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THE NEW PARADIGM SHIFTS IN INNOVATION POLICIES AND THE CHANGING ROLE OF THE STATE

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ABSTRACT

A new paradigm shift in innovation policies has taken place in recent years across the globe. Additionally, notably after 2008 global crisis, a return to industrial policies has begun in the World, even in developed countries. In this paper, we study the evolutionary development of innovation policies and state intervention rationales until today. In this context, to develop technological and innovative solutions to new complex societal problems, it is realized that the level of state intervention should move beyond what orthodox and evolutionary economics advocate. This new policy orientation also requires more holistic and multilateral cooperation among a wide range of actors, including government and private sector, as well as consensus on policy objective. However, it seems unresolved where the state will be positioned in this new policy framework. At this point, a more context-specific government intervention may be recommended for the countries depending on their innovative and institutional capabilities.

Keywords: *Innovation Policy, State Intervention, Mission-Oriented Policy, Transformative Policy.*

Jel Codes: *O32, O33, O38.*

1. INTRODUCTION

In recent years, innovation policy has been going through major changes due to new challenges which the countries have faced. This paradigm shift has been mostly spoken out in "mission-oriented[1] or transformative innovation policies" that seek to tackle some societal challenges such as food security, ageing, poverty, population ageing, climate change, strategic autonomy etc. The efforts to find solutions to these problems and to meet future societal needs beyond technical achievements have recently

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[1] These new policies differ largely from mission-oriented policies based on a technology-led mission prevalent particularly during the 1960s and 1970s. Old mission-oriented policies aimed at the scientific and technological advancements such as "the Apollo Project" started with the mission of putting a man on the moon (Wanzenböck, et al., 2020; Kuhlmann and Rip, 2018).

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galvanized renewed interest into mission-oriented innovation[2] (Wanzenböck, Wesseling, Frenken, Hekkert and Weber, 2020). Considering that the solutions to these challenges require radical innovations and a wide range of economy areas to alter their direction, that means a kind of systemic transformation where the direction of the innovation has gained importance rather than its rate. Naturally, the description of the economic growth has changed including smart, inclusive and sustainable growth (Kattel, Mazzucato, Ryan-Collins and Sharpe, 2018). This new policy orientation contrasts the conventional innovation policies mostly focusing on national competitiveness and economic growth. Economic growth is no longer policy rationale for this new policy framework (Diercks, Larsen, and Steward, 2019). This new wave also refers to "innovation policy 3.0" that strives to mobilize science, technology and innovation for meeting societal needs and solving social problems (Schot and Steinmueller, 2016; Grillitsch, Hansena, Coenen, Miörner and Moodyssone, 2019). In this new era of innovation policy, the nature of state intervention in the process has considerably changed. From now on, neither just funding R&D spending nor fixing system failures have not solely been the fundamental policy rationale. In addition to that, the state has been held responsible for shaping the directionality of innovation and creating new markets for innovations and technologies (Kattel and Mazzucato, 2018; Boon and Edler, 2018; Mazzucato, 2021).

In terms of policy debates, Neo-classical and Evolutionary approaches do not suffice to tackle societal problems and accomplish the system-wide transformation. They are problematic and less useful for generating new technological solutions and creating new markets and sectors, which did not previously exist (Mazzucato, 2016; Foray, Mowery and Nelson, 2012). In this context, the new policy approach stresses the strong ties among a broad set of agents and institutions that can generate pretty more innovative solutions. It regards as a different kind of innovation system with a higher level of cooperation bringing new technological, institutional and behavioural solutions to societal challenges (Hekkert, Janssen, Wesseling and Negro, 2020). However, this does not imply that the policy justifications of previous generations have been entirely invalid.

In the remaining part of this study, after a brief review of innovation policy concept and innovation models' development, we mention the causes for the return to industrial policies in the world and take a look at current industry policy orientation. Then, considering the evolutionary process of rationales of state intervention under various economic theories, the changing role of the state in innovation process is analysed. Finally, we discuss the paradigm shifts in innovation policies in the context of transformative or mission-oriented policies. In the light of all these arguments, with a different perspective on state intervention, whether mission oriented or transformative policies or not, this new policy trend appears to complement the evolutionary-based innovation systems approach at a higher level. Obviously, innovation policies have been undergoing their own evolutionary process in response

[2] In Europe, this is a policy response towards the net zero carbon target in a way (OECD, 2023).

to new problems and their solutions. To a degree, complex problems, which many sectors and technology areas have faced, are the driving force of this evolution. Today, various ideas have been suggested from the market-shaping state to the entrepreneurial state in policy debates. Inevitably, the state is being now positioned in a different place and the justifications for intervention in this process have significantly changed. Similarly, policy tools used have become more diversified and complicated.

2. INNOVATION POLICY AT A GLANCE

National governments often have to use public policies to prompt and direct the technological development and innovation process. Innovation policy is known as a set of actions implemented by the government using various policy tools in order to influence the formation process of technological development and innovations (Borràs and Edquist, 2013). Innovation policies are engaged in a more comprehensive set of tools than science and technology policies (Lundvall and Borràs, 2004).

In Europe, in the early 1990s, some concerns about the transformation of scientific and technological results into economic value[3] were the key factors leading European countries to innovation policies (European Commission, 1995). In this context, policies that encourage innovative behaviour of companies and eliminate incompatibilities between different components of the innovation system became crucial in those years (OECD, 1998). Thus, the policy focus shifted towards practices that enabled the creation, application and dissemination of new knowledge (Soete and ter Weel, 1999). Shortly, innovation policy is differently structured from science and research policies in many respects. Innovation policies focus on a number of agents that affect the innovation process in addition to universities, technology institutes and research centres (Lundvall and Borràs, 2004). Policy content is comprised of issues such as increasing the interaction between interface processes, changing the attitude of consumers towards new products and services, encouraging creative thinking and risk taking and enhancing the capacity of the system to absorb new information (Chabbal, 1995). To put it simply, innovation policy deals with combining scientific and technological knowledge with information from the market in a more productive way (Metcalfe, 2002).

Surely, the modelling of the technology and innovation formation process affected policy orientation. After World War II, technological innovations were seen as a "science-push" event. In those years, science and technology policies were largely designed according to military and strategic priorities. Scientific knowledge and basic research results were accepted as the main source of technological innovations in line with linear innovation models[4] (Jamison, 1989). With the 1980s, it was realized that linear models, which solely focused on the artificial boundaries of firms regardless of interactions between firms and organizations and the institutional aspects of the innovation process, had

[3] It is called the "European Paradox" by European Commission (European Commission, 1995).
[4] Linear models are known as science or technology-push and market-pull models (Rothwell, 1992). The starting point of the linear models was Vannevar Bush's report titled "Science, the Endless Frontier" in 1945. This report formed the general framework of the US science and technology policy (Göker, 2004).

many shortcomings in explaining innovation (Mowery and Rosenberg, 1979). Thus, linear models evolved towards systemic and interactive models emphasizing the more complex innovation process that required intense interactions at the intra-firm and inter-firm level (Tidd, Bessant and Pavitt, 2005). The primary reasons for this shift were the increased pace in technology, the rapid changes in market demands and customer expectations besides the need to being flexible to produce new products and processes. During this period, companies intensively had to establish strategic alliances and integrate into innovation network owing to the multidimensional nature of technological knowledge and innovation creating process (Rothwell, 1994; Rothwell, 1992).

In the next periods, the commonly accepted view that scientific studies and R&D would linearly turn to products and processes began to be questioned in the literature (Rothwell, 1992; Frischmann, 2000). So, the opinions that creating innovations was related to a set of interacting factors such as technology, design, research and application together with scientific and technological developments prevailed in the innovation studies (Mowery, 1994; Schot and Steinmueller, 2018). In the 1990s, policy-makers sought the more interactives models that figured out the random and complex nature of the innovation process (Molas-Galart and Davies, 2006).

3. RETURN TO INDUSTRIAL POLICIES IN THE WORLD

Industrial policy is known as any state intervention that affects various sectors in a country (Federico and Foreman-Peck, 1999). With the industry policy, the main goal is to begin industrialization which may be not achieved by the market mechanism (Soyak, 2011). In doing so, industrial policy aims to diversify the economic structure and create new industrial areas that can bring competitive advantages to the economy (Rodrik, 2004). It should be linked to the technology, innovation, competition, tax, trade and investment policies as well (OECD, 2022)

For the industrial policy, a dual classification can be generally made, namely “functional and selective (targeted)” (Lall, 2000). Selective industrial policies consist of government interventions targeting specific technologies, industries and activities (Lall and Teubal, 1998). Throughout history, developmental state model was identified with strategic or selective industrial policies. In South Korea, for example, market rationality was constrained by industrialization priorities and a high level of industrial selectivity was implemented. The government heavily subsidized a selective group of industries and firms and subsequently exposed them to foreign competition (Öniş, 1991). On the other side, functional industrial policies basically based on Neoclassical economics do not directly target specific industries or technologies (Lall and Teubal, 1998).

Until the 2000s, policymakers were not interested in industrial policy. However, in the wake of 2008 global financial crisis, the debates on industrial policy began in the developed countries such as the USA and Germany. Especially in the post-2010 period, industrial policies have taken a place in the economic literature again. This return to industrial policy has been also closely related to the

phenomenon of "deindustrialization" and the internal market imbalances that it has resulted in. High level of exposure to the crisis was also an important factor to reconsider industry policy in these countries (Aiginger, 2014; Doğruel and Doğruel, 2018). In recent years, the notion that a free market is the best way to stimulate growth and development has been highly questioned (Stiglitz, 2016). Consequently, governments across the globe have begun to intervene in the private sector by technology-focused and mission-oriented industrial policies over the past several years. Changing the ways of doing business, this has created an unfamiliar operating environments for firms in some targeted sectors such as automotive, energy and semiconductor. Also, the intensifying trade wars and competition between the United States and China have no doubt caused the reappearance of industrial policy. The U.S initiatives to restructure the declined strategic sectors are closely linked to this event (Shih, 2023).

Other than 2008 global crisis, since the beginning of the century, the changing structure of global value chains and the emergence of global production networks have been two of other main factors for the new industrial policy debates (Bianchi and Labory, 2011). Increasing complexity of the global value chain has led to new industrial policies in many developed countries. Europe has witnessed the targeted policies supporting specific sectors, technologies and areas of production such as advanced manufacturing, knowledge-intensive services and green economy etc. (Warwick, 2013). Recently, there have been new areas of interest targeted by industrial policy. The policy scope has expanded to include areas such as green transformation, sustainability, poverty and gender inequality in addition to increasing resilience against natural disasters, cyberattacks, epidemics and shocks (OECD, 2022). Moreover, general purpose technologies (GPT) such as big data and artificial intelligence, whose positive externalities can spread to a number of sectors, have been among priority areas for industry policies (OECD, 2022; Bloom, Van Reenen and Williams, 2019).

Recently, it is noticeable that the policy "dichotomy" of functional (horizontal) or selective (vertical) has lost its importance, pointing to a consensus on return to policy mix. Though it was outdated after 1980s for a while, the selective policies aimed at redistributing resources among sectors and different technology areas are not entirely excluded in the new industry policies. However, it is stated that these policies should be handled with care by policy-makers. In brief, horizontal policy instruments should be combined with targeted policy instruments for technological change and transformation (OECD, 2022). Above all, the existence of new technologies at different stages of the value chain affecting different sectors and the complex nature of technology have made single sector-focused policies inadequate. Now, a product, process or service could be fed from different technology areas and sectors today, each of which requires different policy instruments and strategies.

Generally speaking, new industrial policy approach is viewed as a discovery and joint learning process based on establishing closer relationships between public and private sector actors. It mainly centres on discovering, learning, forming effective network of linkages, strategic coordination between public and private sector, setting socio-economic objectives, increasing productivity, upgrading

technological capabilities, enhancing positive externalities and building more comparative institutional arrangements (Dietsche, 2017).

4. THE CHANGING ROLE OF THE STATE IN POLICY-MAKING PROCESS

Despite being different from old protectionism, the state intervention in markets has considerably increased since the 2008 global crisis. This, to some extent, revealed the lack of confidence in "the thinking of laissez-faire and invisible hand of market powers" (Bianchi and Labory, 2011). Today, states have begun to play more different role in shaping and directing innovation process than previous generation policy approaches (Boon and Edler, 2018).

In the literature, innovation policy has been mostly analysed under two theoretical approaches known as Neo-classical and Evolutionary views. The main justification for technology and innovation policy in Neo-classical model is "market failure" resulting from indivisibility, externality, uncertainty, asymmetric information and non-appropriability in the innovation process (Arrow, 1962). Neo-classical policies to fix these market failures in the process of production of technological information argue that the government should encourage invention and R&D activities and protect their results (Smith, 1994). This is because Neo-classical economics assume that the scientific and technological knowledge could be directly turned to innovative results based on linear model (Hauknes and Nordgren, 1999). According to Neo-classical theory, it is inevitable that underinvestment in innovation process will arise due to the divergence of private and social returns of R&D and innovations as well as the problem of appropriating innovation returns. Therefore, policy recommendations focus primarily on reducing the cost of R&D and producing technological knowledge for private sector (Akçomak, 2016).

After the 1980s, great efforts to internalize technological innovation brought, to some extent, different point of views on state intervention in the innovation. And so, more emphasis was placed on policies closing knowledge gap between countries (Stiglitz, 1998). In general, these models are known as "learning by doing model (Romer, 1986), human capital model (Lucas, 1988), R&D model (Romer, 1990) and public infrastructure model (Barro, 1990)" (Cameron, 1996). Endogenous growth models are a set of theories that do not directly attack Neo-classical theory (Froyen, 1998). They are structured on the assumption that the public good nature of producing new knowledge and technology will lead to increasing returns in the economy, drawing attention to close connections between R&D works, human and physical capital investments in creating technological knowledge (Cortright, 2001). For example, in the public expenditure model, public interventions are taken into consideration to accelerate technological developments and innovations. Government expenditures on public goods and services such as infrastructure and human capital investments and political or economic stability are included in the production function (Barro, 1990). Economic growth in the long term depends on the government's investment in physical and human capital, which can be triggered by institutional arrangements or incentive mechanisms outlined by government (Crafts, 1996). Likewise, Lucas made room for public

policies paying attention to improve knowledge and skill capacity at the individual level (Lucas, 1988). Consequently, with the technological development and innovation internalized at both country and firm level, more active policies toward directing these variables gained importance within orthodox economic approach (Turanlı and Sarıdoğan, 2010).

As for Evolutionary policy approach that emerged during 1980s, the state began to undertake more different functions such as strengthening or redesigning a series of institutional factors that set the innovation process in motion (Nelson and Winter, 1977). Above all, Evolutionary economists tried to "open the black box of technology and innovations" to clarify and understand various factors which lay behind technological innovations (Rosenberg, 1982; Mazzucato, 2016). Evolutionary policy content focuses on fixing various "system failures", which reduce the performance of system actors and prevent the functionality of system in creating innovation (Hauknes and Nordgren, 1999; Woolthuis, Lankhuizen and Gilsing, 2005). Evolutionary view states that the loss of the system's diversity-creating potential could give rise to "lock in" certain technologies and path dependent (Fagerberg, 2003). Accordingly, innovation policies aim to trigger the market's diversity-producing mechanism because it is crucial in the continuity of economic evolution (Metcalfe, 1994). In evolutionary analyses, being held responsible for building an effective learning system,the state is also the primary actor of the national innovation system. Further, for a sustainable innovation environment, increasing the diversity of firms and other actors and improving the selection process based on market and non-market criteria are among the priorities for policy-makers. Reducing transaction costs in the flow of information at the system level is also one of the policy justifications (Ghazinoory, Narimani and Tatina, 2017). In the Evolutionary approach, the state is expected to undertake the task of creating a favourable institutional infrastructure that facilitates interactive learning and innovative efforts. In sum, from the evolutionary point of view, neither increasing the number of R&D incentives nor implementing general policies will stimulate the technological development and innovation process as Neo-classical approach expects.

As is known, during the development process of the East Asian, the public sector entered technology-intensive sectors as a producer by creating public initiatives (Lall, 2004; Lall, 2000; Westphal, 1990; Akçomak and Emiroğlu, 2020). For example, the Industrial Technology Research Institute (ITRI), a public institution in Taiwan, managed the process of technology transfer and dissemination taking part in producing of military and civilian technologies (Wade, 2016). The government developed strategic industry and technology policies ensuring that the manufacturing sector would become more innovative and competitive, the examples of which were seen in Japan, Taiwan and South Korea in past (Yağcı, 2021). R&D collaborations between ITRI and the private sector played an important role in Taiwan's high-tech industrial development, which enabled the country to be successful in the areas such as laptop PCs, semiconductors, microprocessors and consumer electronics (Mathews, 2002). In other respects, there are some opinions emphasizing that the East Asian development process is associated with the ability of state to guide the market rather than the scope of state intervention

regardless of the duality of state and market. In addition to implementing a highly strategic and selective industrial policy in terms of sector and technology, the state was central to creating opportunities for the market (Weiss and Hobson, 1999). These developmental states refer to "strong states" that are characterized by a high degree of bureaucratic autonomy and the existence of a continued dialogue and cooperation between the state, other centers of power and stakeholders within society. The capability of the state to isolate itself from social pressures, namely its autonomy, is pivotal for effective state intervention (Öniş, 1991). The state's institutional capacity to implement and monitor policies is seen as the main factor for East Asian development success. In addition to state autonomy and power, the close relations with industry built economic capacity. Thus, resources in the country were mobilized for development purposes (Weiss and Hobson, 1999). Clearly, the effective strategic industrial intervention in East Asian was due to the strength of the internal structure of the state bureaucracy and the strong relationships that the state established with other interest groups (Wade, 1990; Weiss and Hobson, 1999). Despite all these, with the advent of neoliberal waves, strategic policies and intensive state intervention were subject to strong Neoclassical criticisms in the 1980s. The policy-makers and the bureaucrats who carried out industrial policy were accused of promoting their own interests rather than national interests. This refers to the notion of "government failure" caused by rent-seeking (Chang and Andreoni, 2016; Öniş, 1991).

On the other hand, it is clear that a new innovation policy paradigm has recently created different areas of intervention for the state in addition to improving the general functions of the innovation system (Linder et al., 2016). In this new approach, policy makers are given more responsibility for determining the direction of innovation. This indicates a clear paradigm shift in innovation policies with the new justifications for state intervention. The state should determine the direction of technological change and the sectors to be developed. Most importantly, public policies should create and shape new markets. From now on, the role of state is expected to evolve "from fixing markets or systems failures to market-creating", that is, to "the entrepreneurial state". The state could undertake some "transformative functions" in the economy for creating new markets and sectors beyond financing for the R&D process (Mazzucato, 2016; Mazzucato, 2021). A more proactive intervention is also required to direct the research and innovation process and to adapt to possible future shocks (OECD, 2023). Moreover, the state should send the signals about growth prospects for the private sector in various areas of technology and innovation by creating of new techno-economic paradigms. First and foremost, private sector will be willing to entry into any technology and innovation field only if it sees market growth opportunities for future created by the public policies (Mazzucato, 2021). Frankly, the state needs to undertake different roles throughout the innovation chain, including entrepreneurship (Mazzucato and Semieniuk, 2017). The state should be involved in the process until new technologies and innovations have an advantage over others and the relevant sector matures (Karlson, Sandström and Wennberg, 2021).

Also, the scope of state intervention has been analysed under "the generative state" going beyond the entrepreneurial state. Here, the development of Chinese telecom industry is followed. In China, the state was served as catalyst in shaping the telecom industry (Akçomak and Emiroğlu, 2020; Harwit, 2007; Wauschkuhn, 2001). In the generative state, the role of the state is continuously redefined during the innovation process even if the market uncertainty for innovation disappears. Supply-side Neo-classical policy instruments as early stage R&D supports for firms are insufficient to achieve success. Just like entrepreneurial state does, government affects the dissemination and direction of the technological innovation in addition to creating market. And yet, the intervention covers broader and longer process differing from the entrepreneurial state. One aspect of the intervention is to overcome the issue of technological capability of the firms. Taking part in technological development and innovation process as an investor, state also creates demands for the technological innovations. Public enterprises, an integral part of this process, have to establish close collaborations with private sectors. Reforming of public enterprises, avoiding intense privatisation and joint ventures established between national and multi-national companies have been three important dimension of such an intervention approach in China. Notably for the developing countries that lack the necessary institutional and technological capacity to stimulate R&D and innovation process, the generative state approach based on basically public entrepreneurship is presented as a more suitable structure (Akçomak and Emiroğlu, 2020).

As regards the scope of state intervention in particularly the development of high-tech industries, there have been some studies in favour of public entrepreneurship. Although the high-tech industries are supported by various incentive mechanisms, they include a number of risks that could prevent private sectors from entering into these sectors because of the lack of understanding of know-how. In this context, public entrepreneurships are thought to close this gap (Lenger, 2021). Furthermore, public initiatives can contribute to innovation by discovering new opportunities and recombining different knowledge sources in the semiconductor and space industries. In this respect, policies that can reconcile state ownership and market competition are deemed necessary (Benassi and Landoni, 2019; Belloc, 2014). Public initiatives are also good at implementing innovation policies and solving financing coordination problems (Tonurist and Karo, 2016). Nonetheless, it may be argued that there has been no consensus on what the scope of state intervention in the innovation process should be despite the fact that the need for a more heterodox intervention style has been recently put forward.

5. TOWARDS A NEW PARADIGM SHIFT IN INNOVATION POLICY: TRANSFORMATIVE POLICIES

There has been a paradigm shift in which the quality and direction of innovations have been more and more important than the quantitative of innovations for several years. Of course, policy content and the position of the state in the innovation process have begun to change with this new policy paradigm.

Instead of increasing the intensity of innovative activities, this new approach is basically on directing innovation efforts to specific focuses (Kattel and Mazzucato, 2018; Cantner and Vannuccini, 2018). In fact, this paradigm shift represents a transition from the system-focused intervention approach of Evolutionary economics and the market failure-focused approach of Neoclassical economics to more different state intervention in technological change and innovation. Here, the goal is generally to generate solutions to "social challenges" such as poverty, population ageing, climate change and structural transformation since policy contents based on market and system failures have turned out to be insufficient in solving these problems so far (Robert and Yoguel, 2022; Uyarra, Ribeiro and Dale-Clough, 2019).

No doubt, new policies are more complex policies that bring technological and institutional solutions to relevant social problems with the aim of social-technical transformation. Moreover, technological, institutional and behavioural changes should be all addressed together in the policy-making process (Wanzenböck et al., 2020). This new policy orientation is largely conceptualized within the framework of "new mission-oriented innovation policies" that seek to produce solutions to different social problems of the 21st century (OECD, 2022). It has offered a new insight into the transformation of innovation systems rather than merely fixing various failures in the system (Kattel and Mazzucato, 2018).

Mission-oriented policies are also called "transformative innovation policy". The first feature of the transformative policy paradigm is that it focuses on sustainability and social development. Economic growth or innovation are not the primary policy objectives. They are expected to be by-products of broader development process. This new policy paradigm emphasizes political rather than economic discourses. Further, it calls for policymakers to take a much more active role in shaping the direction of technology and markets (Bergek, Hellsmark and Karltor, 2023). Depending on what sort of problems exist in the innovation systems and which transformation is necessary, innovation policy design differs (Kuhlmann and Rip, 2018). That is, the features of existing challenges should be considered to determine policy content.

The innovation systems approach based on Evolutionary economics has not been able to provide the necessary policy prescriptions for long-term transformative change (Weber and Rohracher, 2012; Robert and Yoguel, 2022). They have focused mainly on the creation of framework conditions that can enhance the innovation capacity of the ecosystem omitting some issues such as national strategic priorities and the solution of social problems (Diercks et al., 2019). Mission-oriented policies have reconsidered concerns such as the lack of a holistic strategy, policy coordination problems and fragmented policies experienced in the previous generation policy approach (OECD, 2021). Today, the existence of different development pathways for each sector is other important factor that makes system-based policy contents inadequate since they are not fully effective in setting the direction of change and sending the necessary signals to the market (Mazzucato, 2016). So, mission-oriented policies aim to

spark the process by directing innovation into the desired path by the state (Cantner and Vannuccini, 2018).

On the other hand, the discovery of new sources of failure in the innovation policy studies, except for system and market failures, has had an impact on justifications for innovation policies. The innovation systems approach presents restrictive arguments about policy interventions towards transformational change and omits some kind of failures that block the system. According to new literature, innovation systems are subjected to "a set of additional failures", which provide further justification for state intervention during the transition process (Weber and Rohracher 2012; Bergek et al., 2023).

The new policy approach lays emphasis on changing the direction of innovation systems that may be locked into a particular path. In this context, "transformation failures" have begun to take a place in the relevant literature as a new justification for public intervention (Hekkert et al., 2020). Additionally, "directionality failure" has been included in the policy agenda, pointing to the strategic policy approach that focuses on innovations for social challenges. In order to fix directionality failure, a policy set, which consists of different tools to guide change, is needed (Weber and Rohracher, 2012). The logic behind this is that some kinds of innovation may contribute to worsening current problems let alone producing solutions to the challenges. For this reason, rather than increasing the overall rate of the innovations, stimulating innovations in certain socially desired directions is central to policy-makers, while phasing out non-sustainable options (Schot and Steinmueller 2018; Bergek et al., 2023). The concept of "reflexivity failure" is also frequently mentioned in the literature. It refers to the ability of the innovation system to bring actors together in line with goals set. It is especially about the system's lack of ability to monitor, predict, and include various actors in the process. This concept is regarded as "the quality criterion of innovation systems" and pays attention to adaptive policies (Linder et al., 2016; Weber and Rohracher, 2012). Reflexivity failure is a drawback to the evaluation and monitoring of policy results. It also precludes the revising of the targets set previously (OECD, 2021). In sum, while the new innovation paradigm acknowledges the existence of systemic weaknesses, it has also raised additional problems such as directionality, transformation, coordination and reflexivity failures weakening the innovation system (Bergek et al., 2023).

Examining the Table 1.0 below, the mission-oriented, transformative and holistic innovation policies that stand out in new policy discussions go beyond market and system failure-oriented policies in spite of the small differences between them. Structural change, creating favourable conditions, bottom-up policy-making process and social and political consensus on innovation policy agenda are the main subjects in this framework. The interrelationships of various purposes and instruments, interactions between actors in the process, non-linear dynamics and feedbacks to members are also deemed important. Therefore, neutral R&D incentive programs for firms will be insufficient to automatically achieve policy objectives. Instead, more systemic and complex interventions that can

create significant changes in the learning capabilities of organizations are required. Policy intervention is a flexible and ongoing process that can be adaptive to unforeseen circumstances after implementation. This means that there will be no optimal point to be reached. As for policy type, it is suggested that both vertical (selective) and horizontal policies should be used in order to start structural change (Robert and Yoguel, 2022).

Table 1. New Concepts in Innovation Policies

Policy Type	Policy Rationale	Policy Making Process	Government Intervention Type
Transformative Innovation Policy	Focused on social problems; directionality and sustainability failures	All stakeholders and economic actors in society should centre on the transformation process	Vertical and horizontal policies to create structural change; not neutral innovation policies
Mission-Oriented Innovation Policies	Social challenges oriented; not solely focused on various failures in the system	Optimistic policy makers and rationality A number of actors and policy-makers interested in policy agenda	Vertical policy to start structural change; not neutral innovation policies
Holistic Innovation Policy	Directing the system in the desired direction within the framework of social and political consensus No optimal state or benchmark to be achieved Not solely focused on various failures in the system	Experimental policy to determine the agenda Bottom-up institutional change Policy flexibility for unforeseen consequences	Experimental policy Policy tools aiming at structural change

Source: Robert and Yoguel (2022).

In the new innovation policies, policy process is much more complex and far less linear. Formulating goals and missions are very challenging due to conflicting interests (Normann, Svartefoss and Thune, 2024). First and foremost, a number of different actors and various societal groups need to be involved in the policy-making process. The directions for innovation should be set in close collaboration with a broad set of stakeholders. In transformative or mission-oriented policies, "setting a direction" is taken as the starting point. Above all, it should be also a collective process (Schot and Steinmueller, 2018). It means that coordinating the actions of all relevant stakeholders towards a joint goal and mission is of utmost importance to achieve policy targets (Wittmann, Hufnagl, Lindner, Roth, and Edler, 2020). Additionally, it is an experimental policy-making process whose achievement depends on high degree of deliberation, involvement from bottom-up and social consensus (Robert and Yoguel, 2022; Schot and Steinmueller, 2018). On the other hand, it is inevitable that this transformation process will reveal the question of potential winners and losers "because of political nature of directionality" (Salas Gironés, van Est and Verbong 2020; Wittmann et al. 2020). Naturally, there could be different

views among various interest groups on what directions and pathways will be selected as well as which to exclude throughout policy-making process. The feasibility and sustainability of choices and solutions are also the topic of debate among stakeholders, which are demanding to be managed effectively (Bergek et al., 2023). Clearly, there will be some potential policy challenges in the policy-making process because of the complex nature of missions and goals. This is partly due to the fact that determining clear, inclusive realistic and measurable missions, which can easily be accepted and adopted by many stakeholders, seems to be a pretty tough job. Conflicts of interest between goals and trade-offs between diverging priorities among stakeholders are most likely to appear (Wanzenböck et al. 2020; Mazzucato, 2016; Weber and Rohracher 2012; Bergek et al., 2023). As a result of all these, in the new policy paradigm, multi-scalar coordination, interactions and alignment among various interest groups are of indispensable to harmonise policy objectives. This also affects the directionality of the innovation policy. Above all, it is a kind of decision-making process on which priorities and goals are included or excluded. Consequently, establishing strong ties between government and private sector should be the first step to achieve policy agenda. Previous innovation policy approaches, that is Evolutionary and Neo-classical, have seemed to overlook some of these factors.

6. CONCLUSION

Currently, innovation policies and the justifications for state intervention in innovation process have changed. In this study, we present that, whether mission-oriented or transformative policy, a more heterodox approach has emerged in innovation policy. In other words, a more active state intervention style is required in response to new societal problems, changing structure of technology and innovation and new types of failure. This seems an effort to build a new policy thinking differing from Evolutionary and Neo-classical views in terms of state intervention. In particular, being held responsible for the directionality of innovation and creating new markets for innovation and technology, a state can play a proactive role in innovation chain than before according to some views. Here, we have to say that not all views favour an active state intervention notwithstanding various state intervention styles in the literature such as entrepreneur state, developmental state, market creating state, generative state and regulatory state et al. Nevertheless, it is certain that there have been some doubts that the diminished state intervention in innovation and technological development process will increase the intensifying of innovation in private sector. Admittedly, this paradigm shift emphasized in mostly western literature enables us to draw important inferences for the countries with lower innovation and technological capacity as well as not having a necessity institutional set-up to formulate the policies. It is clear that the implementing success in this new policy framework will depend heavily on the current situation of countries' science and technology system and institutional set-up. Or rather, it can be said that the better institutional set-up and innovation capability accumulation, the more successful policy application. No doubt, the scope and level of state intervention will be the key in this process as well. High level coordination and consensus on agenda-setting and policy formulation, namely a bottom-up policy-

making, are the core of new innovation policy approach. To be honest, all these factors mentioned above cumulatively and gradually develop in historical context. Accordingly, to what extent they have developed so far could give important clues about policy and state intervention level for a country seeking to improve national innovation capacity. The main problem here is whether this policy framework can be appropriate for the countries which lack most of these influential factors and accept the limited state intervention or not because it needs a given policy capacity and technologic level. The realization of missions seems to be tightly coupled with the current level of competence in high technologies that require large investments. And what's more, the private sector could be reluctant to enter into these areas. In this paper, we get the impression that mission-oriented policy framework seems to be more suited to developed countries since policy effectiveness depends on some historically accumulated competencies. As a consequence, we argue that a more context-specific policy and state intervention style in the innovation process will produce better results for different countries. Of course, the more comprehensive future studies on country or regional level will be more productive.

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