are evident, for example in respect to privacy and personal data. In general, very different approaches and safeguards are followed in China, comparing to EU. On the other hand, and regarding the situation in the USA, it is very difficult to compare with EU. There are no such structural differences on how they understand ethical issues but, in the USA, they have a very clear vision for the operation of RECs. For example, human subject research is consistently covered by regulations and approval procedures. At last, the situation in EU is quite complicated since we have different situations in different countries.

Regarding the IRBs, I10 mentioned that in the USA there are *'institutional review boards but they do not have a systematic review, and the institutional review boards are usually*

composed of individuals who know the applicant because they are of the same institution, and may well be in the same field. Seldom is somebody who is outside the field. So I cannot say that I trust institutional review in the USA. For instance, one new hospital – usually hospital, but not necessarily- may have very different standards to another, so the same project might be approved in one institution and not approved in another; that is the starting point which is not good.' On the contrary, the same interviewee reported that in South Africa the system for various types of projects is very satisfactory, as it is discipline specific, and each Faculty in the Universities, for instance, reviews all the relevant projects separately.

About this point, I12, also, provided input by saying that when it comes to university and ethics requirements, in Europe there is more focus on the ethics when filling out a research ethics committee application, whereas in the USA, the impression is that the Institutional Research Boards are much more focused on legalities, rather than ethics. So, '*as long as you are not breaking any laws, you are essentially alright to do what you want to do. […] It is not a compelling position to take, if you say that you will get worried about certain things only when a certain law obligates you to do so, if you take responsibility only when you absolutely have to. It is an ethically lazy position, or, at least, institutionally it has been allowed to propagate it since the 19th century through a focus on positivism in science.'*

I14, also, added that *'from my experience in conducting research in the South East Asia, especially Malaysia and Myanmar, I can say that whilst there are no research ethics panels in Myanmar, individual disciplines do have their own guidance, developed from their own experiences in the domain, but, also, borrowed from Western countries, predominantly from European countries and the US (with the IRBs which have a big influence), but almost acknowledged tacitly in these countries and not enacted. Research that I am looking at in Malaysia […] we had permissions from the UK how to do that, only understanding that, of course, the Malaysian Universities, namely the people we were working with at the time, would give that permission to us. And we sought those permissions and we said that we do have research ethics panels, but we do not hold them. So they have the policy but they do not actually practice it, because it is a bit too unwieldy at the moment. What actually happened was that*

they wrote a letter saying that permission had been granted, no scrutiny whatsoever. So we have almost an imposition by the West and the global North as a whole and tacitly they are being accepted, so people are developing protocols and policies and guidance, but, then, these are not followed up and not enacted.' The same interviewee said this is not necessarily bad, because it is not sure that simple transfer of policies and procedures from one country to another is going to help at all. It is not going to be directly relevant to that particular country necessarily, and may need to develop an indigenous approach to the guidance and the scrutiny of ethics for it to really work. So, again, '*it comes back to the distinction between the global parameters of research that you are looking at, which can cover many disciplines in many different countries, and the specifics that relate to the context in which that research is carried out.'* Regarding, for instance, the developments in the field of covert research as a methodology, they are not the same concerns in these environments. I14 justified this approach by saying that '*the more individualistic culture that we developed in Europe still is different to the much more collectivish, family based cultures of South East Asia which are more family based and collective than Spain, and, I guess, Greece too. So we have that disparate between the two. If the community is a collective one then, if someone in a positional authority in that community approved the research, then it does not matter about the consent for others because the permission has been granted from an elder in the group or someone in a position of power or authority. It is different.*'

In the case of China it should, also, be mentioned that it was reported that the Chinese regulations as regards with human genetics and agriculture genetics, for instance, are in most cases produced only in English. It seems to be so because they are addressed mostly to external observers and auditors; it is what I10 called as 'outside consumption'. It is not expected anybody to actually follow the requirements. I10 said '*That is a little bit harsh, but if we look at the way in which this scientist, He, modified human embryos, modifying a particular protein gene called CCO5 to protect against HIV, without considering what CCO5 actually did and whether the modification might impact on other things rather than the HIV, was illuminating because they have introduced regulations after the event.*'

Another important indicator of the differences among the research environments is the ways in which matters that have to do with **privacy, surveillance and data analytics** are being treated. I12 reported that the Chinese do not seem to worry too much about personal privacy in the face of various surveillance systems and techniques. So, when it comes down to data analytics, they are collecting far more data on their citizens than it would even be feasible in the USA or Europe. In Europe, now with GDPR, we are really quite restricted on the amount of information we can collect. In the USA, they are less restricted and far more focused on the possibility of harm, and they tend to be less worried on collecting and using people's data. In China, there seems to be no worry at all, they just collect masses of data. So there are differences in that regard. Furthermore, when it comes to the legal situation, once more Europe, because of GDPR, is quite restricted, whereas USA and China far lesser.

In these varying research environments with differences regarding the formulation and application of regulations and guidelines, and differences in the mentality of the researchers as working professionals, it is worth examining **the adaptability of the researchers** when changing research environment. And this is important because the research environments nowadays are, also, characterized by mobility, diversity and interaction with other environments. For this matter, I13 claimed that the adaptation of the researchers on different research environments is not so difficult, at least on a personal level. For instance, a Chinese researcher working in the USA can adapt to the requirements and procedures of that specific environment, but, once he/she goes back to China, can adapt to the new circumstances once again. '*There are many things that need to be done as far as China is concerned. Before discussing about ethics in this environment, we need to resolve issues of openness (open science), and China to show the willingness to follow this direction.'*

Regarding the same issue, I14 mentioned that when it comes to the researchers from these environments that come to Europe to conduct their research, there is no real difficulty. '*They are almost been seen as a breath of fresh air. There is a preparedness to engage with the instructions as we see them. I have only experienced the most positive side.'*

Another issue was, also, raised by I19**,** regarding the **animal welfare and the involvement of citizens in conducting research**. *'In the past years, research on primates, especially for the pharmaceutical sector, has moved to China mostly for saving money. Several research laboratories in China have established research standards that are close to European standards, but there is still a lot of research conducted in China that animal welfare standards are very poor. In the United States, these standards are continuously improved, but there are still cases that poor standards are followed, since research is driven by money and animal welfare is not of the highest priorities. In Europe hopefully we will move to even better conditions but this depends to motivation and people's attitudes. Nowadays, public opinion in most of the countries has mainly focused to global warming and climate change (issues that are mostly driven by media) and initiatives that may be taken for these issues could also have positive impact on animal warfare.'* Relevant to this issue is, also, the involvement of citizens, of lay people to the conduct of research. In many cases, citizens that do not have proper training, upset animals, harm them or even force them to reallocate, without thinking the consequences. *'Moreover, the data that is collected in such cases is not interpreted correctly and animal suffering becomes pointless. The solution is not to alienate people from research and pass legislation against citizen research but find a way managing this intertest and help in generating data that will be useful.'*

As I10 supported, we can consider that Europe is better regarding the application and implementation of regulations, but the interpretation of **the requirements in different European countries are different**. '*In the UK,[for example[, they are quite strict usually. Whether that would be true for research being done in Greece, for instance – I do not know. In Italy, it is the same.* […] *Certainly for European funded projects there is no problem, because it is done centrally basically by somebody, by a committee which is called to Brussels, but for internal projects we cannot be sure for funding. […] For EU funding there is an ethical oversight. Other funding, particularly funding by commercial enterprises, probably not. So, that needs to be taken into account. And of course you can have, simply built into Horizon 2020, the possibility of having multiple funding sources and then certain things you can do using EU funding, like making stem cells. But you can make stem cells using somebody else's funding and then put*

them into the EU project. We already have that. This is something like ethical dumping within the EU.'

3.2.5 Revising academic curricula towards the creation of an RE & RI vigilant research culture

The development of the discussion in the course of most of the interviews, and the way that the interviewees responded to the questions regarding the dual use issue and the process of scientists' filling out the ethical assessment forms, brought naturally to the discussion an additional, concluding question about the need to revise academic curricula towards the creation of a Research Ethics & Research Integrity vigilant research culture.

As the interviewees responded, *'basic education on ethical aspects is lacking from scientists. Especially in the field of clinical trials, many scientists treat animals like a tool for their research and not like a living organism.'* (*I19*), and revising the academic curricula accordingly *'should be mandatory in a university level, in order for future scientist to follow proper research practices, placing always human needs over research results (especially in medical sciences)'* (*I2*). In this way, a proper research culture among scientists could be developed which would enable them to perform their research in an ethical way and not just because they are obliged to do so (*I16*).

A common point was that this promotion of an RE & RI vigilant research culture is important to all scientific fields and not only to the fields of healthcare and medicine (*I9*), and awareness should be raised not only to professors and senior researchers, but, also, to junior researchers and PhD students. According to I15, many students and post-docs from the field of science and technology say that ethics is not their concern, so proper teaching of these issues would help not only with ethics but also in interdisciplinarity. For example, many natural scientists do not understand the scientific language used in the Humanities, but it is getting more and more popular the idea that our future needs interdisciplinarity in research. More and more universities in many European countries introduce Research Methodology and Research Ethics as a compulsory module. However, these courses are usually very discipline specific and

probably do not involve Research Ethics in general. Since one of the major changes in research in the recent years is the open access to a huge load of information, which is quite important for researchers, teaching methods should be adapted to this new reality. As I6 pointed out, '*We should adapt current methodologies in order to learn better how to manage all this information.'* Furthermore, as I18 suggested, the revision of academic curricula *' would help but not in a concept of huge modules, because such modules can easily end up being unpopular. They should be structured as a part of a larger package (for example «research methods» module) with tighter schedule, so that scientists do not feel that their ethical obligations outweigh their scientific work.'*

Although the idea of including training on RE & RI in the academic curricula is gaining popularity in many European academic environments, there many cases in which there is disagreement among curriculum committees' members regarding the extent to which this revision is needed and the way it will be accomplished. As I4 mentioned, '*you can have some pretty contentious, almost knock-out, drag-out fights with people, especially with the 'hard' scientists versus the 'softer' people, like the philosophers, the people in the Humanities, the ethicists etc. And you really have to fight for curriculum space if you want to have any time at all in the curriculum for things like ethics, research ethics, research integrity. […] It is a fight conceptually on the value of what you are teaching, because they will think their staff is more valuable than your staff. […][In my country] we made it mandatory that you have to have the ethics training. So here I do a two-day, 16-hour workshop on research integrity which includes research ethics. And, so it's 8 hours one day and 8 hours the next, it's very hands-on, interactive, and I have one course that is designed for the 'hard' scientists, the engineers, chemists, physicists, all those people, and I have another course which is essentially the same content, but different case examples and applications, and that is for social scientists, psychologists, people studying foreign language, History, whatever. But it is required. So in my country you can't graduate with a PhD if you haven't taken the course.'*

Another important issue noted by some interviewees (I8 and I17) is related to who is going to teach these lessons, as there seems to be a lack of experienced trainers that will train

students and researchers over these topics. For example, in the case of medical researchers/students, who should teach them on RE & RI, physicians or philosophers? As this teaching should refer not only to ethics in medicine but ethics as such, as a philosophical discipline, academic teachers should be professional philosophers/ethicists, not just academics with an "interest in ethics".

This shift to the direction of the academic curricula, this enrichment with modules on RE & RI, has been considered by most of the interviewees as very important not only for the researchers' mentality and the quality of research, but, in the long run, for the broader mentality of society towards science and even proper citizenship. As I13 mentioned: *'This is applicable even in the very basic education/training, not only for the researchers. This is that creates the good citizen. Higher Education will combine technical skills together with the virtues that you described. There are already some private schools in the USA that have implemented this mentality. This type of education will formulate not just a new ethos for the researcher, but, also, a new ethos for the citizen.' To the same direction,* I14 concluded that *'it is absolutely imperative in order to humanize all intellectual and scientific endeavour.'*

Conclusions

The current European research environment is a dynamic environment aware of the ethical challenges, whether already existing or emerging, that characterise scientific developments and research enterprises. In this environment, researchers and institutions need to compete with their peers outside Europe, and promote knowledge in an ethical, integral, yet efficient way. It has been clear from the interviewees' responses that in order to succeed in these efforts, researchers and research institutes/organisations need to have the proper guidance and regulating procedures coming from the policy making institutions. Simultaneously, however, they need to develop their own RE & RI vigilance. In other words, governance and self-governance are equally important. The first can be succeeded via proper procedures and codes of research conduct, a combination of hard and soft law. On the other hand, self-governance is the combination of the creation of an RE&RI-oriented research culture – as a result of proper governance-, together with personal initiative and effort.

Furthermore, the interviewee's input revealed that new technologies raise new issues that are not addressed form the existing ethical frameworks, while, at the same time, 'old' ethical problems remain always relevant.

Appendix 1 – Interview's Questionnaire

Questionnaire for the "Horizon Scanning Module"
National Technical University of Athens

PRO-RES

PROmoting integrity in the use of RESearch results

"Horizon scanning module"

1) Which are the latest scientific developments in your field?
2) Which are the foreseen, yet unachieved technologies in your field? (*if applicable*)
3) Please identify potential ethical issues that may arise from foreseen, yet unachieved technology in your field.
4) How possible is it such scientific developments/upcoming technologies to be used for both civilian and military applications (dual use)? (*if applicable*)
5) Do you believe that the «dual use» issue should be treated as an ethical issue?
6) Do you find the current guidelines for ethical self-assessment (H2020 funding scheme) sufficient enough to address such potential ethical issues?
7) Do you identify any significant differences between the European research environment and the non-European one (in the USA, or in China, for example) regarding these potential scientific developments?

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Appendix 2 - Geographical distribution of interviewees