

SOCIETAL CHALLENGES AT HORIZON 2020¹

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ABSTRACT

This note aims to contribute to the debate about the relationship between technology, innovation and societal challenges (SCs). It analyzes how research and innovation (R&I) is related to societal needs in the European Community. In order to do so, this note reviews the SCs, pillar 3 of Horizon 2020 (H2020), the largest European R&I support program. Based on SC programs and projects, it analyzes which problems of European society are actually being prioritized by R&I funding, and how their challenges are defined and supported.

Keywords: Europe; funding; technology; Horizon 2020; societal challenges.

1 SCIENCE, TECHNOLOGY AND SOCIETAL CHALLENGES

Science and technology are responsible for the great achievements of mankind throughout history, especially in sectors such as health, transport, communication and energy. However, although all society is positively impacted by technological evolution, we observe strong differences in technological investments and access to technology per sectors, regions and also per groups of citizens. Besides, in many cases, high investments in science and technology aims the development of superfluous goods, while social needs, which could be minimized with technological aid, do not appear as a priority.

This mismatch between technological development and societal needs has been pointed out by some authors. As Mazzucato (2018, p. 9) reminded us:

Nelson's work on *The Moon and the Ghetto* asked the demanding question of why innovation has resulted in such difficult feats as landing a man on the moon, and yet continues to be so terribly disorganized and technologically unsavvy in dealing with the more earthly problems of poverty, illiteracy, and the emergence of ghettos and slums. He argued that while politics was partly the culprit, the real problem was that a purely scientific and technological solution could not solve such problems. There is a greater need to combine understandings of sociology, politics, economics and technology to solve these problems.

Recently, *Nature* challenged policymakers and society in general in one of its editorials:

scientists in the United States and elsewhere ought to address the needs and employment prospects of taxpayers who have seen little benefit from scientific advances. (...) The needs of millions of people in the United States (and billions of people around the world) are not well enough served by the agendas and interests that drive much of modern science (Researchers..., 2017).

Thus, scientists and scientific organizations should get out of their bubbles and pay attention to social problems and to how science can help to solve them (Negri, 2018).

1. The complete version of this analysis will be available in Portuguese and English at: <www.ipea.gov.br>.

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Based on these reflections, it is important to understand the relationship between technology, innovation and societal challenges (SCs). This note aims to contribute to this debate, analyzing the relationship between research and innovation (R&I) and societal needs in the European Community. In order to do so, it reviews the SCs, pillar 3 of Horizon 2020 (H2020), their largest R&I support program. Based on SC programs and projects, it analyzes which problems of European society are actually being prioritized by R&I funding, and how their challenges are defined and supported.

2 HORIZON 2020

Horizon 2020 is the largest R&I program in the European Union (EU). Its estimated budget was € 77 million for the period from 2014 to 2020 and its funding opportunities are defined in work programs, drawn up with the participation of industry, researchers and civil society. Universities, research institutions, small and large companies, charities and self-employed researchers from EU Member States are eligible for funding. Non-EU countries can also participate (Frenk et al., 2015). Its resources are mostly allocated competitively through public calls, based on scientific excellence, alignment with strategic objectives, geographical diversity and marketing potential.

H2020 is based on three pillars (European Commission, 2014):

- 1) *Excellent Science* aims to exploit the EU's potential in research and innovation, increasing its competitiveness on a global scale. Activities are forward-looking, developing long-term skills and providing support to emerging talent across the EU and associated countries. The estimated budget for this pillar was € 24.44 million, which represents 31.7% of H2020 resources.
- 2) *Industrial Leadership*, to accelerate the development of technologies that will sustain the businesses of the future and collaborate with the innovation of medium and small enterprises (MSE). The estimated budget for this pillar was € 17.02 million, which represents 22.1% of H2020 total resources.
- 3) *Societal Challenges* addresses the main concerns shared by citizens in Europe and elsewhere. The estimated budget for this pillar was € 29.68 million, which represents 38.5% of H2020 resources. This is the pillar with most estimated budgets, which suggests the relevance of support R&I to solve the demands of society.

In addition, there are two specific objectives, 'Spreading Excellence and Widening Participation' and 'Science with and for Society', which includes the recruitment of new talents for science, and also resources to the European Institute of Innovation and Technology and Non-nuclear direct actions. Together, the estimated budget for these areas were € 5.89 million, or 7.7% of total H2020.

3 SCs: WHAT ARE THE PRIORITIES?

The SCs, third pillar of H2020, are organized through seven challenges (European Commission, [s.d.]):

- 3.1) Health, demographic change and wellbeing.
- 3.2) Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bioeconomy.
- 3.3) Secure, clean and efficient energy.
- 3.4) Smart, green and integrated transport.
- 3.5) Climate action, environment, resource efficiency and raw materials.
- 3.6) Europe in a changing world - inclusive, innovative and reflective societies.
- 3.7) Secure societies - protecting freedom and security of Europe and its citizens.

Each SC is divided into programs and, in some cases, sub-programs. Each program is also detailed through “calls” and “topics” (working programs launched every two years).

The database version used in this study includes 20,514 projects started between July 2014 and November 2018. Among them, 4,840 were part of SC, and represented an EU max contribution of € 12.8 billion. Even after almost five years of the seven-year program (2014-2018), this amount represents only 43% of the initial allocation predicted to SC (€ 29.7 billion) (table 1).

Each project is linked to one call and one topic, but it may be part of more than one program and, in some cases, more than one pillar. An expressive number of SC projects (2,278, or 47%) are also part of pillar 2 – Industrial Leadership – which means that they, at the same time, aim to meet the demands of society and promote industrial leadership. Although significant in quantity, projects that include both pillars 2 and 3 account for only 9.7% of the total SC project values (€ 1.2 of € 12.8 billion).⁵

Table 1 compares the initial funding proposed for each SC with the amounts approved so far (EU Contribution). In value, the projects approved follow approximately the initial proposal per challenge. Health, demographic change and well-being (3.1) is the challenge with the highest absolute value (EU Contribution), followed by energy (3.3) and transport (3.4). In average values, health projects also received proportionately more resources, while in a number of projects transportation is the most expressive. The challenge of inclusive innovation (3.6) is the least expressive in value (absolute and average) and in number of projects. 205 projects did not specify the challenges. In addition, a limited group of projects (30) presents more than one SC, e.g. 3.5 and 3.3, and was treated separately.

TABLE 1
SCs – proposed and effective allocation

	Initial allocation to 2014-2020	Projects (2014-2018)					
		EU contribution		Number of projects	Average value		
		€ million (2013)	%		€ million (current)	%	%
SCs (total)	29,679	100.0	12,784	100.0	4,840	100.0	2.76
SC ¹			227	1.8	205	4.2	1.11
3.1 Health, demographic change and wellbeing;	7,472	25.2	2,735	21.4	786	16.2	3.48
3.2 Food security, sustainable agriculture and forestry, marine maritime and inland water research and the bioeconomy;	3,851	13.0	1,670	13.1	632	13.1	2.64
3.3 Secure, clean and efficient energy	5,931	20.0	2,684	21.0	974	20.1	2.76
3.4 Smart, green and integrated transport	6,339	21.4	2,564	20.1	1,137	23.5	2.26
3.5 Climate action, environment resource efficiency and raw materials	3,081	10.4	1,361	10.6	505	10.4	2.70
3.6 Europe in a changing world - Inclusive innovative and reflective societies	1,309	4.4	494	3.9	284	5.9	1.74
3.7 Secure societies – Protecting freedom and security of Europe and its citizens	1,695	5.7	792	6.2	287	5.9	2.76
Mixed (more than one SC)	-	-	256	2.0	30	0.6	8.55

Sources: Factsheet: Horizon 2020 budget; EU Open Data. Available at: <<https://bit.ly/2qpsvyA>>.

Authors' elaboration.

Note: ¹ Challenges not specified.

Obs.: Projects can also be part of pillar 2.

5. Table 2 does not present these projects separately, but they are included inside the SC.

What are the priorities within each challenge? Below, we detail four selected SC programs: health, energy, transport and climate action (table 2).

TABLE 2
Health, energy, transport and climate programs

	Programs	EU contribution		Number of projects		Average value
		€ 1,000	%		%	€ 1,000
H2020-EU.3.1 Total	Health, demographic change and well-being	2,734,929	100.0	786	100.0	3,480
H2020-EU.3.1	Health, demographic change and well-being	942,122	34.4	376	47.8	2,506
H2020-EU.3.1.1	Understanding health, wellbeing and disease	278,454	10.2	37	4.7	7,526
H2020-EU.3.1.3	Treating and managing disease	536,015	19.6	156	19.8	3,436
H2020-EU.3.1.7	Innovative Medicines Initiative 2 (IMI2) (including antimicrobial resistance, diabetes, psychiatric diseases, immune-mediated diseases, vaccine and others)	329,123	12.0	31	3.9	10,617
-	Others	649,214	23.7	186	23.7	3,490
H2020-EU.3.3 Total	Secure, clean and efficient energy	2,684,500	100.0	974	100.0	2,756
H2020-EU.3.3	Secure, clean and efficient energy	283,678	10.6	464	47.6	611
H2020-EU.3.3.1	Reducing energy consumption and carbon footprint by smart and sustainable use	445,741	16.6	76	7.8	5,865
including, H2020-EU.3.3.1.3	Foster European Smart cities and Communities	176,159	6.6	9	0.9	19,573
H2020-EU.3.3.2	Low-cost, low-carbon energy supply (wind energy, solar energy, CO2 capture and re-use, renewable energies)	790,151	29.4	109	11.2	7,249
H2020-EU.3.3.4	A single, smart European electricity grid	389,830	14.5	49	5.0	7,956
-	Others	775,099	28.9	276	28.3	2,808
H2020-EU.3.4 Total	Smart, Green and Integrated Transport	2,564,283	100.0	1,137	100.0	2,255
H2020-EU.3.4	Smart, Green and Integrated Transport	1,688,223	65.8	721	63.4	2,342
H2020-EU.3.4.5	CLEANSKY2 (aircraft, less CO2)	376,715	14.7	266	23.4	1,416
H2020-EU.3.4.6	FCH2 (transport objectives) (fuel cell and hydrogen 2)	149,303	5.8	19	1.7	7,858
H2020-EU.3.4.7	SESAR JU / SESAR Joint Undertaking (air traffic)	175,055	6.8	76	6.7	2,303
H2020-EU.3.4.8	Shift2Rail JU (trains and railway)	148,040	5.8	44	3.9	3,365
-	Others	26,947	1.1	11	1.0	2,450
H2020-EU.3.5 Total	Climate action, Environment, Resource Efficiency and Raw Materials	1,361,404	100.0	505	100.0	2,696
H2020-EU.3.5	Climate action, Environment, Resource Efficiency and Raw Materials	110,093	8.1	290	57.4	380
H2020-EU.3.5.1	Fighting and adapting to climate change	198,016	14.5	34	6.7	5,824
H2020-EU.3.5.3	Ensuring the sustainable supply of non-energy and non-agricultural raw materials (including finding alternatives for raw materials and societal awareness)	268,720	19.7	48	9.5	5,598
H2020-EU.3.5.4	Enabling the transition towards a green economy and society through eco-innovation	400,466	29.4	77	15.2	5,201
-	Others	384,108	28.2	56	11.1	6,859

Source: EU Open Data. Available at: <<https://bit.ly/3471rCA>>. Authors' elaboration.

Most project of *Health programs*, in number (47.8%) and value (34.4%), are not part of a specific program, but of the general challenge (3.1). Among the programs, “Treating and managing disease” (3.1.3) is the most expressive in number (19.8%) and value (19.6%). Innovative Medicines Initiative (IMI), which aims to boost pharmaceutical innovation in Europe and focuses on specific diseases and treatments, has the highest average value (€ 10,617).

Energy Programs emphasizes the importance of alternative sources of energy, aiming to promote a positive environmental impact while encouraging the increase of energy supply. The general program (3.3) represents almost half of the projects (47.6%), but only 10.6% of their values. The “low cost, low-carbon energy supply”, which includes wind, solar and renewable energies, absorbs almost one third of the value, followed by the reduction of energy consumption and carbon footprint and then the electricity grid. Bio-energy, hydrogen and fuel cells are also present, but they are not so relevant in terms of number and value of projects.

Transport Programs aims to boost the competitiveness of the European transport industries and achieve a European transport system that is resource-efficient, environment-friendly and safe. Some programs address general challenges, aiming to promote positive environmental impact, increased mobility and safety, while others focus on specific means of transport, such as aircraft and trains. The environmental issue is explicitly present in several objectives. Most projects (63.4%) were also in the general challenge (3.4), and a significant part of the programs is public-private partnership, especially CLEAN SKY, which supports the development of aircrafts with less CO₂ emissions.

Specific objectives of *Climate Action Programs*, presented provide evidence that, in monetary value, eco-innovation is the main program, focusing on the reduction of production and consumption of raw materials. Also relevant is the program that aims to promote the sustainable supply, use and search for alternative raw materials. Fighting and adapting to climate change, which includes risk prevention and mitigation policies, follows the others. Together, these three programs represent 63.7% of the project values of Climate Challenges.

4 FINAL COMMENTS

Defining SCs is not an easy task. Institutions, policymakers and researchers constantly seek to better define the priorities that public funds should support. In this sense, the next R&I program, Horizon Europe (2012-2027) (European Commission, 2019) propose some changes in comparison to H2020, making the intersection between SCs and industrial competitiveness clearer. Both of them will be part of the same pillar, the “Global Challenges and Industrial Competitiveness” – GCIC (European Commission, 2018). It includes Health; Inclusive and Secure Society; Climate, Energy and Mobility; Food and Natural Resources; and Digital and Industry. Except for the latter, all the others were present in the SC of H2020, although some of them will be joined in the same challenge (i.e., climate, energy and mobility were 3 different challenges at H2020).

An important objective of Horizon Europe is to “create more impact through mission-oriented and citizens’ involvement”. This discussion regarding the selection and development of missions has been supported by the expertise of Mariana Mazzucato and the RISE group:⁶ “a mission should have societal relevance, for example in the ability to improve health, nutrition, or the living environment for a large section of European citizens across a range of Member States. Research and innovation missions should aim to improve society’s welfare” (Mazzucato, 2018, p. 8).

The peculiarity of mission-oriented policies is their focus on societal benefit. We cannot therefore state that one mission is ‘better’ than another (...). We can instead state that a mission is ‘more meaningful’ than another. (...) It is a judgment of values that cannot be measured technically but only gauged through engagement (Georghiou et al., 2018, p. 9).

6. RISE is the Research, Innovation and Science Expert high-level group advising the European Commissioner for Research, Science and Innovation.

These discussions remind us of the importance of thinking about technological investments that really aim to produce social benefits and to improve citizens' lives. Bottom-up processes, which involve society in the definition of the issues to be solved, are a fundamental part of the process. Support for innovations with socio-environmental impact, even if it does not generate profits in the short term, is also key. And, essentially, the selection of societal needs – what are they and who benefits from them – is the first step to investing public resources in technologies that can really impact in the lives of citizens.

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