EU's RTD PROGRAMS, AND THE PARTICIPATION OF NON-EU COUNTRIES IN RTD PROPOSALS

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Abstract

The Framework programmes are the World's largest, multinational, financial instruments funding research and innovation in the European Union (EU). The keywords and characteristics of these Framework programmes are Excellence, Competitiveness, Innovativeness, General Openness and Collaboration. The programmes are results-oriented and focused on societal challenges as defined in relevant EU strategies (such as Europe2020) and Sustainable Development Goals as defined by the United Nations.

The aim of this paper is to present the EU Framework programmes for research and innovation – on-going programme Horizon2020 (value of 80 billion Euros for period 2014 – 2020) and its successor Horizon Europe (estimated value 100 billion Euros for period 2021 – 2027). The Framework programmes support breakthrough innovation intending to provide more impact (scientific, societal and economic) with investments in research and innovation.

Disaster resilient societies are playing an important role in Horizon2020 and will be continued in Horizon Europe under the cluster named "Civil security for society". Tackling global challenges and enabling disaster-resilient societies are in the core of this cluster. For this, international cooperation is essential and provides important window for collaboration of world-wide researchers with European. The paper presents the examples of calls that will be actual in 2020 and inviting researchers to be more active in collaboration on joint projects on topic of disaster-resilient societies.

The paper also presents the overall success of three selected non-European countries from the Asia region - China, South Korea and Japan- in the on-going Horizon2020 programme.

Since Horizon2020 soon comes to the end, the paper provides an insight into the successor programme called Horizon Europe and position of Disaster Resilience in Societies within this programme.

Keywords: European Union, Horizon2020, Horizon Europe, Disaster resilient societies, Excellence

Introduction

The societies (or countries) are always struggling with the progress, stable macroeconomic indicators and security of their population. The crisis situations are appearing in each country, in each society jeopardising the economic growth, destroying natural and economic resources, even worse – human lives. The need to provide sustainable, economically and politically stable living conditions and to preserve nature has become a global issue. The financial crisis in 2008 made significant disturbances at the financial markets all over the World causing many negative effects and economic recession.

In 2009, the European economy faced with the deepest recession since 1930s and with GDP fall of 4% threaten EU to fall to a permanently lower trajectory due to increased unemployment, fewer investments and decreased innovation capacities due to fewer investments in research and development (R&D) (European Commission, 2009) In order to stop recession and get back on positive economic growth indicators, the European Commission had to act. It was necessary to respond to these economic crises with adequate actions, to address people's concern about their safety and environment and to bring Europe back to leading position in research, technology and innovation. The European Commission proposed 10-year strategy to advance European economy recovery through so-

called "smart, sustainable and inclusive growth"(European Commision, 2010) The strategy identified 5 (five) headline targets that should boost and improve economic growth and employment, which are broken down into 7 (seven) Flagship initiatives. The studies have proved that there is a correlation between investments in R&D and economic growth (Lykogianni and Verbeek, 2008) including different analyses performed within the European Commission and Directorate General for Research and Innovation and its Economic Analysis Unit. The main conclusion of these studies is that investing in knowledge boosts economic performance. Therefore, the first Flagship initiative of Europe2020 strategy is Innovation Union Flagship initiative that will support "smart growth".

Horizon2020 Programme

For the European Commission, the smart growth presents efforts to strengthen knowledge and innovation as the drivers of the economic growth in the future. Therefore, the Innovation Union flagship initiative aims to respond to the challenges the European society is facing (climate change, energy, health, demographic, security etc.) and to support economic growth in the European Union (EU) with re-focusing its R&D and innovation policy (European Commision, 2010)

In order to implement this Flagship initiative and to contribute to smart growth, the Commission has established a financial instrument called Horizon2020 (European Commission, 2011). With this financial instrument, the European Commission intends to achieve goal of the Innovation Union:

- To further improve the European Research Area with development of strategic research agenda that is focused on societal challenges (security, climate, health…)
- To improve framework conditions for business to increase their innovation capacities and thus increasing the economic growth (e.g. single EU patent, specialised Patent Court, setting up interoperable standards etc.)
- To launch "European Innovation Partnerships" between the EU and national level to speed up development and deployment of the technologies to resolve identified challenges.
- To further strengthen different EU instruments supporting innovation enabling faster commercialisation of the innovations.
- To make priorities in knowledge expenditures using financial instruments to promote and to attract more private investments in R&D.

In order to meet Innovation Union goals, Horizon2020 programme is structured in three main pillars:

1. **EXCELLENT SCIENCE (24.4 billion EUR) – RESEARCH DRIVEN** – the aim is to raise the level of European research excellence and to ensure world-class research in Europe in order to secure long-term scientific competitiveness. This pillar is composed of four main sub-programmes: 1) European Research Council (aiming to finance talented individuals and their teams to carry out the frontier research); 2) Future and Emerging Technologies (aiming to finance collaborative research on new and promising technologies, such as high performance computing, quantum technologies etc); 3) Marie Sklodowska Curie Actions (aiming to finance individual researchers to provide them with excellent training and career development opportunities); and 4) European Research Infrastructure (aiming to finance improvement of the research infrastructure, including the e-infrastructure).

2. **INDUSTRIAL LEADERSHIP (17 billion EUR) – INDUSTRY DRIVEN** – the aim is to make Europe more attractive for investments in R&D and innovation focusing efforts on key industrial technologies and maximising the growth potential of European companies on the markets. This pillar is composed of three sub-programmes: 1) Leadership in enabling and industrial technologies (aiming to finance development towards the leadership role in ICT, nanotechnology, advanced materials, biotechnology, etc.); 2) Access to risk finance (aiming to support research with risky outcomes); 3) Innovation in SME (aiming to directly fund SMEs innovation capacities in order to launch them as the leaders on the market).

3. **SOCIETAL CHALLENGES (31 billion EUR) – SOCIETY DRIVEN** – the aim of this pillar is to respond directly to the policy priorities from Europe2020 strategy using challenge-based approach coupling knowledge and resources in practical resolving of these 6 (six) challenges: 1) Health, demographic change and wellbeing, 2) Food security, sustainable agriculture, marine and maritime research and the bio-economy, 3) Secure, clean and efficient

energy, 4) Smart, green and integrated transport, 5) Climate action, resource efficiency and raw materials, and 6) Inclusive, innovative and secure societies.

The programme is characterised with the following keywords: *Excellence, Competitiveness, Innovativeness, General Openness* and *Collaboration*. The whole programme is about the collaborative projects that are based on research excellence and generally open to all R&D institutions from the whole World. The aim is to increase innovativeness of institutions and companies thus being more competitive in the markets all over the World. Thanks to the general openness, collaboration and excellence, the competitiveness in the programmes is at a very high level – the **average success rate is in range of 10 to 15%** due to large number of applications and budgetary constraints.

In general, there are three categories of the participating countries in the Horizon2020 programme:

- **MEMBER STATES (MS)** – these are 28 EU member states that are obliged to pay the amount for participation in the programme.
- **ASSOCIATED COUNTRIES (AC)** – there are 16 non–EU countries with a status of the Associated country. These are the countries that have signed bilateral science and technology agreements with the European Union and thus obtained the full participation rights as the EU member states.
- **THIRD COUNTRIES (TC)** – are all other non-EU countries that have not signed accession agreement to Framework programme. The third countries, in general, have limited access to EU funds and they can participate in the programme only if it is claimed in the relevant Work programme. Otherwise their participation is limited. Also, some industrialised and emerging countries (USA, **China, Korea, Japan**, Singapore etc.) are only exceptionally eligible in for funding. The European Commission has specialised bilateral agreements with many of these countries which do not cover the Horizon2020 programme. More details on participation of TC in the programme are available in the relevant Work programme.

The general openness for participation in the programme proclaims that each institution established under the European Union regulation or regulations of country it operates (from MS and AC) can participate in the programme. The precondition is to register in the European Commission database for Framework programme and to obtain so called **Participation Identification Code** (**PIC**), which is unique 9-digit number and institutional identifier in the system. This is very important as all the activities related to the Horizon2020 Programme are electronic and done via **Funding and Tender portal**. The complete management of the Programme happens on this portal – from publishing of the calls, submitting the application, receiving the feedback information, signing the Grant Agreement, implementation of the project, delivering the deliverables to reporting and closing the Grant Agreement.

The **advantages and benefits of participation** in this almost **80 billion EUR worth programme in period 2014-2020** are the following:

- Participation in world-class research and innovation projects with high impact,
- Mobility to Europe and prestigious research centres,
- Gaining access to new networks and alliances,
- Gaining access to world-class research infrastructures,
- Increasing your research visibility and gaining new business opportunities,
- Collaboration with excellent European and International scientists, and
- After all, getting the money for your research!

Security and Disaster resilient societies

Security of the society today presents an ultimate task of each government, thus it is crucial for such a complex society as the European Union. This is a societal challenge that cannot be resolved with independent, single or sector-specific treatment. It is a very complex challenge that requires ambitious, multidisciplinary, well-coordinated and holistic approach and treatment. In order to protect freedom and security of its societies, the European Union requires effective responses using a comprehensive and innovative suite of security instruments where research and innovation plays a clear supporting role. Research and innovation activities should aim at understanding, detecting, preventing, deterring,

preparing and protecting against security threats although research itself it cannot alone guarantee security within society.

The domain of Security research in Horizon2020 covers different areas of insecurity, such as crime, violence, terrorism, natural and/or man-made disasters, cyber-attacks or privacy abuses, and many other forms of social and economic disorders increasingly affect citizens. In line with this holistic approach, the focus of research activities is on (European Commission, 2019a):

- fight crime, illegal trafficking and terrorism, including understanding and tackling terrorist ideas and beliefs;
- protect and improve the resilience of critical infrastructures, supply chains and transport modes;
- strengthen security through border management;
- improve cybersecurity;
- **increase Europe's resilience to crises and disasters**;
- ensure privacy and freedom, including on the Internet, and enhance the societal legal and ethical understanding of all areas of security, risk and management;
- **enhance standardisation and interoperability of systems, including for emergency purposes**;
- support the European Union's external security policies, including conflict prevention and peacebuilding.

The calls within the Security domain are grouped into 5 (five) main categories:

- Protecting the infrastructure of Europe and the people in the European smart cities
- Artificial Intelligence and security: providing a balanced assessment of opportunities and challenges for Law Enforcement in Europe
- Security, divided into sub-groups:
    o **Disaster-Resilient Societies**
    o Fight against Crime and Terrorism
    o Border and External Security
- General Matters, and
- Digital Security.

Security is a societal value and a guiding principle and therefore all individual actions (projects) must be in compliance with the provisions of the "Charter of Fundamental Rights of the European Union" (European Parliament, 2010). Besides this, the actions are expected to support the Sustainable Development Goals (SDGs) of the United Nations, particularly SDG 16 "Promote just, peaceful and inclusive societies" and may also contribute to other SDGs such as SDG 11 "Make cities and human settlements inclusive, safe, resilient and sustainable". (UN,2015)

Security research is challenge-driven and its main purpose is to develop new technologies and working methods that will help practitioners respond to emerging security threats. The actions should aim to bring newly-developed technologies closer to the market is promoted through the application of Pre-Commercial Procurements. As a consequence, the technology readiness levels (TRL) are relatively high (min.4 up to 7).

Disaster resilient societies challenge is about undertaking the research and innovation activities needed to protect citizens, society and economy as well as infrastructures and services, prosperity, political stability and wellbeing. The primary aim is to enhance the resilience of society against natural and man-made disasters. This aim is to be achieved with different actions ranging from the development of new crisis management tools to communication interoperability among different stakeholders, and to develop novel solutions for the protection of citizens and critical infrastructure;

Securing the society against disasters for each government presents one of the most important elements of the functioning of any society. Advancing innovation in the society at large, and primarily among the first responders aim at first place to reduce the loss of human life. However, this is not possible to separate from the response to reduce environmental, economic and material damage from natural and man-made disasters. These natural disasters include climate-related weather events,

earthquakes and volcanic events, space weather events, but also industrial disasters, crime and terrorism threats.

To assist that the end results correspond to real needs and demand, the research will generally require the involvement of different security practitioners, but also those practitioners that are working with at-risk groups, for example fire and rescue services, police forces, border and coast guards, municipalities, social workers, educators and civil society actors. The challenge in such a holistic approach is segmentation of civil security sector that is different from country to country. However, the actions should take into consideration these specifics when preparing universal responding tools and technologies.

The resilience of societies heavily depends on the behaviour of their citizens (individually or collectively). Their in-time education and alarming is of crucial importance for saving human lives, economic goods and infrastructure. But the resilience also depends on governmental and civil society organisations' creation and implementation of policies for disaster risks mitigation, reaction to, overcoming and post-disaster actions. To build the resilience of the societies requires a better understanding and implementation of new technologies and tools for all elements within the disaster resilience chain: planning resources to prevent disasters (mitigation), raising disaster risk awareness (preparedness), acting in the disaster situation (response) and acting in post-disaster situation (recovery)

The estimated budget for the domain of Security in 2018 was 211,44 million EUR, in 2019 240,47 million EUR and planned for 2020 is 286,09 million EUR.

Out of these, for Disaster Resilient Societies was 39 million EUR in 2018, 59,70 million EUR in 2019, and planned for 2020 in the amount of 42,50 million EUR.

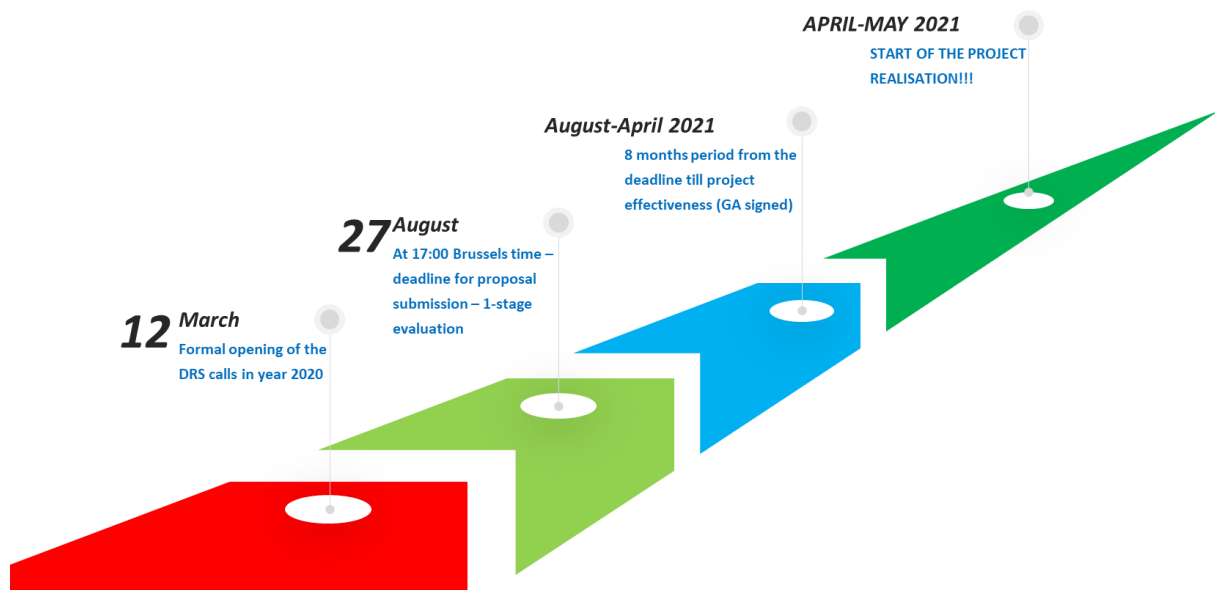**The grant amount per project estimated by the Commission is in range 3,5 to 10 million EUR.**

Figure 1: The timeline for the DRS calls that will be actual in year 2020

Protecting the infrastructure of Europe and the people in the European smart cities

- **SU-INFRA01-2018-2019-2020**: Prevention, detection, response and mitigation of combined physical and cyber threats to critical infrastructure in Europe
- **SU-INFRA02-2019**: Security for smart and safe cities, including for public spaces

AI and security: providing a balanced assessment of opportunities and challenges for Law Enforcement in Europe

- **SU-AI01-2020:** Developing a research roadmap regarding Artificial Intelligence in support of Law Enforcement
- **SU-AI02-2020**: Secure and resilient Artificial Intelligence technologies, tools and solutions in support of Law Enforcement and citizen protection, cybersecurity operations and prevention and protection against adversarial Artificial Intelligence
- **SU-AI03-2020**: Human factors, and ethical, societal, legal and organisational aspects of using Artificial Intelligence in support of Law Enforcement

Disaster-Resilient Societies

- **SU-DRS01-2018-2019-2020**: Human factors, and social, societal, and organisational aspects for disaster-resilient societies
- **SU-DRS02-2018-2019-2020**: Technologies for first responders
- **SU-DRS03-2018-2019-2020**: Pre-normative research and demonstration for disasterresilient societies
- **SU-DRS04-2019-2020**: Chemical, biological, radiological and nuclear (CBRN) cluster
- **SU-DRS05-2019:** Demonstration of novel concepts for the management of pandemic crises

Call: Fight against Crime and Terrorism

- **SU-FCT01-2018-2019-2020**: Human factors, and social, societal, and organisational aspects to solve issues in fighting against crime and terrorism
- **SU-FCT02-2018-2019-2020**: Technologies to enhance the fight against crime and terrorism
- **SU-FCT03-2018-2019-2020**: Information and data stream management to fight against (cyber)crime and terrorism
- **SU-FCT04-2020**: Chemicals: intelligence, detection, forensics

Border and External Security

- **SU-BES01-2018-2019-2020**: Human factors, and social, societal, and organisational aspects of border and external security
- **SU-BES02-2018-2019-2020**: Technologies to enhance border and external security
- **SU-BES03-2018-2019-2020**: Demonstration of applied solutions to enhance border and external security

General Matters

- **SU-GM01-2018-2019-2020**: Pan-European networks of practitioners and other actors in the field of security
- **SU-GM02-2018-2020**: Strategic pre-commercial procurements of innovative, advanced systems to support security
- **SU-GM03-2018**: Pre-commercial procurements of innovative solutions to enhance security

Cybersecurity, Digital Privacy and data protection

- **SU-DS01-2018**: Cybersecurity preparedness - cyber range, simulation and economics
- **SU-DS02-2020**: Intelligent security and privacy management
- **SU-DS03-2019-2020**: Digital Security and privacy for citizens and Small and Medium Enterprises and Micro Enterprises
- **SU-DS04-2018-2020**: Cybersecurity in the Electrical Power and Energy System (EPES):an armour against cyber and privacy attacks and data breaches
- **SU-DS05-2018-2019**: Digital security, privacy, data protection and accountability in critical sectors
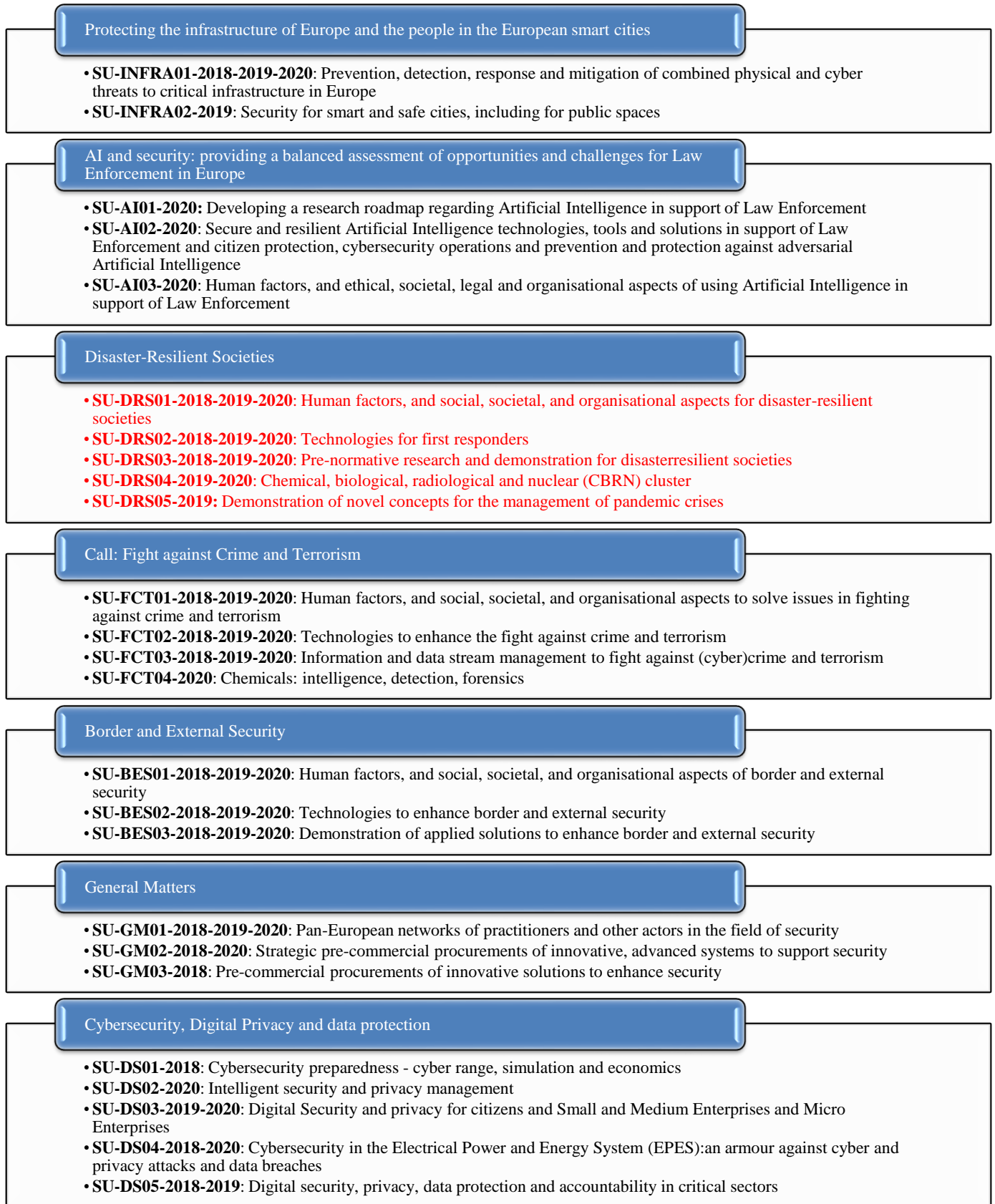
Figure 2: The calls published in Work Programme 2018-2020 related to the domain of Security
(observe the call identifiers containing 2020 refers to the calls that will be actual in year 2020)

Success of China, Rep. of Korea and Japan in Horizon2020 Programme

The international cooperation within the Horizon2020 programme is a cross-cutting issue and it is already mentioned the benefits for participation in this programme. As it was mentioned earlier, China, Korea (Rep.of) and Japan are considered as the Third countries, and furthermore as industrialised countries with limited participation in the Horizon2020 programme.

However, this programme is not closed for the participants from these three countries, just limited. If we look for the overall funds withdrawn with the projects from the Horizon2020 programme budget until 2019, it is obvious that performance of these three countries is not quite satisfactory compare to the USA as the leading country in the group (Figure 3).
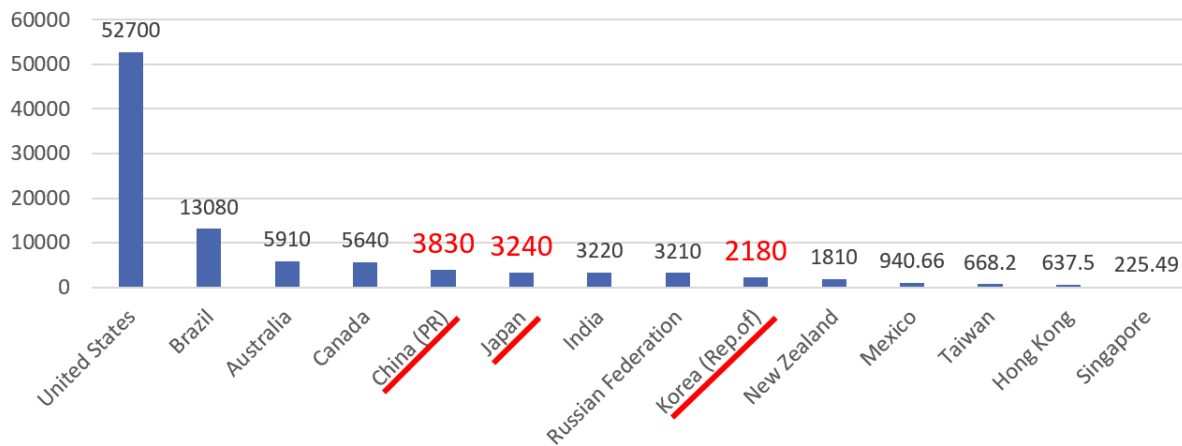
Figure 3: The amounts of EC contribution from the Horizon2020 programme to the TCs (in 000 EUR)

There was no official analysis of reasons for these figures related to EU contribution to these countries. We can just speculate about the following reasons without prejudices on real reasons:

- Starting from the fact that these countries are investing around (and above) 3% of their GDP into the R&D, the researchers have sufficient domestic funds for their research.
- Also, limitations for the participation in the programme make this programme less attractive for the researchers from these countries, despite the number of benefits it brings with.
- Cultural differences in research practices may also cause a decreased interest in the programme.

From the Table 1 below, it is obvious that between these three countries China is the most successful one from all criteria – signed grants, participation in the programme, number of applications and number of eligible proposals.

Why these data are important? It is obvious that the programme is very competitive (10-15% success rate) and thus those countries with a higher number of proposals and applications may expect better higher number of approved proposal. From the other hand, this decreases their success rate as it is obvious in case of China- 18.51%, while Korea with far fewer applications marks almost 23% success rate.

Here is another criteria introduced – participation in Marie Sklodowska Curie Actions (MSCA). This is a very popular programme within the Excellent Science pillar intended for improvement of individual researchers' careers (at all stages of their career from PhD students to post-docs). This data tells us how many individuals found Europe attractive to do their research there. From the data we can conclude that compare to the size of the academic population eligible for this programme, there is very modest participation in this programme.

Table 1: Overview of the participation success of China, Korea and Japan in Horizon2020

COUNTRY	Signed grants	%of other countries total	Participations	Success rate	Eligible proposals	Applications	MSCA participations
CHINA	189	10.78%	412	18.51%	1021	2097	162
KOREA	60	3.42%	81	22.99%	261	336	22
JAPAN	116	6.62%	147	19.40%	629	785	95

If we look for the most successful programme within the Horizon2020 programme having in mind amount of EC contribution for these three countries in case, it is obvious that the most successful is **Societal challenge 5 - Climate Action, Environment, Resource Efficiency and Raw Materials**. The participating institutions from these three countries have accumulated **over 2.6 million EUR** in this domain.

If we look at the number of participation in the programme, then the situation is different. **The most attractive programme is MSCA with 279 participations**. This statistics is understandable as for participation in collaborative and institutional projects the number of institutions per country is counted, while in MSCA individuals are counted.

These three countries have established best connections with EU researchers from **Germany, UK, France and the Netherlands** with whom they collaborated in most of the successful proposals.

Despite these more than modest statistical indicators, there is one that is encouraging and promising. It is a trend of increased participation from the Framework Programme 7 (FP7, the predecessor) to Horizon2020 in all three countries. So, it is sincere hope that this trend will continue in next R&D Framework Programme – Horizon Europe.

Horizon Europe Programme and position of Disaster resilient societies in it

Horizon Europe programme is the next EU research and innovation investment programme. It was planned for **period 2021-2027 in the amount of 100 billion EUR**, which is 20% increase from the previous programme – Horizon2020.

The basic rules for participation stay the same and some simplifications will be introduced. The aims of the programme are aligned with the UN's Sustainable Development Goals and other relevant European Commission's strategies. The provisional structure of the programme is given in Figure 4. below.
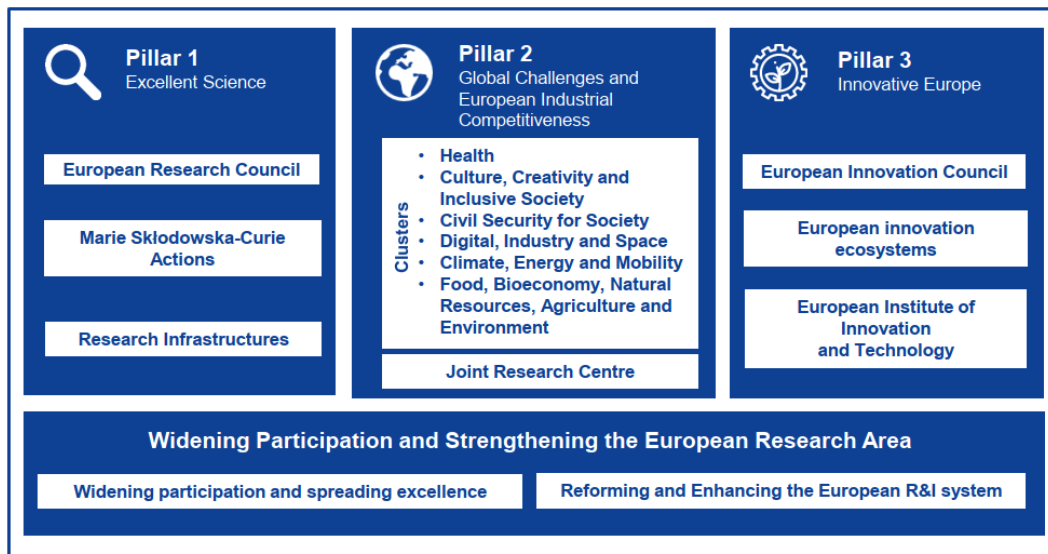

Figure 4: The preliminary structure of Horizon Europe programme (European Commission, 2019b)

The programme aims to:

- Strengthen the EU's scientific and technological bases and the European Research Area (ERA),
- Boost Europe's innovation capacity, competitiveness and jobs,
- Deliver on citizen's priorities and sustain the EU's socio-economic model and values.

International cooperation will play again the significant role in the programme by tackling global challenges, access to the best talents in the World and enhancing the supply and demand for innovative solutions.

Where will we find calls related to Disaster Resilient Societies in this programme?

The Research and Innovation Missions are the spine of the programme as a key novelty for achieving more impact and visibility of the research results. The second pillar of the programme titled "Global Challenges & European Industrial Competitiveness" aims to boost key technologies and solutions underpinning EU policies and Sustainable Development Goals. This pillar contains 6 (six) clusters: 1- Digital industry and Space, 2 - Civil Security for Society, 3 - Health, 4 - Food, Bioeconomy, Natural Resources, Agriculture and Environment, 5 - Culture, Creativity and Inclusive Societies, and 6 – Climate, Energy and Mobility.

The "Disaster Resilient Societies" will be accommodated in the cluster 2 – "Civil Security for Society" as the area of intervention together with "Protection and Security" and "Cybersecurity".

It is expected that the first draft of the Work programme for this area of intervention to be available in the second half of 2020, and the official start of the programme is scheduled for 1.1.2021.

Conclusion

The EU Framework Programme Horizon2020 is the largest programme for funding research and innovation worth 80 billion EUR in period 2014-2020. This programme aims to meet the objectives of the Europe2020 strategy and involves 28 member states countries and 16 associated countries. Due to the openness of the programme, R&D institutions from all over the world can participate in the programme. The programme is structured into three main pillars that exclude nuclear-related research.

Disaster resilient societies are part of the programme "Inclusive, innovative and secure societies", within the pillar "Societal Challenges". The aim of this intervention is to fund the research and innovation activities needed to protect citizens, society and economy as well as infrastructures and services, prosperity, political stability and wellbeing in the domain of enhancing the resilience of the society against natural and man-made disasters.

The paper presented also some basic statistics of participation of three industrialised third countries – China, Korea and Japan. These countries belong to the category of so called Third countries and have specific conditions for participation and thus their participation is limited. However, these countries have specific S&T bilateral agreements signed with the European Union for specific research activities. The conclusion is that the participation of these countries, having in mind the size of academic population that can participate, is very modest and that there should be better collaboration achieved. The trend in these countries is in favour of increasing this collaboration from one framework programme to another one.

It is to be seen if this trend shall be repeated in the next EU Framework Programme funding research and innovation titled Horizon Europe. This programme is planned for budget period 2021-2027 and will be worth planned 100 billion EUR. The intervention Disaster Resilient Societies remain an important part of international cooperation providing innovative solutions for natural and man-made disasters prevention, reaction and resilience. This intervention will be located under programme pillar two titled "Global Challenges & European Industrial Competitiveness" and cluster two "Civil Security for Society".

Now it is up to researchers from all over the World to establish mutual links for collaboration and to participate in the prestigious, competitive and excellence based programme for the benefit of the whole World population.

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