

SCIENCE, TECHNOLOGY AND INNOVATION POLICY TRANSFORMATION IN THE CONTEXT OF UNCERTAINTIES

Bach Tan Sinh¹

Vietnam Institute of Science, Technology and Innovation.

*“Problems cannot be solved at the same
level of awareness that created them”
(Albert Einstein)*

Abstract:

The article first examines the transformation of science, technology and innovation policy (hereinafter referred to as STI policy) in the world in general and in Vietnam in particular. Then, the article shares Vietnam's experience in efforts to cope with risks from pandemic Covid 19 considered from the perspective of mobilizing/involving stakeholders in the exploitation and use of initiatives in the field of community-based risk management and communication. From the experience of Vietnam, the article conveys the message that developing countries like Vietnam also have their own approach to exploiting and using STI resources to solve crisis related to uncertainty. Following the trend of STI policy transformation that are currently taking place in the world, it is time to re-acknowledge the prevailing assumption that developing countries need to learn and apply the experiences of developed countries in STI policy making. Instead, countries have equal opportunities to develop and share experiences and appropriate STI policymaking approaches based on national endogenous capacities and the actual context of the problem to be solved.

Keywords: STI policy; Policy transformation.

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1. Introduction

The concept of “innovation” used in this article is essentially INNOVATION in English, but when translated into Vietnamese, it is used as “inventive innovation” for a reason that is to avoid the misunderstanding of the concept “ĐỔI MỚI” proposed by General Secretary Truong Chinh at the 10th Meeting of the Hanoi Party Congress, prior the 6th National Congress in 1986 and considered “ĐỔI MỚI” as the survival afford. In that spirit, there are 3 main views related to ĐỔI MỚI: (i) The first point is to reform investment structure and economic structure to replace the old one promoting for heavy industry, through the implementation of Three programs - food beverage, food, consumer goods and exports; (ii) The second point of view is that, applying multi-sector economy to continue developing the private economy, replacing the socialist policy reform in industry and commerce, capitalism, and private business; (iii) and the third viewpoint is, to renew the economic management

¹ Author's contact email address: sinhbt@gmail.com

mechanism, to abolish the socialist business and accounting mechanism, to initially apply the commodity-monetary relationship in association with the planning mechanism (Documentary Film - Vietnam Ho Chi Minh era - Television Chronicles - 1986, part 1. VTV1 20:10 on 6th October, 2020).

In essence, the INNOVATION carried out by Vietnam in the late 1980s (since 1986 after the 6th National Party Congress) is to renew the state management of economy, from centralized, bureaucratic, subsidizing to the State-regulated market mechanism. In other words, ĐỔI MỚI in Vietnam is the REFORM in the way of economic management which was no longer appropriate, now it must change to comply with the law of the objective of socio-economic development. These fundamental changes may be similar to “reform - opening” in China and “perestroika” (reform) in Russia. These changes are equivalent to “Renovation” in English, not equivalent to the concept of “INNOVATION” in English. This ĐỔI MỚI concept differs from the INNOVATION that is specifically mentioned in the remainder of this article. In fact, when translating the language from the original English into Vietnamese, it is best to leave the original name if there is no similar word with the same meaning, such as Innovation, like the concept of Internet being accepted as Internet in Vietnam - instead of having to translate into Vietnamese as “inventive innovation”. The current concept of “inventive innovation” is now having many incorrect interpretations, leading to confusion in using for example creative start-up ecosystem instead of innovative start-up ecosystem.

Public policies, including STI policy, derive from an understanding of past experience with actions, reflect current challenges and perceptions of future potential, which help in making appropriate action. The connection between past, present and future has been analyzed and made policy action by researchers and policy makers. These interpretative connections create “policy cognitive frameworks” (referred to as “Policy Framework”), which include: interpretation of experience, arrangement of present situations and imagination of potential in future, thereby, laying the foundation for policy analysis and making, has a strong influence on perceptions of policy potentials and opportunities (*Taylor, 2003*). These policy frameworks evolve over time and they change when they are no longer relevant to the current circumstances. Policy frameworks impact the functioning of governmental and non-governmental organizations, as well as businesses, even families and individuals.

Currently, there are three STI policy frameworks, two of which are being systematically operated through policy debate and enforcement. Each of these Policy Frameworks includes an innovation model where, defining the roles of policy actors and describing policy actions to address policy objectives - is also seen as part of the Policy Frameworks. A third policy framework is currently considered to be unformed (only in the developmental stage), although it has existed in the form of scholarly policy debate over recent years (*Short and Steinmueller, 2018*).

The next section will analyze the evolution of all three Policy Frameworks, illustrating how each Policy Framework evolves to adapt to changing economic and social circumstances.

2. Theoretical framework analyzing STI policy transformation

The policy culture approach to science and technology policy was developed by Jamison, Baark and Elzinga (*Elzinga and Jamison, 1995; Jamison and Baark, 1990*) and continued to be developed and applied by Bach Tan Sinh relevant for developing countries such as Vietnam (*Bach Tan Sinh, 2019*), is used to analyze STI policy transformation - is the basic content of this article. According to this approach, “four policy cultures” coexist - academia, bureaucraties, economics and civil society (see Tables 1 and 2). Policy cultures compete for resources and assert varying degrees of influence on STI development. The nature of STI policy differs depending on the relative degree of influence and the mode of interaction between the above policy cultures. The STI policy after being formed will affect the institutional regulations in that country about the form of STI organization in general and the mode of knowledge production in particular.

Table 1. Policy cultures of STI Policies

Policy cultures	Academic	Bureaucratic	Economic	Civic
	<i>policy for science</i>	<i>policy by science</i>	<i>innovation policy</i>	<i>transformative innovation policy</i>
Policy doctrine (macro)	Enlightenment	Development and national security	Economic growth; Enterprises as centre of innovation.	Inclusiveness (no one left behind); Strengthening of engagement and participation of citizen in Innovation.
Operation mechanism (meso)	Expert-based assessment; linear innovation model starting from R&D / market demand to development of prototypes and commercialization (<i>Kline and Rosenberg, 1986</i>).	Planning	Commercial and profits; Interactive innovation/ innovation systems (national and regional) (<i>Lundvall, 1992; Edquist, 1997; Malerba, 2005; IDRC, 1999; Dinh Tuan Minh, 2019; Nguyen Trung Kien, 2019</i>).	Social appraisal and monitoring transformative innovation addressing the challenges of the current development mode/pattern
Features (micro)	Scientific properties (academic research)	administrative mechanism (role of the State in managing STI) (<i>Bush, 1945</i>).	Entrepreneurship (innovation at enterprises) (<i>Schumpeter, 1934</i>).	Participatory and inclusive engagement. Innovation by the

				user/customers ²), free innovation (Von Hippel, 2017) / open innovation/ inclusive innovation. (citizen science) (UNCTAD, 2019).
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Sources: Jamison and Baark, 1990; Bach Tan Sinh, 2019.

Table 2. Models of STI Policies

	Academic	Bureaucratic	Economic	Civic
Groups of policy actors	<i>Representing research communities</i>	<i>Representing state administrative management domain</i>	<i>Representing technological developers and producers</i>	<i>Representing Non-governmental institutions</i>
Policy feature	<i>policy for science</i>	<i>policy by science</i>	<i>innovation policy</i>	<i>transformative innovation policy</i>
Policy goals	Development of knowledge	Development and national security	Economic growth	Development and social equality
Policy doctrine	Autonomous/independent and accountability	external intervention	Driven and managed by the market	Full participation of the policy actors
Policy measures	Expert / per review, establishment of research institutions	Planning	Market-driven assessment and commercialization	debates among concerned communities, impact assessment of STI
Characteristics	Autonomous and self-determined	Hierarchy and command	Entrepreneurship, commercialization	Citizenship, wide engagement of policy actors
Representative groups of policy actors	Institutes, universities	Ministry of Defence and other sectoral ministries	Entrepreneurs, production managers, star-up enterprises.	grass-root movement, NGOs (associations,...) and individuals including citizen scientists, amateur inventors,...

Sources: Elzinga and Jamison, 1995 (revised with author inputs); Bach Tan Sinh, 2019.

² Innovation by customers/users - user proposition - can be in the form of a business or an individual (Von Hippel, 2005). These are people's initiatives and inventions - often called amateur inventors. Currently, there are a series of documents to promote citizens' initiatives and inventions in Vietnam, including Decree No. 13/2012/ND-CP of the Government on the issued on March 2nd, 2012. In practice in Vietnam, there have been many vivid examples of innovation (including innovation, engineering and social innovation) of people, especially farmers in the agricultural sector and rural development (Hoang Xuan Long, 2012; Pham Phi Anh et al., 2012; Nguyen Thi Phuong Mai, 2016).

The first policy culture - an academic policy culture, formed primarily at research institutes and universities, where science is conducted as a professional profession, creating scientific knowledge is considered an important factor for the development of humanity and civilization, contributing to the human knowledge treasure. The STI policy of this policy culture is a policy for science, which is primarily concerned with the development of science as an objective in itself and wants to increasingly scale the development of research institutes. In the realm of this academic policy culture, respected scientists and politicians play an important role in determining the direction of a nation's STI development.

The second policy culture - an administrative/civil service policy culture, in many countries dominated by the military forces, is formed on the basis of state management organizations, committees, council and advisory organization. The concern of this policy culture is that the effective organization and management of a national, scientific STI system must serve the development of society and have social use value. Policy STI in this policy culture is policy by science.

The third policy culture - the economic policy culture - is primarily based on companies and firms where STIs are the vehicle for production development goals, contributing to wealth creation, material and economic growth. The concern of this policy culture is the use of knowledge (application and transformation into a commercially viable product, process). This policy culture is concerned with the policy of applying, adapting and disseminating technology, considering enterprises as the center of innovation, as a place to create material wealth for society. The economic policy culture is influenced by entrepreneurial scientists, engineers, and managers.

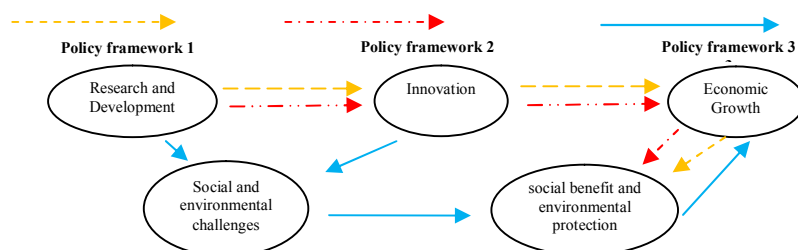
Finally, the fourth policy culture - the civic policy culture of STI policy, relies on the wide participation of STI organizations, being outside the public sector and the member of STI associations. The concern of this policy culture is the social impact of the STI rather than the effective generation and application of the STI results. This policy culture publishes its views through social organizations as well as social criticism on socio-economic development policies in general and STI policy in particular. The degree of influence of this policy culture depends on the strength of civil society in that country.

The next part of the article is to apply a policy culture approach to analyze the formation and development of STI Policy Frameworks focusing on two key policy elements: (i) modes of innovations and their respective policy actors and (ii) policy practice.

3. The Formation and Development of STI Policy Frameworks

STI have played a key role in the development of the world as we know it today. Especially after World War II, STI policy became of interest to governments as an engine of growth, development and well-being. However,

as we know today, technology and innovation have also become part of the problem that needs to be solved. To understand how STI policy affects the transformation, we need to understand the logic behind relating to the Policy Framework formation process (see Figure 1).



Source: Schot, J. et al. 2019, revised by the author³

Figure 1. STI policy frameworks

3.1. The first policy framework

Innovation model and its key policy actors

The first generation policy framework identifies the most important elements of innovation as the invention process and linear model of innovation, in which technology is considered to be the application of scientific knowledge. This linear model assumes that the invention is the origin of application demand, partly because it is based on the assumption that the results obtained from the application will be realized through a fully functioning market system. Only when that market fails government intervention need to be. This policy framework is also known as the linear model of innovation, reflecting a period of rapid economic and technological growth, and the notion that unintended S&T consequences such as environmental pollution can be handled by S&T advances and legal regulations.

The policy actors in this innovation model have a clear division of labour and responsibility. Scientists, as expected, would pursue the advancement of science with little attention paid to the potential commercial value of such scientific inventions, concentrating their efforts to publish their work with research methods and new research and findings, and assume that those who receive their inventions will use them responsibly. The public sector is expected to generously fund scientific research and tailor scientific practice to its openness, while at the same time, to encourage autonomy in correcting non-standard behaviours about science within the scientific community. The public sector is also expected to provide tools to identify problems arising from scientific application, and to recommend them to experts in the scientific

³ Compared with the model of Schot et al 2019 this model is simpler.

community to evaluate and propose corrective solutions. The role of the private sector is to turn scientific inventions into innovations that support long-term economic growth. In the 1960s, it was thought that the capacity to do this existed mainly in large enterprise conglomerates who could build research capacities in industry to carry out adaptive research efforts and develop necessary technologies to commercialize scientific inventions. At the end of the period, a new group of social agents appears - an enterprise established on new technologies. They became increasingly interested in the nature of entrepreneurship and innovation-based start-ups, which Schumpeter had studied earlier in the first years of this century.

Policy Practice

Although governments have responded positively to public funding for science, almost no country can afford to be financially able to develop all areas of S&T. Therefore, a priority setting in funding scientific research is essential. This leads to proposing mechanisms for making research priorities. One prominent mechanism/tool developed in the 1980s and 1990s was the Technology Foresight (*Martin and Irvine, 1989*). These activities incorporate social considerations into the selection process, but in reality, factors of supply (recognized technological opportunity) often prevail. The Foresight Tool provides a process approach to the selection of government R&D funding priorities - in line with the First Policy Framework approach.

3.2. The second policy framework

Innovation Model and its key policy actors

The fundamental model of innovation in the Second Policy Framework has been fundamentally revised with important implications for policy practice. It moves from a linear concept of the innovation to a more interactive model as illustrated by the chain link model. A related important research has distinguished the knowledge-creating structure of Model 1 and Model 2, distinguishing five basic features of the knowledge creation process of Model 2: (1) knowledge is increasingly created in the context of application; (2) a trans-disciplinary approach - merging or penetrating interdisciplinary frameworks to create new common frameworks for research in applied contexts; (3) heterogeneity and organizational diversity, reflecting the growing diversity of actors involved in knowledge production; (4) social responsibility and criticality, including many experts in the research process to respond to ethical and environmental issues; and (5) quality control, the observation of expert judgment about the contribution to positive science, becomes more complicated when knowledge is created in the context of application, not within of the scientific discipline with their purely scientific professional norms (*Gibbons, Limoges, Nowotny et al. 1994*). This group of authors proposes the need for institutional reform, paying special attention to the

relationship between direct government research efforts (e.g. in public/public research laboratories), research in industry and university research to encourage the creation of collaborative and collaborative networks. The focus on institutional links and interactions is very close to the second generation Innovation Policy Framework - the national system of innovation.

The second policy framework, or “the national innovation system,” emerged in a context of increasing international competition marked by economic shocks such as the oil crisis of the 1970s. Analysts began to realize that the transfer of knowledge encounters many difficulties/obstacles, and there, hidden organizational elements have not been considered. Following the emergence of Japan (*Freeman et al, 1988*) and South Korea (*Kim, 1999*) in the knowledge economy, this new policy framework has attracted the attention of society to different countries and regions of the world choose to learn in building innovation systems, characterized by systems and organizations that support learning, capacity building, and start-up. This policy framework led to a shift from a linear view to a system's interactive view of innovation.

The second policy framework aims to make better use of knowledge generated in the research area, to facilitate commercialization, and to bridge the gap between inventions and applications. This policy framework emphasizes different forms of learning, including learning through use, production and interaction, linkages between different actors (*Lundvall, 1992*), the ability to absorb and formulate corporate capacity and entrepreneurship. The reason for the policy intervention is the system failure: the inability to make the most of what's available due to lack of linkage or malfunction in the innovation system. Innovation policy focuses on technology transfer, building technology platforms and technology clusters to stimulate interaction and form human capital. In this innovation model, the tools such as Foresight, Evaluation and Management are the complementary activities to the core activities that promote the innovation with the assumption that any innovation is encouraged because the innovation is considered driver to economic growth and competitiveness (*World Bank and MPI 2018*).

Regarding policy actors, The Second Policy Framework reflects the changes in perception in the processes in which knowledge is created and exchanged. Rather than a linear sequential flow from scientific research to technological application and commercialization, knowledge is created through interactions between (more diverse) policy actors in innovation systems (National, sectoral and regional innovation) (*Edquist, 1997; Freeman, 1987; Lundvall, 1992, Lundvall et al, 2009; Malerba, 2005*). These interactions involve an interactive learning process and the building of capacities for acquiring and modifying knowledge, often influenced by geographical and cognitive proximity (*Lundvall, 1992*). For these processes to be effective, alignment of the goals

and the actor's competencies is needed. According to this model, several examples in the world have appeared, including Silicon Valley in the State of California or Street 128 in Boston City in the United States or the British Cambridgeshire region.

Policy practice

One of the defining features of the second Policy Framework is its greater concern with entrepreneurship. The spirit of the entrepreneurial spirit is a central issue in Schumpeter's writings. It was not until the 1980s, however, that a particular focus was on policies that nurtured entrepreneurship in relation to the formation and developments of new businesses, especially those enterprises involved in the application of technology, become a policy concern.

Government policy practice applied in the Second Policy Framework deals with education and training of workforce with the aim of supporting the absorptive capacity of businesses and other organizations. Absorptive capacity is one of the visible capacities when analyzing the process of knowledge creation and distribution deepened beyond the scope of the linear model of innovation shown in the First Policy Framework. 1. The First policy framework is based on the assumption that science is the foundation for long-term economic growth and innovation is mainly related to the commercialization of scientific research, which currently exists in contemporary STI policy debates.

Clearly scientific discoveries still play an important role in opening new opportunities for economic growth, although current understanding of the research process suggests that, in addition to entrepreneurial entrepreneurs, we also need the participation of large research groups and coordination among them. Reflections on policy practice stemming from the First Policy Framework have led to questions about the focus of research and research activities. It is argued that it is important to consider how the results of research efforts are used and absorbed in the economy. The Second policy framework appears to be aimed at enhancing the absorptive capacity of entrepreneurs through institutional linkages. The First Policy framework has shown that this innovation model has not yet resolved the externality-related problems. It is not only the speed of technological change, but also the direction of current technology development that still mainly focuses on using a lot of energy and natural resources, and lacks broad participation of stakeholders concerned. These features have not been addressed in the framework of the First and Second Policy Framework.

Although the first and second policy frameworks, with the exception of negative external influences, it is assumed that the innovation process is compatible with the welfare and social progress goals, the Third policy framework raises the question of STI's shortcomings in addressing sustainability and poverty issues and inequitable income distribution. These shortcomings can be seen as large externality that can be overcome through the

management tool within First and Second Policy Frameworks. However, The Third Policy Framework encourages deeper exploration of interrelationships of existing social-technical systems with social goals and ultimately the governance of innovation processes.

3.3. The Third Policy Framework

Innovation model and its key policy actors

The Third policy framework aims to change existing socio-technical systems. Several factors, including skills, infrastructure, industry structure, products, regulations and policies, user preferences, and cultural factors are considered to evolve together within a social-technical system (*Noorgard, 1994*). The components of a system tend to link and reinforce each other, making them difficult to change. Radical system innovation refers to the need to change all constituent elements of the existing socio-technical system and integrate them into the broader economy and society. Systems innovation is also related to social innovation, as the focus is not only on the technology component, but also includes other socially relevant components such as user preferences, policy and perception on the values and culture of other actors in the system. System innovation, in this context, concerns not only new technologies, but also the reuse and improvement of old technologies. System renewal involves many actors, including radical civil society actors who play an important role in the construction of new systems (*Kervlist, et al. 2008*). System reform is carried out throughout the development of the First and Second Policy Frameworks, but many social actors and constituent elements of the system always want to go beyond the scale of the traditional innovation model (mainly focused on economic development purposes) and became the key foundation for this Third Policy Framework.

In the innovation model operating under the Third Policy Framework, there is no best path to sustainability, income equity, and other socially desirable goals awaiting discovery. Instead, the process of system innovation (demonstrating change and disseminating technology or adopting) involves actors in the selection of alternative pathways, each capable of establishing yourself a trajectory for systemic change (*Stirling, 2009*). In this Policy Framework, the innovation paradigm must be experimental because, in the first place, there is no known path suitable for the purpose of meeting social goals or workability in large-scale applications. It is only through the accumulation of experience of many policy actors with different motivations and priorities that a path suitable for the purpose can be identified⁴. The aim of the experiment is systemic change backed by the scepticism that externality changes in existing socio-technical systems are likely to meet social objectives effectively.

⁴ This judgment will be illustrated and clarified in the remainder of this article - an analysis of Vietnam's experience in responding to the risks of the Covid pandemic 19.

It is important to emphasize that the Third Policy Framework is not a model of S&T management itself. Instead, it focuses on the innovation - seen as a search process, driven by social and environmental goals, perceived through experience and learning, and understanding by experiment and learning associated with experiment, ready to review existing agreements to redefine how social challenges are addressed. A fundamental requirement of the Third Policy Framework is that the innovation process can be effective in achieving these goals if it includes characteristics such as the participation of actors/stakeholders, being experimented and change the direction of development of socio-technical systems. This stems from the focus of the First Policy Framework on investment in research and development and expands useful knowledge flows, in which the interaction between government and the scientific community is central, combined with the issue of wide/spread. It also goes beyond the Second Policy Framework's focus - aimed at enhancing the ability of the innovation system to absorb and learn by building knowledge networks between the organizations that create and use knowledge, stimulates the cohesion and coordination of these organizations in an effort to induce technological change and to facilitate entrepreneurship, but at the same time, it is also geared towards growth, jobs and improve international competitiveness.

Both First and Second Policy Frameworks state that social and environmental goals can be achieved through economic growth and the ability to redistribute surplus generated through improved productivity and capacity of the technologist's community to tailor the externality factors involved in serving social and environmental goals. The Third Policy Framework, on the other hand, deals with considering and exploring these social and environmental goals with their underlying values, integrating them into systemic change processes. Open discussions help reach mutual commitment/consensus and seek solutions that effectively respond to social and environmental challenges, while acknowledging that these options are required to be tested, reviewing fundamental assumptions and values. The Third Policy Framework reveals the fact that, assumptions and values are co-created in these processes, they emerge with specific characteristics that are more shaped and reinforced in the process of system change.

Policy practice

Given the importance of search, testing, and learning, the policy practice in the Third Policy Framework involves finding the means to facilitate and empower those involved in these processes⁵. Technological change has always been related to a search process. In this Policy Framework, however, it is essential to

⁵ Policy practice of this Third Policy Framework can be seen in Vietnam with the sand-box experimental model currently being applied in searching for a new economic model - sharing economy/business model based on the platform (the form of technology taxi exist together with the traditional taxi form) or fintech financial model in financial and banking activities.

build capacity to reflect social and environmental needs, the search process must be guided by improvements in anticipate effects and unpredictable consequences of future risks⁶. Develop processes through which the prediction is to be a priority target for the implementation of the policy (through specific policy solutions) in the Third Policy Framework. Some guidance on the processes to facilitate project implementation and predictions are available in the practices developed related to the Technology Preview activities and evaluation activities. The focus of the Third Policy Framework's efforts is often on large-scale commercial applications that capture the next wave of new technology opportunities that could open up new possibilities, as seen in technology assessment of nanotechnology or biotechnology. In the Third Policy Framework, the purpose of prediction or anticipate is to identify areas for testing, through which to test the consequences of energy and natural resource use, newly created jobs, and the environmental impact of those changes. Predictive consideration is not intended to make blueprints available, but to create a wide variety of possibilities for choosing a variety of development methods. It aims to maintain a collective search and learning process instead of short-term assessment based on narrow criteria in the decision-making process.

Predictions are intrinsically inaccurate. While it can provide general outlines of possibilities, it cannot foresee details, but can only be clarified through experimentation and learning. Therefore, predictions must be combined with testing in a variety of possibilities proposed by predictions. Is recycling better than repairing and upgrading? What agricultural practices will prove viable to replace the current reliance on fossil fuels for energy, fertilizer, transportation and processing needs? What practices will be most effective in creating low-carbon buildings and infrastructure? These questions can only be answered through social experimentation - on a scale that goes beyond pure science. It requires social experimentation, only through real social experimentation, experience and deep learning generated; the advantages and disadvantages of a particular innovation pathway can be identified and overcome by modifying or by choosing a different development path.

The need to anticipate, experiment, learn and form networks and alliances reveals the emerging governance structure and institutional arrangements in all three domains - government, market, and civil society. It also proposes issues related to public and private finance and new ways to share and master the knowledge gained from these activities. In addition to these new institutional arrangements, ways to better connect existing institutions to gain coordination, accumulate, and learn from prediction and learning processes are essential.

⁶ This can be even more evident when the world is facing risks from the Covid 19 pandemic, a kind of risk that we have not really prepared due to unpredictability (uncertainty) as well as level of the impact coming from this pandemic risk, leading to not only a crisis in the health sector, but also an economic and social crisis.

This will require a range of new skills to connect the social sciences as well as to link the science, technology; engendering and mathematic (STEM) disciplines which have recently been a top priority for many countries are seeking to meet the need for international competition and economic growth through increased productivity. As the targets set for socio-technical systems reflect a broader range of social and environmental needs and broader ideas about social welfare, the connection between what is possible and what is desired would require policy actors to connect three disciplines - society, science and technology. This leads to the need to reorient the education policy and ultimately a pedagogical approach to the desired transition towards a more sustainable impact (*Vu Cao Dam, 2014*).

The Third policy framework (3rd generation policy framework) aims to transformational change, taking the starting point as negative impacts or external impacts of the innovation that may outweigh the positive contributions. This policy framework focuses on mobilizing the innovation process to address a variety of social challenges, including: inequality, unemployment and climate change. It emphasizes policies that orient socio-technical systems in the desired direction and integrate them into social processes of change. It requires socio-technical system change involving structural transformation in governance arrangements between the state, the market, civic society and the community of scientists, along with experimentation and responsible social learning, research and innovation, and a constructive role of the Foresight tool aims to shape the innovation process early. The innovation policy framework aiming at transformative change has the following objectives:

Expanding the concept of the innovation beyond its traditional focus on the innovation - not only paying attention to the innovation and considering the business as the center of the innovation, but also paying attention to the effects arising from integrating the innovation in society - broader concern beyond only supporting research and identifying priorities in research with the assumption that innovation is an extension and a next step from S&T activities to market and society. This type of innovation is called innovation based on the foundation of research and development (R&D). In addition to this type of innovation, which accounts for the majority, there are other types of innovation that account for a smaller part, asserts that innovation does not necessarily come from research and research activities, but as a result of practical activities in production and life. This may be called innovation not based on R&D. However, even if it did not arise from R&D activities of an organization, this type of innovation must still be based on the accumulation of knowledge, experience, and previous training of the innovators and so on, which is still the result of learning activities from S&T, education and training. Innovation policy needs to be continuously supported and revised, and at the same time, re-create socio-technical systems as well as develop new services and organizational

models to address social and economic challenges. STI policy formulation and implementation requires the participation of many actors from the business and other knowledge-producing organizations to users, NGOs and governments.

Provides direction for the innovation. In the Third Policy Framework, the innovation policy is not about defining priorities, but improving the process to open up a variety of options and pay more attention to the reasons for the elimination of options. The innovation policy will allow for in-depth learning, address the challenge of prevailing perspectives, and foster a greater variety of options. It will allow experimentation with options beyond those that have been formed in a narrow range and established by incumbent organizations - public and private sectors. It draws advice from the perspective of conflicts of interest as well as trade-offs between options favoured by different groups of actors (*Bach Tan Sinh, 1998 and Bach Tan Sinh, 2019*). It involves ensuring that governance arrangements are made in line with these goals.

Policy Framework 3 raises questions of the STI's gaps/limitations in addressing sustainability and poverty issues or inequitable income distribution. These gaps are considered to be external factors that have not been addressed in First and Second Policy Frameworks. This makes them inconsistent with each other. However, proposing Third Policy Framework does not mean giving up First and Second Policy Frameworks. Investing in knowledge-generating infrastructure and R&D is an important component of any policy. STIs, as well as building a set of linkages between policy actors and the encouragement of effective interactions, learning between them in the context of national or industry innovation systems.

The mismatch between the Policy Frameworks and the policy tools corresponding to each Policy Framework will be corrected from the Third Policy Framework. If we look at First and Second Policy Frameworks from the perspective of the Third Policy Framework, we will see that the proposed R&D investments in First Policy Framework should be consistent with the ongoing prediction and testing process and in line with the process of establishing sustainable development roadmap. Sustainable development is being recognized by society. The Second Policy framework, which addresses the process of building an innovation system and promoting entrepreneurship, also needs to be done at a more open level with the wide participation of policy actors. The questions that need to be asked are whether existing social-technical systems and activities promoting entrepreneurship will lead to unsustainable paths/modes of development, or whether we can find other paths and options for sustainable development (*Frenken, 2017*). In addition, we not only need to have the capacity to learn through use, production and interaction encouraged in the Second Policy Framework considered as examples of learning formed in the First Policy Framework, but also need a deeper learning approach, which can only happen when the innovations systems accept conflict, diversity and disagreement. In the long term, The Third Policy

Framework should address those factors affecting the formation and operation direction of innovation systems as well as investment methods for R&D (*Schot and Steinmueller, 2018*).

Instead of recommending the establishment of innovation systems at all levels (country, region and industry), it is possible to propose the exact opposite role of government - participating in experimenting and transforming existing relationships. Proposing to change the role of the government instead of focusing efforts to build the innovation system at all levels following to the model of developed countries, but need to support transformation through experimenting existing relationships, focusing on addressing local development challenges, which will be further analyzed in the next section of this article on Vietnam's experience in coping with risks from the Covid 19 pandemic - a policy experimental effort toward transformative innovation.

One thing that needs to be affirmed is that the challenges identified and embodied in the 2030 Agenda for Sustainable Development with 17 UN Sustainable Development Goals are very real. If inequality becomes more severe, the consequences of climate change and pollution begin to worsen, leading to more migration and possibly even more conflicts. Pervasive instability and the threat of armed conflict, most recently the 19 Covid pandemic, will eventually force the government and other actors to react. STI will have to be part of this response, as they are closely related to the creation of all these so-called peripherals (*Lundin and Serger, 2018*). It is therefore imperative that policy makers and researchers in this area not only develop a new Policy Framework, but also begin to test these new policy practices. These efforts will help address the dual social and environmental challenges that contribute to the transformation of existing socio-technical systems securely and at low cost (*Borras, 2019*).

However, even when policy actors are able to coordinate among Policy Frameworks and thereby achieve greater efficiency from the perspective of Third Policy Framework, there is still a mismatch between the frameworks over which policy actors will have to adjust. This is because the Third Policy Framework raises a series of deeper/more fundamental questions regarding the suitability of current socio-technical services with social objectives, and finally about the governance of the innovation processes. The Third Policy Framework argues that we will ultimately need a transformative change in many socio-technical systems for food supply, energy use, mobility, healthcare, provision of water and information in a sustainable way.

On a final note, the First and Second Policy Frameworks emerged and are being operated mainly in the United States and Europe, and have been criticized from a development perspective. Both of these Policy Frameworks argue that developing countries need to catch up with developed countries and that STI policy is a means of serving this process. The Third policy framework does not

assume that socio-technical system innovations and changes necessarily come from developed countries and other countries need to catch up with those innovations. On the contrary, all countries have the same role and position to contribute to transformative change and through which countries can learn from each other. This policy framework argues that there may be diverse pathways/modalities for change, and that building and adapting to complex and systematic change processes in each country should be recognized and accepted.

4. Piloting transformative innovation policies in the context of increased uncertainties in the future in Vietnam

As analyzed on the innovation model in the third-generation STI Policy Framework in the previous section of the article, “In this Policy Framework, the innovation model must be experimental, since there is no path to be found in the beginning to be suitable for the purpose of meeting social goals. It is only through the accumulation of experience of many policy actors with different motivations and priorities that a path suitable for the purpose can be identified”. This statement is quite relevant when considering the reasons why Vietnam has been successful in coping with Covid19's risks. That is, Vietnam has gathered a lot of valuable experiences over many generations in disaster risk management, climate change response (risks coming from outside - natural disasters) and applied for managing risks generated by human development (human induced disasters), such as community-based disaster management with the philosophy of “living with floods”⁷ especially suitable for the natural environment in The Mekong Delta and its “four on spot” principle applied in community-based disaster risk management (*Thomalla, et al 2017; Bach Tan Sinh et al, 2009*).

In the case of coping with the double risks from Vietnam's Covid 19 pandemic, the “four on spots” principle has shown the mobilization of participation from all sectors of society, from management organizations, state-to-business, public service-providing organizations, including research organizations at research institutes and universities, mass society organizations, in which there are non-governmental organizations, community, and especially the forces of the health sector, the military and the police. All response activities of all concerned social actors have been coordinated smoothly, flexibly but drastically by the State with the role of constructing and participating in the provision of public services. Since the discovery that Vietnam had two cases of Covid 19 infection at the end of January 2020 and the number increased rapidly after March 7th, 2020 showed signs of infection in the community, Vietnam has declared the pandemics across the country, strict application of travel restrictions and social

⁷ In the Third Principle of the Strategy for Natural Disaster Prevention and Mitigation to 2020, approved by the Government in 2007, stated: “The work of natural disaster prevention, fighting and reduction must comply with the motto “four at on the spot” (on-site command, on-site forces, on-site supplies, logistics on-site) and proactive prevention, timely response, and prompt and effective recovery” (*JANI, 2010*).

isolation from April 1st, 2020. By the second half of April 2020, the number of infections gradually decreased, no more infectious cases appeared in the community. By the end of June 2020, Vietnam had good control of new infections from immigrants.

In each evolutionary period of the 19 Covid pandemic, Vietnam has had flexible and timely policy responses, mobilizing the participation of the entire socio-political system. With the motto “anti-epidemic like anti-enemy”, epidemic control is the top priority, facilitating social and psychological stability of the people, minimizing damage, then gradually shifting to epidemic prevention and restore production - business activities, restore the economy after the pandemic. Vietnam has built up the confidence of people and businesses in epidemic prevention, especially in terms of management associated with “dual goals” - while focusing on promoting production - business and continuing to prevent Covid pandemic.

Communication activities on pandemic epidemic, government scenarios and solutions are carried out in a transparent, regular manner and with broad participation of social actors representing different interest groups. The lessons of communication through various forms such as sharing the song “Jealousy Covid”⁸ on the mass media and social networks have been highly appreciated by the world as a “phenomenon” for other countries to learn⁹. This is an example of communication innovation that involves scientists from the university with musicians, media and regulators to deliver messages about how to prevent spread in the way easy to understand and thereby raising awareness of the entire population.

Vietnam's experience in responding to risks from the Covid 19 pandemic shows the need to reconsider the approach in STI policymaking in Vietnam, which emphasizes the shift from learning and applying STI policy models built in developed countries (under the First and Second Policy Frameworks) to piloting policy towards transformative innovation (under The Third Policy Framework), where to re-establish the roles and interactions of policy actors representing the public sector, the STI community, the business community, and non-state organizations.

⁸ “Jealous Co Vy” is based on a V-pop song, “Jealous” (English: “Jealous”), originally released by Min and Erik on YouTube on May 23rd, 2017. Updated song released by the Ministry of Health and released in response to the COVID-19 epidemic in Vietnam as a measure to promote hygiene habits against COVID-19, including washing hands, not touching faces and keep the surroundings clean. Khac Hung was contacted by producer Hoang Diem Huyen from the National Institute of Occupational and Environmental Health (VNNIOEH) in early 2020 to compose a song to promote methods of preventing virus. However, due to the lack of time, the two decided to choose a hit song and rewrite the lyrics. Hung, then chose Jealous as the title of the song. The video was taken by Yang Animation while Quang Dang composed the video based on the hand movements described in the lyrics.

⁹ From (hashtag) #GhenCoVyChallenge has achieved more than 21.5 million views on video sharing app TikTok. Quang Dang's dance video was also promoted by the United Nations Children's Fund (UNICEF). American comedian and TV presenter John Oliver “Last Week Tonight with John Oliver”, called the song “genuine club-banger”. The Huffington Post complimented the song with the dance moves in the video. It also received praise from South Korea's Seoul Broadcasting System while French BFM TV claimed that the V-pop song may have helped prevent Covid's massive destruction in Vietnam.

5. Conclusion

Reconsidering the innovation policy is a topic of social concern. Many research councils, governments and international organizations want the Innovation concern should give more attention to the major challenges facing society today. Social renewal practitioners are already familiar with the ideas of social change and fundamental/deep transformation. However, such ideas are still little-known in the innovation policy community. In the policy-makers community, STI and social innovation are often seen as two different groups of fields, the first group of areas interested in economic policy and science-education-universities, and the second group of areas interested in development and social policy (*Lundin, N and Serger, S., 2018*). A transformative innovation policy is a way to connect these two disciplines to conceptualize relevant concepts and provide practical action/ activity for transformation. The transformative innovation policy recognizes that, at present, social challenges, such as climate change, inequality and migration, are systemic issues that cannot be radically resolved if only based on science and technology. Therefore, there is a need for a change in perception and action in research and policy making on science, technology and innovation according to Einstein's argument that "Problems cannot be solved at the same level of awareness that created them" /.

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