
Counteracting the COVID-19 Crisis with Innovation Policy Tools: A Case Study of the EU's Supranational Innovation Policy

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Abstract:

Purpose: In June 2018, the European Union (“EU”) decided to use missions as tools of innovation policy in accordance with the market-shaping, mission-oriented innovation policy approach. It stemmed from the EU’s efforts to improve the efficiency of innovation policy when it comes to handling major social challenges. In the first quarter of 2020, the EU had to unexpectedly face another social challenge, the COVID-19 pandemic, and the economic and social crisis that followed. This article analyses the actions undertaken by the EU at the supranational level within its innovation policy in relation to the COVID-19 crisis. It also aims to assess the coherence of the EU’s interventions with the mission-oriented innovation policy approach implemented and promoted by the EU.

Design/Methodology/Approach: The research is descriptive and analytical in nature. First, it covers a case study of the EU’s supranational innovation policy. Second, it searches, on a theoretical level, for the reasons of discrepancies between the market-shaping and mission-oriented policy approach promoted by the EU and the interventions that the EU in fact conducts in relation to the COVID-19 crisis.

Findings: The results of the research point to certain incoherence in the EU’s innovation policy when tackling major policy platforms. On one hand, the EU implements and promotes a mission-oriented policy as a more efficient way of solving major social challenges. On the other hand, its actions (and plans) hardly consider the application of an innovation policy mission as a means for fighting the most recent and crucial challenge, namely the COVID-19 crisis.

Originality/Value: This is the first study to point out the incoherence that currently characterise the EU’s innovation policy on the supranational level.

Keywords: Innovation policy, mission-oriented policy, policy intervention, European Union, COVID-19 crisis.

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1. Introduction

There are just a few areas of a state's policy that have gained as much importance over the last two decades as innovation policy. Innovation policy covers a range of different policies (and policy instruments) that have been introduced at various points in time, with different motivations, and using a variety of labels; much of what is called innovation policy today may previously have gone under labels such as industrial policy, science policy, research policy, or technology policy (Edler and Fagerberg, 2017). Consequently, innovation policy may be defined broadly as all policies that have an impact on innovation, or more narrowly as policies (or policy instruments) created with the intent to affect innovation (Edquist, 2004; Fagerberg, 2017). For the purpose of this article the latter definition is used, as the research covers only intentional state interventions.

The growth of innovation policy has triggered changes as regards the rationale for state interventions (Chaminade and Edquist, 2010; Mazzucato *et al.*, 2020; Schot and Steinmueller, 2018). For example, the traditional *market failure* and *system failure* justifications for innovation policy intervention have been complemented with a more active *market creating* framework (Mazzucato, 2015). The European Union's innovation policy adjusts to those changes, as the EU tries to keep up and follow the most recent research results in this area. A great example of the EU's dedication to following the research is the attempt to implement missions as tools of innovation policy in accordance with the mission-oriented innovation policy approach (Mazzucato, 2018b; 2019).

Mission-oriented policies are defined as systemic public policies that draw on frontier knowledge to attain specific goals (Mazzucato, 2018b). "Missions provide a solution, an opportunity, and an approach to address the numerous challenges that people face in their daily lives. Whether that be to have clean air to breathe in congested cities, to live a healthy and independent life at all ages, to have access to digital technologies that improve public services, or to have better and cheaper treatment of diseases like cancer" (Mazzucato, 2018b).

The implementation of the mission-oriented innovation policy aims at improving the efficiency of tackling the social challenges that are put in front of European leaders (Weber and Rohrer, 2012). Such problems have been held for years on issues such as climate change, environmental pollution, lifestyle diseases, poverty and growing social inequalities. In the first quarter of 2020, the list of major social challenges was joined by the rapidly expanding coronavirus SARS-CoV-2 (hereinafter "coronavirus") and, later on, the social crisis triggered by the COVID-19 pandemic. In this case, the state's intervention using the tools of innovation policy was rather natural as the necessity to stop the spread of coronavirus demanded the use of a number of innovative solutions in the healthcare sector. For example, combating the crisis required the development of vaccines, medications, and distributing efficient personal protection equipment as well as creating solutions for

remote working and learning, etc. Therefore, many interventions planned within innovation policy were *ad hoc* adjusted to the new circumstances and directed towards combating with the pandemic and its consequences.

Various problems tied with the COVID-19 crisis allow the EU to create new missions of innovation policy. This potential response of the EU to the coronavirus crisis seems reasonable, especially since the implementation of the mission-oriented innovation policy by the EU is officially aiming at the already discussed goal of increasing the effectiveness of EU's interventions based on innovation policy to target major social challenges.

This article analyses the actions undertaken by the EU with its innovation policy in relation to the COVID-19 crisis. It also aims to assess their adherence to the mission-oriented innovation policy approach simultaneously implemented and promoted by the EU. Bearing in mind the fact that this research points to incoherence in the EU's actions, the article also tries to determine the theoretical cause for such inconsistencies.

The article first reviews the source literature, which builds the theoretical foundation used to determine whether to launch an intervention using innovation policy tools. Particular attention is devoted to transformative innovation policy and the implementation of the EU's mission-oriented innovation policy approach. Next, the methodology and analysed data are presented. The subsequent part of the paper: (1) presents the EU's actions with innovation policy that aim at counteracting the pandemic and, more broadly, the COVID-19 crisis, (2) assesses the possibility of using the concept of mission-oriented innovation policy to combat the pandemic and the related crisis, and (3) analyses the causes for the very limited use of the mission, even though it is potentially the most efficient tool when it comes to handling the COVID-19 crisis. Finally, part 5 reaches general conclusions.

2. Literature Review

2.1 The Changing Rationale for Innovation Policy Intervention

Until nearly half of the 2020s, the justification for an intervention using innovation policy was based on two premises: *market failure* and *system failure*. *Market failure* may happen where there are limited possibilities to protect intellectual property, uncertainty regarding the success of an innovation project, limited options of dividing the innovation process or asymmetry of innovation. *System failure* is tied to the insufficient capabilities of the innovation agents (e.g., enterprises, research institutes, etc.) related to innovation systems, venture capital funding accessibility, subpar cooperation skills or unreliability of institutions such as patent law, norms and regulations (de Jong *et al.*, 2015; Kowalski, 2020). Each premise (*market failure* and *system failure*) stems from a different attitude regarding the state's intervention using innovation policy. The first one is rooted in neoclassical economics and its

way of perceiving innovation processes, while the other refers to evolutionary economy and invokes the theory of innovation systems (Bach and Matt 2005; Chaminade and Edquist, 2010; Diercks *et al.*, 2019; Lipsey and Carlaw, 1998; Schot and Steinmueller, 2018; Smith, 2000).

The trend originating in neoclassical economics is characterised by narrowing down the innovation process to research and the inventions that follow, perceiving them as linear. In other words, that new inventions are seen as a sequence of successive stages, where the stage of conducting research is nearly automatically transformed into the phase of manufacturing new products, with little regard to using the results for creating products that could be successfully launched onto the market (Rosenberg, 1982; 1994).

Market failure as a premise for innovation policy intervention as seen by the neoclassicists is a strictly theoretical concept, not particularly useful from the practical point of view. Chaminade and Edquist point out that “the policy implications that emerge from market failure theory (...) are too blunt to provide much guidance. They do not indicate how large the subsidies or other interventions should be (as it is not possible do determine the optimum level of investment in R&D or innovation activities) or within which specific area one should intervene” (Chaminade and Edquist, 2010). Moreover, interventions that are to counteract (limit or eliminate) certain activity on the market may actually disrupt the market in other areas and, consequently, lead to its further failures (Bach and Matt, 2005; Chaminade and Edquist, 2010).

The representatives of the second attitude for state intervention using innovation policy stem from evolutionary economics and refer to the theory of innovation systems (IS), completely abandoning the linear view of innovation processes (Borrás and Edquist, 2019; Edquist 1997; Freeman 1987; Lundvall 1992; Nelson 1993). In the system-based approach, innovations are a result of complex and non-linear processes within which businesses interact in various ways with different types of organisations (e.g., financial bodies, state authorities, research facilities, and consumers) as well as institutions (e.g., legal regulations and cultural norms, etc.). In the course of the above processes, those mutual interactions and the mechanisms that facilitate the flow of feedback are highly important (Edquist, 1997; Freeman, 1988; Klein *et al.*, 2005; Lundvall, 1992; Nelson, 1993). The concepts arising from this attitude completely cut themselves off from the neoclassicist theories of the sustainable market and the need for state interventions only in the case of failures.

The system-based approach conditions the state intervention on the occurrence of problems related to system functioning (referred to as *system problems* or *system failures*), but the analysis of whether the system functions properly is directed on the processes therein (results of actions) and not its individual elements (Edquist 2011). Importantly, optimal operations are not considered as part of an assessment of innovation system functioning (or a part of it). The idea of optimality completely

loses its value here. The current rooted in neoclassicist economics describes *market failure* by comparing the actual state of the market with its optimal configuration. In turn, evolutionary economics and the SI theory assumes that the system never reaches its optimal functioning. It is, therefore, impossible to determine how this optimal system works or is structured and, consequently, cannot be compared with the current state of the system (Chaminade and Edquist, 2010).

A possible state intervention is rather a reaction to a system problem revealed while juxtaposing a given system with other existing systems. Such comparisons may in this respect be carried out from the viewpoint of various concepts of innovation systems, in particular: National Innovation Systems (Freeman, 1995; Lundvall, 2016; 1992; Nelson, 1993), Regional Innovation Systems (Cooke *et al.*, 1997), Open Regional Innovation Systems (Belussi *et al.*, 2010), Sectoral Innovation Systems (Breschi and Malerba, 1997), Technological Innovation System (Bergek *et al.*, 2008; Carlsson and Stankiewicz, 1991; Carlsson *et al.*, 2002; Hekkert *et al.*, 2007), Organizational Innovation Systems (Van Lancker *et al.*, 2016).

The third attitude for perceiving state intervention refers to transformative innovation policy and favours the idea in which science and innovation can, and should, contribute to overcoming social challenges, including the ones related to completing the Sustainable Development Goals (Edler *et al.*, 2016; Fagerberg, 2018). In other words, it calls for a transformative change that refers to a socio-technical system change as conceptualised in the sustainability transitions literature (Schot and Steinmueller, 2018). Weber and Rohracher (2012) argue that the *market failure* and *system failure* that underpin innovation policies should be complemented by policies aimed at transformation and propose four types of new failures as a rationale for policy intervention. The four failures described are *directionality failure*, *policy coordination failure*, *demand-articulation failure*, and *reflexivity failure*. The concept outlined by Weber and Rohracher was further expanded by Schot and Steinmueller (2018), but the premise for intervention within transformative innovation policy included therein should be treated as one out of many possible solutions.

On the opposite extreme of the Schot and Steinmueller idea lies the notion of intervention posed by Mazzucato, which, importantly for the viewpoint of this article, inspired the changes in the rules of conducting innovation policy in the European Union (Mazzucato 2016; 2018b). Mazzucato draws attention to the need of public organisations being “responsible for actively shaping and creating markets and systems, not just fixing them, and for creating wealth, not just redistributing it” (Mazzucato, 2018a). While correcting the improper operation of a market or system (just as other failures, such as those listed by Schot and Steinmueller) may lead to optimising the current situation, creating new markets or industries is tied with transformative change mentioned earlier (Robinson and Mazzucato, 2019). In the light of the discussed concept, the basic duty of state authorities lies in: (1) determining the course for the innovation-related development of the country in a

manner that allows for both satisfying the needs of the country itself (in the area of, e.g., defence, security, etc.) and its citizens (in the area of, e.g., healthcare, education, etc.), as well as (2) taking risks and assisting in the creation of new markets in social demand (Edler, 2016; Mazzucato, 2015). Mazzucato ties the challenge of leading a state intervention, which aims at shaping new markets, with the mission-oriented policy approach, as will be discussed further in the article.

The transformative innovation policy largely breaks the rules of policies that have been in force to date and is seen as an emerging new paradigm. Nevertheless, it needs to be highlighted that this emerging policy paradigm should be seen “as layered upon but not fully replacing earlier paradigms” (Diercks *et al.*, 2019). On one hand, it is crucial to notice that researchers expanding the idea of transformative innovation policy do not separate themselves from the contemporary legacy of SI theory; they instead use it as an inspiration in developing mission-oriented innovation systems (Hekkert *et al.*, 2020) or problem-oriented innovation systems (Ghazinoory *et al.*, 2020). On the other hand, the main advocates of the SI theory have been pointing for a long time to the broad (theoretical) spectrum of potential goals for innovation policy. For instance, Borrás and Edquist (2013; 2019) suggest that the end goals of this policy may be not only of an economic nature (economic growth, employment, competitiveness, etc.) as they may also relate to environmental protection, healthcare, defence, security and social objectives.

2.2 Market-Shaping, Mission-Oriented Innovation Policy Approach

Establishing a new direction for the development of the EU’s innovation policy, as well as the related need to change the organisation and functioning of the innovation systems of member states comes from the fact that EU leaders follow the research on the role of a state in the economy. As shown above, Mazzucato drew the attention of the state’s role in actively shaping and creating markets and systems; the researcher also pointed to the underappreciated role of the state in financing breakthrough innovations (Mazzucato, 2013). It is important to remember that even such successful companies as Apple or Tesla reached for public support. As Mazzucato highlights, it is crucial for the capital that is to finance innovations be patient and willing to accept the fact that innovations are very unstable and time consuming.

Up to this point, private equity/venture capital (“PE/VC”) were seen by companies as the most desirable source of funding for their high-risk innovation-related activity. Mazzucato reveals the weaknesses of such funding when there is a need for long-term engagement and flexible adjustments to changing conditions because of, e.g., market instability. In such cases, funding from public sources is better than PE/VC or commercial banking as it is “patient” and engaged in developing innovations, giving the companies a chance to overcome the significant instability of innovation processes (Mazzucato, 2013; Mazzucato and Penna, 2014).

According to Mazzucato, a transformative change is a process which demands a translation of the identified social challenges into solvable problems by determining and executing specific missions. In this way, it thereby expands the idea of mission-oriented innovation policy. This idea in relation to public policy, particularly in regards to space exploration, is not a new approach (Chiang, 1990; Ergas, 1986). Nevertheless, EU's innovation policy on the supranational level has not been conducted in this manner before. Even though it might seem that directing the innovation policy towards achieving specific missions merely means that it receives new and precisely formulated goals, the idea behind Mazzucato's solution – as already mentioned, involves a radical change in conducting this policy. Specifically, it regards modifications in when, why and how interventions using the tools of innovation policy should be applied. Most importantly, Mazzucato recommends that states should not focus on fixing markets and/or systems, but create and shape markets by directing the policy on completing specific missions (Mazzucato, 2015; 2018a; 2018b).

Research on various aspects of mission-oriented innovation policy have been conducted by numerous researchers for several years (Amanatidou *et al.*, 2014; Edquist and Zabala-Iturriagoitia, 2012; Foray 2018; Morgan and Marques, 2019; Wittmann *et al.*, 2020), yet it should be mentioned that directing the innovation policy towards a mission is not identical to implementing the rules of state interventions as suggested by Mazzucato. Therefore, this researcher's concept of innovation policy that the EU has decided to implement shall be referred to as the market-shaping, mission-oriented policy approach.

From the perspective of Robinson and Mazzucato's proposal (2019), social challenges may be reflected in specific actions via the "intermediary stage" of a mission-oriented innovation policy that is to create, shape and direct the development of the market. Namely, the changes that would not happen if the interventions within said policy would aim at only correcting the malfunctions of markets and/or systems. Therefore, the intervention of a state should mainly consist in not only preventing inconsistencies (correcting malfunctions) but rather, on taking the initiative and shaping markets. Any remedial measures might concern the adjustments in the course of market development (if the direction does not facilitate the completion of a mission). Innovation policy conducted in this manner becomes part of the cross-sector and needs to be coordinated (to a great extent) with the state's policies in other areas.

3. Methodology

This article is a case study that aims at describing and analysing the interventions undertaken by the EU using the tools of innovation policy in order to counteract the COVID-19 crisis. This case study is of special character as it regards EU's policy on the supranational level, which, because of the uniqueness of such a solution, introduces limitations in the possibilities of comparative analysis while also making

the analysis results applicable only to a limited extent to the policies conducted by specific member states on the national level. Assuming a more detailed perspective, this research attempts to confront the EU's promoted and gradually implemented concept of state interventions using market-shaping and mission-oriented innovation policy tools with the interventions actually carried out within the innovation policy that are to counteract the COVID-19 crisis.

The research was composed of two stages. The first stage was designed to answer the question of whether the innovation policy interventions conducted and planned by the EU to combat the COVID-19 crisis fall in line with the idea of a market-shaping, mission-oriented innovation policy (that the EU has officially declared to implement in order to improve the efficiency of handling grand social challenges)?

The logic of the research process is subjected to the above research question. First, the new manner of interventions using innovation policy tools as implemented by the EU was analysed from a theoretical standpoint. Next, I analysed the conducted and planned interventions, gathered from official EU reports, documents, and press releases (including unprocessed data provided by the EU for the needs of the OECD survey). I then sought to determine whether (and to what extent) the EU applied the most efficient innovation policy tools (missions) to combat the COVID-19 crisis.

Due to the fact that the abovementioned analysis showed considerable discrepancies between the market-shaping and mission-oriented policy approach promoted by the EU and the interventions that the EU in fact conducts, or plans to carry out, in relation to the COVID-19 crisis, the second stage of this research searches for the reasons of such discrepancies. The author seeks the answers to the above questions on a theoretical level, referring to the (1) new theory of crisisification of policy-making in the UE (Rhinard, 2019) and (2) the crisis management framework determining the conditions of success or failure in public policies (McConnell, 2011). The timeframe for the research encompasses a period from 1 March 2020 to 28 February 2021.

4. Research Results and Discussion

4.1 Interventions Carried Out By the EU within the Innovation Policy to Counteract the COVID-19 Crisis

The coronavirus pandemic affected all EU member states. Because of the methods of reducing the spread of the virus, especially restrictions in the free movement of people and measures related to isolation and/or social distancing, it disrupted the way of life for virtually every EU citizen and became the source of a serious social and economic crisis.

Even though the character and intensity of the COVID-19 crisis differs among particular member states, its universal presence, uniqueness of generated problems

and grave socioeconomic consequences led to a belief that counteractive measures must be applied, not only by individual member states, but also at the supranational level. The joint EU response to the crisis was also necessary due to the fact that COVID-19 does not respect borders. Therefore, a new challenge for the supranational innovation policy of the EU was born.

Although at the initial phase of the pandemic the borders were temporarily closed and countries tried to reduce the spread of the coronavirus on a strictly national level, the innovation policy became the area in which the above-national reaction of the EU developed relatively quickly. It could even be stated that the pandemic revealed EU's weakness as a community in many areas, but it proved that, when it comes to innovation policy, the EU is both ready to act and flexible in changing as compared to previously planned interventions.

The initiatives undertaken within innovation policy on the level of the European Community as a response to the COVID-19 crisis mainly consisted of direct support for research and innovation. The activities undertaken by the European Commission ("EC") focused on: (1) supporting new research and innovation; (2) speeding up research by optimising framework conditions; (3) translating research findings into public health policy for pandemic response; (4) cooperation with the member states and (internal and external) coordination of the undertaken activities; (5) analysis of social and economic impact of research and innovation; and (6) supporting communication, especially between researchers, innovators and healthcare providers.

When it comes to research and innovation, an important role is played by the EU Framework Programme for research and innovation, Horizon 2020, which officially ended in the year 2020, but some of its projects will run for a few more years. Within this programme, the so-called "crisis financing" was released, which encompassed important research and innovation in broadly understood healthcare areas that were tied with the COVID-19 pandemic, such as: (1) developing diagnostics, treatment and vaccines; (2) shifting production to ensure quick manufacturing of essential medical equipment and devices; (3) improving medical technologies and digital tools to upgrade infection detection as well as patients' monitoring and care; (4) better understanding of behavioural and socioeconomic results of the pandemic, for example, in regards to mental health, to develop guidelines for bodies shaping healthcare policies, along with improving the overall readiness with regard to future events of this kind; (5) analysing large cohorts of patients by comparing the cohorts existing within the EU and beyond to assess their exposure to some risk factors and deepen the understanding of possible causes for the disease as well as improve the reactions to the virus and any future threats to public health (EC, 2000g; 2000h; 2000i).

As for financing specific projects/initiatives, the Horizon 2020 funds supported the initiative regarding innovative medicine in a public-private partnership between the

EU and the pharmaceutical sector. The investments planned within this initiative reach a total of 117 mln Euros, with 72 mln coming from the abovementioned framework programme (OECD, 2020). Also, it is noteworthy that Horizon 2020 finances the pilot programme of the European Innovation Council known as the Accelerator. It aims at supporting bottom-up innovative actions and is addressed at start-ups as well as small and medium-sized companies. The interest in the Accelerator programme is record-breaking. As of March 2020, nearly 4 thousand entities applied for grants. Because of this huge demand, the initial amount was increased (by 150 mln Euros) and the total value of funds for the projects supported within this programme reached 314 mln Euros (OECD, 2020).

Apart from financing new projects that are to counteract the COVID-19 crisis, Horizon's actions within projects already in progress were also reoriented. The Digital Innovation Hubs in Healthcare Robotics ("DIH-HERO") project, an independent platform joining digital innovation centres in Europe, is a great example. Its goal is to create a stable network of cooperation among organisations working in robotics within the healthcare sector. In the case of fighting the COVID-19 pandemic, a decision was made to transfer 5 mln Euros to actions aiming at streamlining robotics-related solutions that may be swiftly implemented in healthcare (OECD, 2020). Furthermore, the Horizon 2020 funds were used to support (optimise) various system solutions, especially the ones related to research infrastructure and enabling or facilitating the exchange of research data. The funding under Horizon 2020 is part of the Commission's 1.4 billion Euros pledge to the Coronavirus Global Response initiative, launched by President Ursula von der Leyen in May 2020 (EC, 2000e).

Funds for counteracting the COVID-19 crisis were released from other sources as well; for instance, the EC's Directorate-General for Research and Innovation in cooperation with the European Investment Bank reviewed the priorities and allocated funds from the InnovFin programme so that approx. 400 mln Euros could be redirected to actions related to fighting the pandemic challenge through financing diagnostics, vaccination and treatment options. Also, nearly 6 mln Euros were granted by the European Institute of Innovation and Technology to health innovation projects across Europe (OECD, 2000).

Parallel to working on the immediate response to the coronavirus pandemic, programmes that will be launched in the years 2021–2027 are also being developed. The new financial perspective that started in the beginning of 2021 involved establishing a new healthcare programme, EU4Health, to which 9.4 bln Euros would be granted. The goals of this programme are mainly oriented towards improving the wellbeing of EU citizens, strengthening healthcare systems and promoting innovation in the health sector. EU4Health is meant to fill the gaps disclosed by the pandemic in the healthcare systems of the member states so those systems are fit to face any future threats. Importantly, the EU4Health programme is designed with the assumption of a close cooperation with the new framework programme, Horizon

Europe. It is to finance research and innovation in areas such as life-long attention to health; social and environmental conditions for health; non-transmittable and rare diseases; transmittable diseases; digital tools, technologies and solutions for health and healthcare systems.

Moreover, funds from the new financial perspective will also support innovative actions related to the COVID-19 pandemic within other programmes such as the European Social Fund Plus which supports access to healthcare for vulnerable groups, the European Regional Development Fund which improves the regional healthcare infrastructure, the rescEU programme which establishes emergency reserves of medical supplies, and the Digital Europe programme which develops digital infrastructure essential for using digital healthcare tools.

4.2 The Implementation of Market-Shaping and Mission-Oriented Innovation Policy Versus the COVID-19 Crisis

While executing the Horizon 2020 (2014-2020) framework programme, the EU established the goals of research and innovation related to grand social challenges. As the interim assessment of this programme pointed to an insufficient effect that the EU's public investments into research and innovation have on the completion of the goal and since there is a constant need to include the society in the undertaken actions at a broader extent, a revision of the adopted manners of acting and a determination of the possible changes in this area became essential. The concept of market-shaping, mission-oriented innovation policy seemed to be a perfect response to the problems pointed out during the assessment (Mazzucato, 2015; 2016). The guidelines for directing the EU's research and innovation activities towards completing specific missions were included in, among others, a report prepared for the EC in July 2017 by the independent High Level Group on maximising the impact of EU research and innovation programmes (EC, 2017a).

As requested by the EU, Mazzucato prepared a report (Mazzucato, 2018b) in February 2018 where she presented the conditions for implementing the mission-oriented innovation policy in the EU, including, among others, criteria for creating and selecting missions. The decision to implement this concept of innovation policy in order to improve the efficiency in facing social challenges was officially announced by Carlos Moedas, Commissioner for research, science and innovation, in June 2018. It was assumed that the EU would undertake missions within the Horizon Europe programme.

The next step was to develop the initial plan of executing five missions. The premise was that the goal is to provide solutions to such social problems as cancer, climate change, clean oceans, climate-neutral cities as well as healthy soil and food. The official onset of the work on shaping the missions in those areas took place in July 2019. The proposals of five missions with feasible solutions were announced in June 2020 (for further social consultations) (EC, 2020a; 2020b; 2020c; 2020d; 2020j), and

in September 2020 high-level independent experts (Missions Boards) presented their proposals for possible EU missions to the European Commission. At present, there is a preparatory phase of missions creation. The phase began in November 2020, and – according to the plan – it will last maximum of 12 months.

As presented above, the chronology of the fundamental stages of implementing the mission-oriented innovation policy within the new framework programme Horizon Europe overlaps with the works on the planned interventions that are to counteract the COVID-19 pandemic. Nevertheless, from the viewpoint of programming intervention instruments, the above processes are carried out almost independently. Although the missions are supposed to be tools that boost the efficiency of solving problems related to major social challenges, the EU has not yet decided to create a mission that would directly aim at facing the problems related to the COVID-19 crisis. There are only plans that some of the missions may respond to the COVID-19 crisis if the crisis had an impact on the problems assigned to the given mission area. For instance, as the COVID-19 crisis endangers food security due to breakdown of the international food chain, the mission in the area of soil health and food may, *inter alia*, explore the role of major European soils on global food security, considering climate change scenarios (EC, 2020c). Similarly, the Mission Board for climate-neutral and smart cities points out that ‘to make the most of the new EU Recovery Fund, investments should have both a multiplying effect on the economy and a transformative effect towards climate sustainability. Such an investment strategy can build on the Mission for climate neutral cities’ (EC, 2020a). However, the general response of the planned missions to the COVID-19 crisis should be regarded as limited.

It is a good moment to ask a basic question, should the COVID-19 crisis be viewed as one of the major social challenges, the handling of which is to be supported by interventions using the innovation policy? Generally, treating the mission-oriented innovation policy as an anti-crisis tool may be undermined (as not all the crisis-related problems need to be solved by innovation-focused missions), but in the case of this particular crisis it may actually be a justified approach. The unique nature of the discussed crisis lies in (1) the demand for innovative products and services, such as vaccines, medications, digital solutions supporting remote learning, and monitoring outbreaks of infections, as well as in (2) the wide social upheaval the pandemic has had on the EU, since it is difficult to recall another crisis that would have such a significant impact on the daily life of virtually every EU citizen.

As the answer is affirmative, another issue needs to be settled, namely, is it possible, and justifiable, to create a mission satisfying EU’s criteria as a response to the social challenge of the COVID-19 crisis? As it has already been mentioned, the criteria that should be met by each mission have been established in Mazzucato’s report prepared for the EC. According to the report’s recommendations, the missions should: (1) regard substantial and inspiring problems of significant social importance; (2) have a clearly established goal, measurable results and determined temporal framework; (3)

encompass ambitious yet achievable research and development activities; (4) be of an interdisciplinary and cross-sectoral nature and assume that the execution of innovative processes is a joint effort of several actors; and (5) promote multifaceted, bottom-up solutions (Mazzucato, 2018b).

Analysing the COVID-19 pandemic and crisis from the perspective of the above criteria confirms both the possibility and sensibility of creating missions oriented approach towards solving the specific problems related to this challenge. Furthermore, when it comes to healthcare and the approach of counteracting COVID-19 as a disease, the answer to the above question is also positive, especially since there is a plan of developing a mission for another disease that threatens a large portion of the population, namely cancer. Additionally, even if the experts confirm that the progress on developing vaccines, medications and so forth is advanced enough to assume that this problem no longer requires justifiable support in the form of being included in a mission, it is possible to treat the pandemic as a new type of threat and direct the mission elsewhere, for example, protection against highly-transmittable and hazardous zoonotic viruses which have been reported by epidemiologists to spread more frequently in the future. In other words, the array of possible problems to solve is very wide.

In sum, the innovation policy of the EU on the supranational level is characterised by incoherence between the undertaken (and planned) interventions related to counteracting the COVID-19 crisis and the newly implemented market-shaping, mission-oriented innovation policy approach. On the one hand, the EU implements and promotes the mission-oriented policy as a theoretically more efficient method of solving the problems within major social challenges. On the other hand, it hardly uses the tools compliant with this new policy concept to fight the most recent and highly important social challenge, namely the COVID-19 crisis.

4.3 Reasons for Not Using the Missions for Planned Interventions Aimed at Counteracting the COVID-19 Crisis

The emerging crisis, as a source of various types of threats, initially calls for actions from persons responsible for overcoming it, like namely politicians and other decision-makers, towards the basic need – maintaining safety. However, security-based logic shapes decision-making not only in the field of security per se but also beyond this area (Huysmans, 2006; Neal, 2010). Rhinard (2019) reminds us of how an overarching concern with insecurity, urgency and crisis can become the norm rather than the exception to normal policy-making. While developing this theory of crisisification in policy-making in the EU, Rhinard draws attention to the aspects of policies on the supranational level, which are useful when it comes to identifying the causes of the incoherence in leading the innovation policy in the EU, as mentioned in the previous section of the article.

First of all, the dynamics of the decision-making process is crucial, meaning that 'leaders must be seen to be taking action and Brussels-level initiatives become important' (Rhinard, 2019). For this reason, EU leaders focused on a swift reaction, yet quick responses are not always tied with using new solutions. Second of all, Rhinard states that a policy that reacts to a crisis, combined with the regular monitoring of potential new areas affected by the crisis such as new threats, displays a tendency to crowd out the policy, which requires a deeper, democratic deliberation. Consequently, it might be expected that the EU's policy as a COVID-19 crisis response may tend to pull out actions aimed at implementing new tools of innovation policy, even though the logic of maximising efficiency suggests the application of a mission-oriented policy approach in fighting the COVID-19 crisis.

New light on this problem is shed by research on the success and failure in public policies, tied to the theories of crisis management. As McConnell (2011) states, "political 'successes' may emerge out of crisis, but also may political 'failures'", but at the same time: "assumptions about success and failure rest on ground that is less stable than we might think." The fragile status of successes and failures of a policy conducted during a crisis is tied to the fact that evaluating crisis management initiatives is very difficult. However, what is problematic to the evaluators may be viewed in a completely different way by the politicians. In the past, the multifaceted nature and difficulties in assessing crisis management initiatives frequently benefited the politicians; it happened that they could turn into a general political success the actions and decisions that were not viewed as successes on their own merit.

The implemented concept of mission-oriented innovation policy is an example of a change that facilitated the assessment of the conducted interventions. Missions are expected to have clearly defined and measurable goals with specific timeframes for their completion (Mazzucato, 2018b). It would be easily verifiable whether a particular mission was successful and it might be expected that a political success will be difficult to achieve if the mission fails.

Furthermore, McConnell (2011) draws attention to the fact that the "destructive capacities of crises can to some degree be prevented, prepared for, managed, recovered from and learned about, through adherence to certain principles which should be embedded in institutional structures, rules and procedures, as well as the cognitive processes of actors." The underlying logic is that certain processes are best practice and that neglecting these generates a risk of failure. From the above perspective, following a well-travelled road generates a sense of lowering the risk of failure and reaching for new solutions increases it. For this reason, namely the fear of failure, EU decision-makers may reach for what they already know by relying on already tested policy instruments and distance themselves from the idea of counteracting the COVID-19 pandemic by applying the mission-oriented innovation policy approach. Those cautious attitudes are conditioned by other factors as well in the case of a health and social crisis as serious as the one triggered by the coronavirus. EU leaders must face the risk of failure stemming from objective

difficulties in planning a complex policy that is to encompass various recipients, their behaviour, lack of sufficient information, and the uncertain future (which entails a constant necessity of making decisions based on limited data).

5. Conclusions

Supranational actions undertaken by the EU that are to counteract (by means of the innovation policy tools) the COVID-19 pandemic and related crisis are chronologically intertwined with the endeavours tied to implementing the market-shaping, mission-oriented innovation policy approach in the EU. The COVID-19 pandemic came to Europe while the EU was working on the ways of implementing the concept of a mission-oriented policy within one of the main supranational instruments of its innovation policy, namely the framework programme Horizon Europe. It was a time when the mission areas were already outlined, large-scale social consultations were completed (EC, 2018), teams responsible for shaping specific missions were appointed and the works aiming at developing plans of executing particular missions so as to select the ones to be carried out were already officially announced. The plans that the EU sketched for the mission areas and implementation have hardly changed to date, except for the extension of the preparatory phase of missions creation and the limited response to the problems of the COVID-19 crisis that appear within the areas of the planned missions.

This article points to the incoherence that characterise the EU's innovation policy on the supranational level. It lies in the fact that the EU implements and promotes the mission-oriented policy as, theoretically, the most efficient tool in handling major social challenges, but at the same time does not show many signs, even in its plans, of attempting to apply the tools compliant with this concept to fight the most current social challenge, namely the COVID-19 crisis. As for the reasons for such a state of affairs, the following points are the most important: (1) the political pressure for a swift reaction to a crisis, (2) crowding out by the policy which responds to the crisis all other activities that require deeper, democratic deliberation, and (3) the fear of failure and the determination to lower the risk of failure by resorting to the known solutions, the so-called well-travelled road.

References:

- Amanatidou, E., Cunningham, P., Gök, A., Garefi, I. 2014. Using Evaluation Research as a Means for Policy Analysis in a 'New' Mission-Oriented Policy Context. *Minerva*, 52(4), 419-438. <https://doi.org/10.1007/s11024-014-9258-x>.
- Belussi, F., Sammarra, A., Sedita, S.R. 2010. Learning at the boundaries in an "Open regional innovation system": a focus on firms' innovation strategies in the Emilia Romagna life science industry. *Research Policy*, 39(6), 710-721. <https://doi.org/10.1016/j.respol.2010.01.014>.
- Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., Rickne, A. 2008. Analyzing the functional dynamics of technological innovation systems: A scheme of analysis. *Research Policy*, 37(3), 407-429. <https://doi.org/10.1016/j.respol.2007.12.003>.

- Breschi, S., Malerba, F. 1997. Sectoral innovation systems: technological regimes, Schumpeterian dynamics, and spatial boundaries. In: C. Edquist (Ed.), *Systems of innovation: Technologies, Institutions and Organizations*. Routledge, London, NY.
- Bach, L., Matt, M. 2005. From economic foundations to S&T policy tools: a comparative analysis of the dominant paradigms. In: M. Matt, P. Llerena (Eds), *Innovation Policy in a Knowledge-Based Economy: theories and Practices*. Springer-Verlag, Berlin and Heidelberg, Germany and New York, USA.
- Borrás, S., Edquist, C. 2013. The choice of innovation policy instruments. *Technological Forecasting & Social Change*, 80(8), 1513-1522. <https://doi.org/10.1016/j.techfore.2013.03.002>.
- Borrás, S., Edquist, C. 2019. *Holistic Innovation Policy: Theoretical Foundations, Policy Problems, and Instrument Choices*. Oxford University Press, Oxford, New York.
- Carlsson, B., Jacobsson, S., Holmen, M., Rickne, A. 2002. Innovation systems: analytical and methodological issues. *Research Policy*. 31(2), 233-245. [https://doi.org/10.1016/S0048-7333\(01\)00138-X](https://doi.org/10.1016/S0048-7333(01)00138-X).
- Carlsson, B., Stankiewicz, R. 1991. On the nature, function and composition of technological systems. *Journal of Evolutionary Economics*, 1(2), 93-118. <https://doi.org/10.1007/BF01224915>.
- Chaminade, C., Edquist, C. 2010. Rationales for public policy intervention in the innovation process: a systems of innovation approach. In: R. Smits, S. Kuhlman, P. Shapira (Eds), *Innovation policy – theory and practice. An international handbook*. Edward Elgar Publishing, London.
- Chiang, J.T. 1990. From ‘Mission-oriented’ to ‘Diffusion-Oriented’ Paradigm: New Trends of U.S. Industrial Technology Policy. Working Paper, WP 3225-90-BPS. Alfred P. Sloan School of Management, Massachusetts Institute of Technology.
- Cooke, P., Uranga, M.G., Etxebarria, G. 1997. Regional innovation systems: institutional and organisational dimensions. *Research Policy*, 26(4-5), 475-491. [https://doi.org/10.1016/S0048-7333\(97\)00025-5](https://doi.org/10.1016/S0048-7333(97)00025-5).
- Diercks, G., Larsen, H., Steward, F. 2019. Transformative innovation policy: Addressing variety in an emerging policy paradigm. *Research Policy*, 48(4), 880-894. <https://doi.org/10.1016/j.respol.2018.10.028>.
- Edler, J., Cunningham, P., Gök, A., Shapira, P. 2016. Introduction: Making sense of innovation policy. In: J. Edler, P. Cunningham, A. Gök, P. Shapira (Eds), *Handbook of Innovation Policy Impact*. Edward Elgar Publishing, Cheltenham, UK & Northampton, USA.
- Edler, J., Fagerberg, J. 2017. Innovation policy: what, why, and how. *Oxford Review of Economic Policy*, 33(1), 2-23. <https://doi.org/10.1093/oxrep/grx001>.
- Edquist, C. (ed.). 1997. *Systems of Innovation: Technologies, Institutions and Organizations*. Pinter, London, UK and New York, USA.
- Edquist, C. 2004. *Systems of Innovation: Perspectives and Challenges*. In: J. Fagerberg, D. Mowery, R. Nelson (Eds). *Oxford Handbook of Innovation*. Oxford University Press.
- Edquist, C. 2011. Design of innovation policy through diagnostic analysis: identification of systemic problems (or failures). *Industrial and Corporate Change*, 20(6), 1725-1753. <https://doi.org/10.1093/icc/dtr060>.
- Edquist, C., Zabala-Iturriagoitia, J.M. 2012. Public Procurement for Innovation as mission-oriented innovation policy. *Research Policy*, 41(10), 1757-1769. <https://doi.org/10.1016/j.respol.2012.04.022>.
- European Commission (EC) 2017a, LAB – FAB – APP. Investing in the European future we

- want. Report of the independent High Level Group on maximising the impact of EU Research & Innovation Programmes. Retrieved from:
http://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/hlg_2017_report.pdf.
- European Commission (EC) 2017b, Towards a Mission-Oriented Research and Innovation Policy in the European Union. An ESIR Memorandum: Executive Summary, December 2017. Retrieved from:
https://ec.europa.eu/info/sites/info/files/an_esir_memorandum-towards_a_mission-oriented_research-and-innovation_policy_in_the_european_union-executive_summary.pdf.
- European Commission (EC) 2018, Analysis Report: Responses to the call for feedback on “Mission-Oriented Research & Innovation in the European Union” by Marianna Mazzucato, June 2018. Retrieved from: <https://op.europa.eu/en/publication-detail/-/publication/b46756ae-f1f6-11e8-9982-01aa75ed71a1>.
- European Commission (EC) 2020a, Proposed Mission: 100 Climate-neutral Cities by 2030 – by and for the Citizens. Report of the Mission Board for climate-neutral and smart cities. Retrieved from:
https://ec.europa.eu/info/sites/info/files/research_and_innovation/funding/documents/ec_rtd_mission-board-report-climate-neutral-and-smart-cities.pdf.
- European Commission (EC) 2020b, Accelerating the Transition to a Climate Prepared and Resilient Europe. Interim report of the Mission Board for Adaptation to Climate Change, including Societal Transformation. Retrieved from:
https://eo4society.esa.int/wp-content/uploads/2020/09/Climate-adaptation.en_.pdf.
- European Commission (EC) 2020c, Caring for soil is caring for life. Ensure 75% of soils are healthy by 2030 for healthy food, people, nature and climate. Interim report of the Mission Board for Soil health and food. Retrieved from:
<https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/32d5d312-b689-11ea-bb7a-01aa75ed71a1>.
- European Commission (EC) 2020d, Conquering Cancer: Mission possible. Interim report of the Mission Board for Cancer. Retrieved from: <https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/d0235612-b68a-11ea-bb7a-01aa75ed71a1>.
- European Commission (EC) 2020e, Coronavirus research boosted by €122 million of additional funding. Retrieved from: https://ec.europa.eu/info/live-work-travel-eu/coronavirus-response/highlights/march-august-2020_en.
- European Commission (EC) 2020f, EU research and innovation in action against the coronavirus. Funding, results and impact. September 2020. Retrieved from:
<file:///C:/Users/jstry/Downloads/KI0220723ENN.en.pdf>.
- European Commission (EC) 2020g, KE finansuje badania nad koronawirusem. Retrieved From: https://ec.europa.eu/poland/news/200811_covidue_pl.
- European Commission (EC) 2020h, New research projects on Coronavirus (March 2020), October 22, 2020. Retrieved from:
https://ec.europa.eu/info/sites/info/files/research_and_innovation/research_by_area/documents/ec_rtd_cv-projects.pdf.
- European Commission (EC) 2020i, New research projects on Coronavirus (August 2020), December 1, 2020. Retrieved from:
https://ec.europa.eu/info/sites/info/files/research_and_innovation/research_by_area/documents/ec_rtd_coronavirus-new-research-projects.pdf.
- European Commission (EC) 2020j, Regenerating our Ocean and Waters by 2030. Interim

- report of the Mission Board Healthy Oceans, Seas, Coastal and Inland Water. Retrieved from: <https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/d0246783-b68a-11ea-bb7a-01aa75ed71a1>.
- Fagerberg, J. 2017. Innovation Policy: Rationales, Lessons and Challenges. *Journal of Economic Surveys*, 31(2), 497-512. <https://doi.org/10.1111/joes.12164>.
- Fagerberg, J. 2018. Mobilizing innovation for sustainability transitions: A comment on transformative innovation policy. *Research Policy*, 47(9), 1568-1576. <https://doi.org/10.1016/j.respol.2018.08.012>.
- Foray, D. 2018. Smart specialization strategies as a case of mission-oriented policy - a case study on the emergence of new policy practices. *Industrial and Corporate Change*, 27(5), 817-832, <https://doi.org/10.1093/icc/dty030>.
- Freeman, C. 1987. *Technology Policy and Economic Performance: Lessons from Japan*. Pinter, London, UK and New York, USA.
- Freeman, C. 1988. *The Economics of Industrial Innovation*. Pinter, London.
- Freeman, C. 1995. The 'National system of innovation' in historical perspective. *Cambridge Journal of Economics*, 19(1). <https://doi.org/10.1093/oxfordjournals.cje.a035309>.
- Ghazinoorya, S., Nasria, S., Amerib, F., Montazerc, G.A., Shayana, A. 2020. Why do we need 'Problem-oriented Innovation System (PIS)' for solving macro-level societal problems? *Technological Forecasting and Social Change*, 150(119749). <https://doi.org/10.1016/j.techfore.2019.119749>.
- Hekkert, M.P., Janssen, M.J., Wesseling, J.H., Negro, S.O. 2020. Mission-oriented innovation systems. *Environmental Innovation and Societal Transitions*, 34, 76-79. <https://doi.org/10.1016/j.eist.2019.11.011>.
- Hekkert, M.P., Suurs, R.A.A., Negro, S.O., Kuhlmann, S., Smits, R.E.H.M. 2007. Functions of innovation systems: A new approach for analysing technological change. *Technological Forecasting and Social Change*, 74(4), 413-432. <https://doi.org/10.1016/j.techfore.2006.03.002>.
- de Jong, J.P.J., von Hippel, E., Gault, F., Kuusisto, J., Raasch, C. 2015. Market Failure in the Diffusion of Consumer-Developed Innovations: Patterns in Finland. *Research Policy*, 44(10), 1856-1865. <https://doi.org/10.1016/j.respol.2015.06.015>.
- Klein Woolthuis, R., Lankhuizen, M., Gilsing, V. 2005. A system failure framework for innovation policy design. *Technovation*, 25(6), 609-619. <https://doi.org/10.1016/j.technovation.2003.11.002>.
- Kowalski, A. 2020. Innowacyjność przedsiębiorstw z wybranych krajów Europy Środkowo-Wschodniej – analiza mikroekonomiczna. In *Raport SGH i Forum Ekonomicznego 2020*. Oficyna Wydawnicza SGH, Warszawa.
- Lipsey, R., Carlaw, K. 1998. *A structural assessment of technology policies: taking Schumpeter seriously on policy*. Industry Canada, Ottawa.
- Lundvall, B.Å (ed.). 1992. *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. Pinter, London, UK and New York, USA.
- Lundvall, B.Å. (ed.). 2016. *The Learning Economy and the Economics of Hope*. Anthem Press, London, UK and New York, USA.
- Mazzucato, M. 2013. *The Entrepreneurial State: Debunking the Public Vs. Private Myth in Risk and Innovation*. Anthem Press, London.
- Mazzucato, M., Penna, C.C.R. 2014. Beyond market failures: the market creating and shaping role of state investment banks. University of Sussex SPRU, Working Paper.
- Mazzucato, M. 2015. Innovation systems: from fixing market failures to creating markets. *Revista Do Serviço Público*, 66(4), 627-640. <https://doi.org/10.21874/rsp.v66i4.1303>.

- Mazzucato, M. 2016. From market fixing to market-creating: a new framework for innovation policy. *Industry and Innovation*, 23(2), 140-156. <https://doi.org/10.1080/13662716.2016.1146124>.
- Mazzucato, M. 2018a. Mission-Oriented Innovation Policies: Challenges and Opportunities. *Industrial and Corporate Change*, 27(5), 803-815. <https://doi.org/10.1093/icc/dty034>.
- Mazzucato, M. 2018b. Mission-Oriented Research & Innovation in the European Union. A problem-solving approach to fuel innovation-led growth. Publications Office of the EU, Luxembourg.
- Mazzucato, M. 2019. Governing Missions: Governing Missions in the EU. Publications Office of the EU, Luxembourg.
- Mazzucato, M., Kattel, R., Ryan-Collins, J. 2020. Challenge-Driven Innovation Policy: Towards a New Policy Toolkit, *Journal of Industry, Competition and Trade*, 20, 421-437, <https://doi.org/10.1007/s10842-019-00329-w>.
- McConnell, A. 2011. Success? Failure? Something in-between? A framework for evaluating crisis management. *Policy and Society*, 30, 63-76. <https://doi.org/10.1016/j.polsoc.2011.03.002>.
- Morgan, K., Marques, P. 2019. The Public Animateur: mission-led innovation and the “smart state” in Europe. *Cambridge Journal of Regions, Economy and Society*, 12(2), 179-193. <https://doi.org/10.1093/cjres/rsz002>.
- Nelson, R. (ed.). 1993. *National Innovation Systems: A Comparative Analysis*. Oxford University Press, Oxford, UK and New York, USA.
- OECD, OECD Survey on the STI policy responses to Covid-19. Retrieved from: <https://stip.oecd.org/Covid.html>.
- Rhinard, M. 2019. The Crisification of Policy-making in the European Union. *Journal of Common Market Studies*, 57(3), 616-633. <https://doi.org/10.1111/jcms.12838>.
- Robinson, D.K.R., Mazzucato, M. 2019. The evolution of mission-oriented policies: Exploring changing market creating policies in the US and European space sector. *Research Policy*, 48(4), 936-948. <https://doi.org/10.1016/j.respol.2018.10.005>.
- Rosenberg, N. 1982. *Inside the Black Box*. Cambridge University Press, Cambridge.
- Rosenberg, N. 1994. *Exploring the Black Box: Technology, Economics and History*. Cambridge University Press, Cambridge.
- Schot, J., Steinmueller, W.E. 2018. Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, 47(9), 1554-1567. <https://doi.org/10.1016/j.respol.2018.08.011>.
- Smith, K. 2000. Innovation as a Systemic Phenomenon: Rethinking the Role of Policy. *Enterprise and Innovation Management Studies*, 1(1), 73-102. <https://doi.org/10.1080/146324400363536>.
- Van Lancker, J., Mondelaers, K., Wauters, E., Van Huylenbroeck, G. 2016. The Organizational Innovation System: a systemic framework for radical innovation at the organizational level. *Technovation*, 52-53, 40-50. <https://doi.org/10.1016/j.technovation.2015.11.008>.
- Weber, K.M., Rohrer, H. 2012. Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspective in a comprehensive ‘failures’ framework. *Research Policy*, 41(6), 1037-1047. <https://doi.org/10.1016/j.respol.2011.10.015>.
- Wittmann, F., Hufnagl, M., Lindner, R., Roth, F., Edler, J. 2020. Developing a typology for mission-oriented innovation policies. Fraunhofer ISI Discussion Papers – Innovation Systems and Policy Analysis. No. 64, Fraunhofer ISI, Karlsruhe.