

INNOVATION AND NATIONAL INNOVATION SYSTEM THAT ARE BEING FORMED¹

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Summary:

The article introduces the concept and basic connotations of Innovation and analyzes the use of the term “Innovation” to ensure correct (accurate) use in research as well as in administration and management. After a summary of the concept, constituent elements and activities of the National Innovation System, some concepts about other “systems” and “ecosystems” are presented additionally to clarify the differences between these types. In the final part, the article analyzes the characteristics of the National Innovation System being emerged in developing countries, then identifies some common structural problems and determines the role of the state in building the foundation for the NIS in Vietnam in the near future.

Keywords: Innovation; National innovation system.

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1. Background

Innovation along with science and technology (S&T) plays a huge role and importance in the socio-economic development of each country and the whole world. Looking around in everyday life, everything we see can be considered a product of innovation. Computers, candles, televisions, satellites, kettles, cars, medicines and even handwriting are all products of mankind's past innovations. Innovation does not only take place in tangible products, software, design, art, and a series of other less tangible innovations are also at the heart of the modern economy. Innovation is the lifeblood of an enterprise. It allows companies to compete in the market, create new products and services that serve customers, and reduce costs by improving efficiency. Innovative companies are more likely to gain a larger share of existing markets and create new markets: many popular products are highly appreciated today, such as smartphones or online television services, was conceived less than a generation ago. Enterprises with innovation grow twice as fast as enterprises without innovation.

With the great contributions of innovation to development, over the past decades, there have been many efforts to research and understand more clearly the nature and concept of innovation and issues related to innovation to help

¹ The author used some reference materials from colleagues Tran Ngoc Ca, Nguyen Vo Hung, Nguyen Ha Thi Quynh Trang (National Institute for Science and Technology Policy and Strategy Studies) with the consent of the authors.

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policy makers in countries can maximize the role and impact of innovation activities in economic and social life.

In Vietnam, in recent years, there have been studies approaching the National Innovation System (NIS) to learn about the characteristics and roles of science, technology and innovation (STI) in socio-economic development, especially in developing countries like Vietnam to serve management and policy making works. However, up to now, the concepts of “innovation”, “technological innovation”, “creative innovation”, “innovative start-up”, “innovative system”, The “national innovation system” in Vietnam is still not uniformly understood. Besides, in recent years, many new concepts have appeared such as “innovative startup ecosystem”, “innovative ecosystem”, “innovative enterprise” causing confusion in identifying objects and policy solutions, as well as causing difficulties for management and administration.

Besides, according to research by Tran Ngoc Ca and colleagues, after nearly 40 years of Doi Moi (reform) and opening up the economy, the entities in Vietnam's NIS have developed very diversely, performing different roles. But because the functions between relevant parties in the NIS are not clearly defined, the co-evolutionary connection between the institutional system, state agencies, public organizations with market elements are still weak, sometimes even out of phase, so the operation of Vietnam's NIS is still not really in sync, creating new growth momentum for the economy. This can be considered one of the biggest challenges for planning and building Vietnam's economic policies in the coming period.

To contribute to improve the mechanisms, policies, and state management of innovation in the coming time, this article provides some explanations with the desire to further delineate and clarify the concepts and connotations of innovation, as well as that of the NIS and along with that, state management activities in this field.

2. Innovation - Concept, connotation, and some related terms

2.1. Concept and connotation of innovation

In a study by Schumpeter J.A (1934) on economics, innovation³ is described as forms related to: *The deployment of new goods (products) for consumers, or of high quality than their previous products; Implement new production methods for the specific industries and economic activities in which they are used; Open new markets; Using new raw materials; Implementing new forms of competition leads to structural changes in industries (Backhaus J.G., 2003).*

³ “Innovation” is translated into Vietnamese as “Doi moi sang tao” to distinguish it from the Vietnamese phrase “Doi moi” that has been internationalized as socio-economic “reform” in the 1980s-1990s in Vietnam.

Research by Nguyen Hoang Hai (2022) has synthesized some concepts and characteristics of innovation as follows:

- Drucker P. F. (1985) describes “Innovation as a path to change”. According to the authors, “Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for another business or another service. It is expressed in terms of the ability/capacity to learn and practice” and “The application of practical tools and techniques that create changes, large and small, to products, processes and services that bring something new to the organization that adds value to customers and contribute to the organization's knowledge base;
- The innovation process must be seen as a series of changes in a complex system not only in hardware, but also in the market, production base, knowledge, and social context of the innovation organization (*Kline S. J. , Rosenberg N., 1986*). Innovation is not just about developing technology, it includes how to finance, how to market and marketing relationships, how to create strategic partnerships, how to deal with governments. The innovative nature of business activities must be pervasive within the company and must consider more than technological developments (*Rasul F., 2003*);
- Godin B. (2008) gives some concepts of innovation described as follows: Innovation is the process of implementing something new; Innovation is a process of imitation; Innovation is invention; Innovation is discovery; Innovation as human ability for creative activities; Innovation is imagination; Innovation is ingenuity; Innovation is creativity; Innovation is change in all areas of life; Innovation is cultural change; Innovation is social change; Innovation is organizational, political, and technological change; Innovation is the commercialization of new products.

With the desire to come to a more unified understanding, the Organization for Economic Cooperation and Development (*OECD, 2005*) has made recommendations on the concept of innovation: “is the implementation of a good improved product or service or process, a new marketing method or a new organizational method in business practices, work organization, or in external relations”. In 2005, OECD divided innovation into 4 types based on 4 constituent elements with the purpose of specifying innovation activities, including: product innovation, process innovation, marketing innovation and organizational innovation. Since 2018, OECD has rearranged to only product and process innovation. Accordingly, an innovation is a new or improved product/process (or combination) that has a clear difference from the unit's previous products or processes and is at the same time offered to potential users (for products) or used by the unit (for processes).

According to research by Tran Ngoc Ca (2021a), it can be identified that “*Innovation is the conversion/process of converting new ideas and knowledge*

into a specific result such as a product, service, process... that brings increased benefits for the economy and society”. In other words, innovation is considered something new (products, processes, markets, raw material sources...) but must be linked to production and markets. Therefore, innovation plays an essential role in economic growth as well as social development of countries. With the above content, most innovations come from sources of knowledge, and ideas, which are basically based on the results of scientific research and technological development of research institutes, universities, or the business sector. According to this approach, *innovation is an extension, the next step of S&T activities going to the market to create added values for socio-economic development, therefore, innovation cannot be separated from S&T*.

Regarding classification, innovation and innovation activities can be classified in several different ways.

- Based on the output of the innovation process, OECD classifies it as follows: Product innovation: quickly bringing new products to market or simply improving existing product lines; Service innovation: providing a new service or improving existing service models; Process innovation: putting a new process into use, even though it may be for a non-new product; Innovation aims to introduce a new business model or completely new market;
- Based on the nature of the process of implementing innovation, Schumpeter classifies it as follows: Incremental innovation: type of innovation that offers small improvements but has a significant impact on existing products and services. For example, laundry detergent mixed with bleach and scented laundry detergent; Radical innovation: type of innovation based on the creation and application of new technologies to create new services and new products to serve the market. New products and new services can create new markets, or even new industries. For example, the shift from traditional phones to smart phones led by the iPhone has created new generations of customers and new industries and services.

2.2. Some related terms

Invention:

According to Vu Cao Dam (2005), an invention is a technical solution that is new in technical principles, creative and applicable. According to the above explanation, an invention is an idea, model or drawing of a new product or production process. Inventions may or may not be patented (after registration) and may not immediately create new products or processes that are accepted by the market. A new invention is only at the potential level, registered but has not yet created specific value. Meanwhile, innovation is about putting these ideas into practice to create added value (for example through commercialization) because innovation needs to have both novelty and implementation. In many

cases, “invention” and “innovation” are so closely linked that it is difficult to distinguish, but basically there is always a time lag between the creation of an “invention” and the creation of an “Innovation” results.

Innovative startups:

By the end of the twentieth century, with the rapid development of information technology and the birth of many new business solutions, the term start-up was added and formed a new term, gradually being used more frequently. A more common way is the term “start-up”. The term start-up is often used to refer to a new enterprise that conducts business activities on a creative, groundbreaking, and highly effective platform. According to Isenberg (2011), an entrepreneur is someone who continuously tries to create economic value through growth. This implies that entrepreneurs are often dissatisfied with the present, always aspirational, adventurous, and have different perceptions. Entrepreneurship can be understood as self-employment plus aspiration. He believes that it is necessary to distinguish between small and medium-sized enterprises and start-up enterprises. Blank and Dorf (2012) studying startups also agree with Isenberg (2011) and argue that a startup is a temporary organization that seeks a scalable, repeatable, and profitable business model, besides that, it has a growth potential. Startup companies are also often characterized as innovative because they tend to develop/intend to provide new products and services to the market.

Meanwhile, a concept called innovation-driven enterprises (IDEs), which can be abbreviated as innovation startups, is defined by Aulet and Murray (2013) as businesses that try to exploit global opportunities by identifying and commercializing innovations with high growth potential, or in other words innovation-based growth, creating competitive advantage. IDEs seek to change the way an industry operates, or the way people work by introducing an innovation that has the potential to impact an entire region or even the world. They are ambitious and can attract outside investors who will support their rapid growth goals to access regional and global markets. They attract talent and build strong teams with diverse capabilities to meet this major challenge. Such an IDE business can be understood as a startup business based on innovation, developing through 3 stages according to the simplified model of Autio (2017): startup, scale up and standup (Nguyen Ha Thi Quynh Trang, 2019).

According to research by Nguyen Ha Thi Quynh Trang (2019), innovative startups are different from regular business startups or SMEs in that: (i) The main goals of business startups or SMEs are for financial benefits, while innovative startups aim for innovation and invention; (ii) The business loop is the process of production and distribution to target customers and receiving profits. Business loops often create value, but innovative startups don't always care about that. That is the reason why many innovative startups must bear huge debts and face financial problems, in many cases leading to bankruptcy; (iii)

Risk and pressure: This is an issue closely related to the innovative startup entity, related to the entire project.

In Vietnam today, there is still a lot of debate about how the concept of “innovative startups” (currently called “innovative startups” in Vietnam) is distinguished from other types of business startups. In Vietnam's current conditions, with the ambition to innovate the growth model based on creativity and technological innovation, participating in global competition, the concept of innovative entrepreneurship needs to be understood more broadly and policies for innovative startups and innovative startup ecosystems also need to be more comprehensive. As seen in the research of Nguyen Ha Thi Quynh Trang (2019), it is possible to consider the type of startup enterprise based on innovation (Innovation Driven Enterprises) *as a set of resources (including human resources, finance, time,...) to implement the idea of finding and building a new business model, capable of repeating or replicating in different markets, often risks taking, and trying to exploit new global opportunities by identifying and commercializing innovations with high growth potential, creating competitive advantage.* This concept is close to the concept of innovation-driven-enterprises (IDEs), identified by Aulet and Murray (2013) *as businesses that try to exploit global opportunities by identifying and commercializing innovations with high growth potential, or in other words growth based on innovation, creating competitive advantage.*

3. National innovation system and the role of the state in the national innovation system

3.1. National innovation system

NIS has been recognized by researchers and policymakers as a theoretical framework to identify, review and analyze a country's science, technology, and innovation system. Currently, there are many different definitions of the NIS, typically the definition of Freeman (1987); Lundvall (1992); Nelson (1993). Each scholar has a different perspective on the innovation system (*OECD, 1997*).

Freeman (1987) sees the NIS as a network of institutions in the public and private sectors that operate and interact with each other in initiating, receiving, adjusting, and disseminating new technologies.

Lundvall (1992) sees the NIS as consisting of “interacting elements and relationships in the production and dissemination of new, economically useful knowledge”. Lundvall no longer focuses much on the sectoral aspect but shifts its focus to the broader national institutional framework within which businesses and other organizations operate, and this framework appears to be especially important with the speed, degree, and success of innovation that emerges and spreads throughout the economy.

Nelson (1993), in his study describing the innovation systems of countries, identified the NIS as a set of institutions with decisive interactions in the implementation of innovation in national enterprises. In Nelson's view, innovation is implemented according to the model of science, technology, and innovation and therefore the NIS is synonymous with the national science system.

According to Metcalfe (1995), the NIS is considered a set of institutions, which collectively and individually contribute to the development and diffusion of new technologies and provide a framework for implementing government policies in the innovation process. The most important characteristic of this set is its interconnectedness, the way the different elements interact (*OECD, 1997*).

Nowadays, the broad view of innovation systems is more widely used. The NIS is seen as an open, evolving, and complex system, including relationships within each organization and between organizations, institutions, and socio-economic structures, which regulate the pace and path of innovation as well as building professional capacity comes from the process of science-based learning and experiential learning.

The main strength of this analytical approach of this model is that it helps explain the position and role of small companies in innovation and how they can survive the competition and pressure from large companies. The synergistic effect of innovation networks explains their ability to generate positive overall effects for all participating actors. Small companies are also very capable and can adapt more easily to changing requirements coming from different customers and markets. They are better equipped to deal with technological risk and uncertainty. These systems facilitate communication, information provision and knowledge transfer.

The NIS also explains the differences between countries and the different roles of government. It highlights specific patterns of science, technological and industrial specialization, expertise, and institutional structures, and most importantly, how different countries learn to develop technology. This concept is also not only relevant at the national level and can be applied worldwide or to regions, localities, and sectors.

According to Tran Ngoc Ca (2021b), in general, innovation systems have a few common points:

- Includes organizations (research institutes, universities, businesses, state innovation support organizations,), and most importantly, the interactive links between these organizations;
- Includes both public (government) and private sector actors;
- Includes institutions such as policies and laws that affect the above interactive links;
- Have a common goal of supporting innovation activities (transforming knowledge and ideas into specific products that create value).

Regarding classification, innovation systems in countries can be divided into emerging innovation systems and mature innovation systems (*Lundvall et al., 2009*).

Emerging innovation systems are innovation systems in the early stages of formation, already have some elements (universities, companies, intermediary organizations) but often have low technological capacity and weak formal links between institutions, and a socio-economic environment characterized by high levels of informality, limited access to basic infrastructure, poor business environment, uncertain institutional framework and human capital has very limited qualifications. In this system, learning is based heavily on traditional knowledge and craftsmanship. Learning-by-doing and vocational training dominate economic activities, although learning about science, technology and innovation can also take place in some organizations of the economy. Social networks tend to be based on kinship and geographical location.

The mature innovation system: it usually exists in high- or middle-income countries. Some previously developing economies that had mature innovation systems were Asian tigers such as Hong Kong, Singapore, South Korea, and Taiwan. It can be seen that some common points of the NIS are: Including organizations, also known as actors or elements, (R&D, universities, businesses, intermediaries,...) and most importantly, the connection interactive links between these organizations; Including both public (government) and private actors throughout the country; Including institutions such as policies and laws that affect the above interactive links; They have a common purpose of supporting innovation activities (transforming knowledge and ideas into specific products that create value) (*Dang Thanh Tung, Tran Ngoc Ca, 2023*).

According to Cao Thu Anh et al. (2019), Hoang Van Tuyen et al. (2019), the innovation system can also be approached according to the Sector Innovation System (SIS) and the Regional Innovation System (RIS). In particular, the sectoral innovation system is the approach used for innovation activities in scale and at the level of an economic sector. The innovation system perspective has been used to enrich the economic field of an industry and its dynamics. The sectoral innovation system approach also focuses on groups of manufacturing and product development companies in the same industry, creating and using the technologies of that industry. The sectoral approach is widely used by many developing countries as an analytical basis for industrial policy and strategy definition, as it allows a better understanding of the structure and boundaries of groups and chains, intervening agents, and interactions between them.

For regional innovation systems, this concept comes from the development of the most general concept of innovation systems, applied to more specific types for a certain area or boundary, called scale specialization. The specialized innovation system is the focus area of many businesses (including equipment and service suppliers and customers) and non-market organizations (universities, research institutes, training organizations, quality certification

agencies, local trade associations, legislatures, technology transfer organizations, business associations, government agencies, etc.) join to create products, new services in certain areas.

3.2. The role of the state in the national innovation system

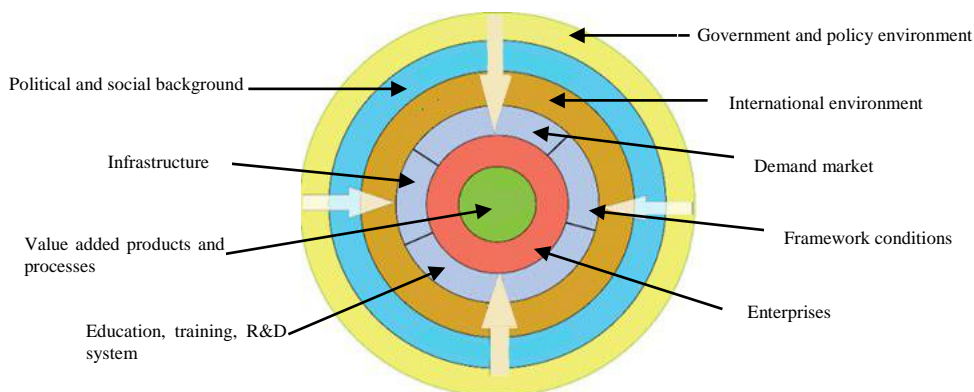
In most countries in the world, especially in developed countries, the state is the subject that plays an important role in building the NIS. The role of the state is expressed through the implementation of the following functions (*Nguyen Thi Tue Anh, Tran Binh Minh, 2019*):

- *Direct investment in innovation:* The formation and construction of the NIS cannot be separated from the direct investment role of the state to quickly promote the creation, transfer, application and dissemination of knowledge, science and technology, and new product. OECD reports show that, in most countries, from 10% to 20% of enterprise research and development is funded by the state budget through various forms of investment.
- *Creating a favorable environment for innovation:* Building a NIS requires a good environment, including mechanisms to encourage innovation, intellectual property policies, innovation funds, legal systems and civil rights guarantees in research activities. State mechanisms and policies are important for promoting innovation, research, and development activities of businesses in all fields and industries, contributing to helping businesses grasp mainstream technology trends. Besides, building and perfecting the legal system to create a legal environment for innovation is also an important role of the state. In addition to promulgating legal documents, the most common view that countries agree on is “recognizing and encouraging everyone to have maximum freedom within the framework of the law; through freedom to innovate and unleash creativity”; Implementing the motto “liberation of thought”, ensuring freedom of thought in scientific research, especially in social science and humanities research, is also an issue that developed countries attach importance to in order to contribute to promote innovation and creativity;
- *Regulating innovation activities:* Building a NIS requires the integration of resources and strength from the national and international, central, and local levels, state agencies, and the state-enterprises-universities and research institutions. All of this requires the state to perform well its regulatory function, including state regulation of international cooperation activities in science and technology to promote international exchange and cooperation in science and technology in width and depth.
- *National innovation policy and strategy planning:* Building a national innovation strategy requires a clear innovation strategy. The innovation strategy will set out goals, time, steps, and tasks.

4. Some concepts related to the national innovation system

4.1. Innovation ecosystem

According to research by Tran Ngoc Ca (2021a), innovation ecosystems originate from a concept in biology: a biological ecosystem is a complex set of relationships between living sources, habitats, and other individuals of an area, whose functional goal is to maintain equilibrium. Meanwhile, an innovation ecosystem simulates the economic dynamics of complex relationships formed between actors or entities with the functional goal of facilitating technological development and innovation. Here, the actors include physical resources (funds, equipment, facilities...) and human resources (students, lecturers, staff, industrial researchers, representative's industries...) form entities participating in the ecosystem (e.g., universities, colleges, business schools, enterprises, venture capitalists (VCs), universities, research institutes, industry, centers of excellence, business support organizations, funding agencies, policy makers, etc.). Thus, in essence, an innovation ecosystem is no different from an innovation system in general but puts more emphasis on the dynamic interaction factor (ecological as in a biological organism) of the actors in the system, which is core of the innovation system. Therefore, the full name should be called Innovation Ecosystem with the prefix *eco* placed before the word *system*, and *Innovative Ecosys* is just an abbreviation.



Source: Tran Ngoc Ca (2021a)

Figure 4. Innovative ecosystem with businesses as the center

4.2. Startup ecosystem and innovation startup ecosystem

According to research by Nguyen Ha Quynh Trang (2019), the startup ecosystem approach inherits several existing scientific approaches and disciplines when explaining the relationship between the development of a geographical area and the convergence association of entities and different economic activities in that geographical area. According to Isenberg (2011), the entrepreneurial ecosystem consists of a group of factors (merged into 6 groups),

although these factors are common, they interact in very complex ways, always present if entrepreneurship is to sustain itself. Thus, although the combinations are always unique, for a sustainable start-up, it is necessary to have policies, markets, capital, skills, culture, and support.

Combining the ecosystem approach with innovation start-up efforts has led to an approach to analyzing the innovation start-up ecosystem. According to foreign research, the innovation startup ecosystem can be understood as a system of innovation-based startups entities, organizations and individuals that support each other within a scope of activities (city, region, country, field, area, etc.) and certain environments. The individual contributions as well as the combined impact and interaction of the above factors with the goal of supporting startup activities based on innovation are all necessary for the growth and development of the ecosystem. Startup ecosystems can have specific industry characteristics (pharmaceuticals, information technology,) but can also evolve from one industry to attract several other industries.

Compared to the innovation ecosystem, the innovation startup ecosystem approach has a more limited scale and only focuses on the startup area and cannot completely replace the innovation system related to all innovation activities of different types of businesses.

4.3. Startup center and startup support center

Along with start-ups and startup ecosystems, the concepts of “Startup Center” and “Startup Support Center” also need further clarification. A center is a type of organization, which can be a hard organization (with physical headquarters, geographical boundaries, functions) or a soft organization (no specific location, no geographical boundaries or headquarters as a program or group) to carry out startup business activities or provide support services for startup businesses. Regarding the main function, the startup center is a place to gather startup businesses, directly carrying out startup activities such as raising capital, organizing product development... while the startup support center will carry out support activities for startups such as training, organizing events to meet investors, site or premises supporting,...

A concept that also needs further clarification is innovation center. This can also be a hard or soft organization, but different from a startup center or a startup support center that targets startups and startup activities, an innovation center is to carry out activities related to innovation to bring knowledge (mostly in the form of technology, know-how, management solutions, etc.) into production and business practices to create added economic value (meets the two connotations of innovation: being new and being put to use to create value). In other words, to be called an innovation center, that organization must create direct economic efficiency from innovation activities; otherwise, that organization will be a research and development center, or a technology incubation center or

technology consulting center, etc. The name innovation center can also be attached to a small organization with a few people with limited funding or to a large organization with thousands of people with abundant resources. Depending on the scale and focus, innovation centers can be associated with different names such as: National Innovation Center, Regional Innovation Center, Sectoral or specific localities such as Hanoi City, Ho Chi Minh City, or it can be from an enterprise such as FPT Innovation Center or TH True Milk, or from a group of individuals belonging to an professional association such as the Vietnam Union of Science and Technology Associations (VUSTA), or Hanoi University of Science and Technology,... Even the name of the national innovation center is not unique but can be different types of organizations with different scales and focuses (for example, the National Innovation Center on medicinal materials, National Innovation Center on microchips, National Innovation Center on smart transportation...).

5. National innovation systems are forming in developing countries and in Vietnam

Many studies on NIS in developing countries are conducted based on the model for a complete NIS like in developed countries, so assessments often focus on the system of S&T agencies such as research institutes, national laboratories, universities, etc. and almost exclusively focus on R&D activities and commercialization of R&D results of public S&T organizations. When analyzing institutions, these studies often focus on formal institutions expressed in legal documents. There are not many studies on enforcement effectiveness as well as on other types of institutions, including official and unofficial.

However, the NIS of developing countries or the NIS that are being formed are fundamentally different from the completed NIS model identified by the OECD (*Lundvall, et al., 2009*). In the emerging NIS, several entities, institutions, and linkages have appeared and are operating, but many other institutions, entities and linkages are still missing. Determining which institutions, entities and links govern the formation of the development direction of the NIS in developing countries will help the planning of innovation policies in general and science and technology policies more objective, realistic, and operationally meaningful.

According to research by Lundvall and colleagues (2009) and Tran Ngoc Ca (2021a,b), the emerging innovation system in developing countries has the following typical characteristics:

Incompleteness:

In low- and middle-income developing countries, the emerging NIS has completely different characteristics from the established innovation systems in developed countries. A complete, well-functioning system is understood to have all kinds of capable organizations, interactions between these organizations are

positive, helping to create the dynamism of the system. Both market and non-market institutions have shaped, taken root and promoted its role in coordinating the activities of the whole system, creating a favorable environment for innovation activities. The emerging innovation system does not have such completeness. However, that inadequacy should not be seen as a manifestation of weakness; on the contrary, this may just be a normal feature, consistent with the level of development as well as the economic structure of the developing country.

Business interaction is key:

Although interactions within the business sector are the most obvious and important interactions in the emerging NIS, the nature of these enterprises can hinder the NIS from developing to a higher level. Developing countries have very different framework conditions than developed countries, such as weak legal systems (weaker property rights guarantees, weaker contract enforcement, higher transaction costs...), unfavorable demand conditions (low purchasing power of the domestic market, simple demand, no sophisticated requirements, often modest market size...), instability of macroeconomics and prices are also higher. The above factors all cause difficulties for innovation activities.

Business structures often lack diversity, focusing one-sidedly on some industries and regions. Exports are still mainly agricultural products and resources. Some manufacturing industries account for a high proportion of exports but are controlled by foreign direct investment (FDI) enterprises and have low added value, due to the majority of input materials must import. Enterprises mainly invest and learn to improve production capacity, while design capacity, market capacity, and innovation capacity have not yet developed.

There are not many businesses implementing innovations that are “new compared to the world” or “new compared to the (domestic) market”. Most businesses passively buy technology without innovation or with only minor improvements. The gap in labor productivity compared to international standards is still very large, and the prospect of rapidly narrowing it through the diffusion and dissemination of stable technologies is very promising, however, in reality, not many countries have realized this, partly due to weakness in policy design.

The number of enterprises in the low productivity group, operating without standards, and slow progress still accounts for the majority, while only a few enterprises surpass and continuously improve their capacity and labor productivity. It is noteworthy that the above stagnation exists in the context of a relatively large number of businesses entering and leaving the market. If in developed economies, a new business is born, no matter how small, but it often means they have a new business idea, some innovation and can completely challenge the position of previous businesses. In developing countries, it is often seen that a series of “average” businesses are born to replace a series of other “average” businesses that leave without any change in quality.

Although the interaction between businesses in the emerging NIS is the main type of interaction, clearer than other interactions, it is still at a low level. High transaction costs due to low contract enforcement and many other uncertainties make market-based transactions (based on sales contracts) between businesses contain many risks, the benefits of expertise, therefore, is not fully exploited. With limited domestic supply of machinery, equipment and intermediate products, businesses must choose between accepting the use of low quality, unstable inputs and self-guaranteeing inputs or importing them. Many businesses have chosen the second way, whereby cooperation between domestic businesses is limited, opportunities to learn technology within the bloc have not been promoted (*Tran Ngoc Ca, 2021b*).

In the emerging NIS, many FDI enterprises contribute an important part to creating the interactions and dynamics of the system. The proportion of FDI in total fixed assets formed is quite large. The group is also a valuable source of new technology for local businesses. FDI enterprises can bring technological know-how, management and marketing skills, export leads as well as reputation. On the contrary, these enterprises can also stunt efforts to develop indigenous industries. Exploiting the opportunities that FDI enterprises bring and limiting possible negatives will be an important content to upgrade the innovation system to a higher level of development. In addition, the governance model of the global value chain (GVC) that indigenous enterprises participate in will regulate the learning mechanisms that indigenous enterprises can exploit.

Research organizations and universities play a supporting role instead of leading innovation:

The linear model considers innovation as a consequence of R&D activities, so research organizations and universities with the function of creating and disseminating knowledge are often expected to play a leading role in innovation. The above linear model is actually only suitable in some fields with high research intensity, mainly in leading developed countries, where important innovations often come from official R&D achievements. In the context of developing countries like Vietnam, the novelty characteristics of innovation are relative (new compared to businesses), where innovation is often implemented according to the methods of learning by doing, learning by using and learning by interacting with customers and suppliers, it will be difficult for research organizations and universities to meet the expectations of leading innovation roles.

To capture business opportunities, many businesses invest in standard machinery and equipment systems, mostly from foreign suppliers, to help them connect with the market and win customer's orders. Domestic S&T organizations often do not have a competitive position as suppliers of alternative technology and equipment to indigenous businesses because the incentives that govern their activities often do not encourage them to move in this direction. The role of supporting domestic enterprises in the process of learning technology

is probably more appropriate and it is necessary to adjust the incentive mechanism of S&T organizations in this direction (*Tran Ngoc Ca, 2021b*).

Unlike universities in developed countries, universities in developing countries participate in the innovation system mainly with the function of providing trained labor. However, if motivations and incentives are misaligned, some universities can become degree-producing machines, rather than actually helping provide a quality, capable workforce with appropriate knowledge. University systems in developing countries also have very limited investment and lack resources to create new knowledge and important innovations.

Formal institutions are lacking and weak

In a developed market economy, the most important institution is the market, especially the laws and rules that ensure competition and competitive choice mechanisms. When competing, businesses with higher productivity and more successful innovation will profit and develop, while weaker businesses will be eliminated. Over time, average productivity and income will gradually increase (*Nguyen Vo Hung, 2014*).

In developing countries, formal regulations and laws have limitations, and more importantly, enforcement is often unreliable and lacking standards. In some developing countries, governments often intervene deeply in resource allocation in many ways with the desire to pursue development goals and expect widespread effects. However, intervention can also be diverted to bring local benefits to some businesses, regions, or industries. The results of such an intervention method will not encourage innovation activities (*Nguyen Vo Hung, 2014*).

The lack of effective and transparent legal institutions is also a major problem, making law enforcement difficult, investment risks and transaction costs increasing. As a result: (i) long-term investment is not encouraged, but instead the business style is still predatory and short-term; (ii) businesses often avoid dependence on other businesses by making their own or importing, leading to a reduction in the benefits of specialization and mutual learning between businesses and accordingly the value chain is shortened.

The NIS approach often focuses on non-market institutions, such as knowledge brokering and network building, university-business linkages, science parks or technology parks, and support mechanisms from the state for technology transfer and learning activities. The development of science, technology, and innovation policies according to the NIS approach therefore often focuses on institutions of this type. However, in the context of developing countries, due to the weakness of market institutions, this focus needs to be balanced with the task of building market institutions in general to have a long-term and profound impact on all entities in the economy.

Resources are scattered among many goals and many other goals must be prioritized

For most developing countries, infrastructure development and poverty reduction are often high priority goals. This leads to two problems for innovation policy: (i) With a limited budget, priority must be given to spending on social welfare, investment in infrastructure development and basic services. There will not be much state budget left for science, technology and innovation programs. In fact, the ratio of spending on R&D and other innovation activities to GDP of developing countries is often much lower than that of developed countries; (ii) The small amount of budget available to support innovation must be spread across many fields, while focusing on activities that help create a sustainable living foundation and better income for people (*Nguyen Vo Hung, 2014*).

One thing that is often seen in science, technology and innovation policies in developing countries is the copying (imitation) of policies of developing countries and/or of emerging countries and territories (most notably Korea, Taiwan, Singapore) accordingly invest in advanced technology with ambitious technology programs. There are many reasons supporting this view, such as: (i) helping increase international competitiveness; (ii) replacing imports of expensive technology, equipment, and materials; (iii) be proactive in strategic areas. In addition, policymakers also expect capacity building and spillover effects from these projects to the entire economy. However, it is necessary to evaluate whether these programs will benefit the majority of people and note that these types of programs will often require long-term financial security, not just for R&D activities but also for activities aimed at converting those R&D results into real benefits for the community. In fact, in some developing countries, due to limited budgets, limited management capabilities, competition from other basic priorities, etc., many ambitious programs have run out of steam and are not effective and not achieved initial expectations (*Nguyen Vo Hung, 2014*).

The policy lesson in many developing countries is that it is necessary to prioritize protecting people's interests by building an innovation system “for the people” and targeting the poor. Investment in national technological capacity should focus on production management capacity, design capacity, and manufacturing plans to turn the world's existing knowledge into new components and the acquisition of technology. Adjusting and disseminating technology plays a much more important role than developing advanced innovations based on original R&D.

In Vietnam, the NIS includes four main entities: Government; Enterprise; Research Institute; and University System. In the previous period, Vietnam's NIS was centered on research institutes. In the context of the strong impact on many areas of socio-economic life of the Industrial Revolution 4.0, the role of Science, Technology and Innovation is increasingly important in promoting labor productivity, growth quality and competitiveness of the economy. That's why, in recent years, the NIS is moving towards being business-centered (*Nguyen Thi Tue Anh, Tran Binh Minh, 2019*). However, the “Vietnam 2035” Report stated that, currently, Vietnam's Innovation System is still weak and has not contributed

much to output and growth. The economy still lacks many dynamic and creative businesses that create demand for innovation. Furthermore, the capacity of the business sector to absorb and deploy new research is also limited. Most businesses still lack a common strategic vision, as well as product upgrading strategy and human resources necessary for innovation.

The following section presents a preliminary identification of some structural errors and thereby identifies the role of the state in building the foundation for the NIS in Vietnam.

Several structural errors have been identified in the NIS that is emerging in Vietnam

The institutional environment is not favorable for interactive learning and innovation: (i) Lack of basic foundation in standards in production activities; (ii) Law enforcement and awareness of intellectual property are not good; (iii) The work of developing legal documents still has many limitations; (iv) Lack of coordination and adjustment mechanism in innovation policy making; (v) Lack of effective mechanism to deal with new issues; (vi) Lack of trust; (vii) Inappropriate competitive environment; (viii) Information is incomplete and unreliable.

Limitations of entities and interactions in the system: (i) Enterprise's product design and industrial design capacity is limited; (ii) Small, scattered agricultural production has not yet shaped sustainable value chains; (iii) The institute – university sector is not in a good position to support businesses; (iv) Vocational training and apprenticeship activities are still dominated by the “culture” of favoring diplomas; (v) Credit for innovation has not been cleared.

The State, with the role of building the foundation for the innovation system, can carry out the following activities:

Building an innovation-friendly institutional environment: (i) Creating competitive pressure on businesses; (ii) Laws and policies reflect the legitimate interests of all social stratum; (iii) Building a public-public cooperation mechanism.

Building a knowledge base, standards, and technological capacity: (i) Building a warehouse of existing technological knowledge in a user-friendly manner; (ii) Documenting experiential knowledge and traditional knowledge; (iii) Balancing between vocational training and university training; (iv) Building a foundation of basic standards to create a premise for building trust; (v) Developing the entrepreneurial spirit or the spirit of daring to think and daring to do.

The State, with the role of supporting innovation, can implement the following contents:

Develop a network of technical and technology service providers: (i) Develop a technology extension partner program; (ii) R&D services aimed at businesses.

Support businesses to learn through connections: (i) Equip businesses with standard practices on quality management and intellectual property; (ii) Support small and medium-sized enterprises to visit and survey tour abroad; (iii) Support businesses to participate in global value chains.

Incubation and financial assurance for innovation: (i) Incubation through different types of business incubation; (ii) Finance for innovation, focusing on financial solutions for innovation projects of small and medium-sized enterprises.

6. Conclusion

As analyzed, the main function of innovation is to put creativity and novelty into practical application to create added values for socio-economic development. Therefore, innovation plays an essential role in economic growth as well as social development of countries. In essence, innovation is an extension, the next step of science and technology activities entering the market, and innovation cannot be separated from science and technology.

Using the term innovation in Vietnamese language if it is not associated with science and technology and does not have the same meaning as the original English – “innovation” will make society confused, difficult to understand, and even misunderstand about innovation, and at the same time, cause confusion. inconsistent and not synchronized in identifying subjects as well as in building and implementing mechanisms and policies of state management agencies. Decree No. 28/2023/ND-CP dated June 2nd, 2023 of the Government regulating the functions, tasks, powers and organizational structure of the Ministry of Science and Technology has stipulated that innovation is one of the functions of state management of the Ministry of Science and Technology (together with Science and Technology), therefore, it is recommended that the Government and the Ministry of Science and Technology soon issue regulations to unify terms and unify state management with subjects implementing innovation as well as with other innovation activities.

The NIS is a system of organizations/agents, institutions and especially the interactions between actors in the system for the common purpose of developing and disseminating innovations. Actors in innovation systems include organizations from the public sector as well as the private sector. In the context that Vietnam's National Research System is in the process of being formed, perfecting the state management institution on innovation will both continue to improve the state management function of science and technology (with a focus on the activities of creating, absorbing, mastering, and spreading science and technology into production and life), and at the same time, expanding the functions of state management in the NIS, especially in the context of the strongly ongoing 4.0 Industrial Revolution in a global scale, focusing on some of the following main contents:

Develop and promulgate regulations and coordination mechanisms and regulations between the focal agency for state management of innovation, the Ministry of Science and Technology, with ministries, branches, and localities to create unity, efficiency, and continuity throughout state management of innovation.

Focus on building and perfecting mechanisms and policies to promote innovation activities, form, and develop the NIS in accordance with Vietnamese conditions in the context of Industrial Revolution 4.0 where Science, Technology and Innovation is the main driving force for socio-economic development. In particular, we must soon build unique/special and superior institutions, mechanisms, and policies to promote technology application and transfer; remove barriers in the legal system and economic and financial policies for science, technology, and innovation activities; develop a creative startup ecosystem; Encourage and support enterprises to improve innovation capacity so that enterprises can take on the central role of the NIS.

The State prioritizes allocating resources from the budget for science, technology, and innovation; Increase attraction of non-budget resources to invest in science, technology, and innovation.

Raise social awareness of the role of Science, Technology, and Innovation. Strengthen the proactiveness of ministries, branches, and localities in promoting science, technology, and innovation activities; Each level, each sector, and each locality needs to clearly define targets and action programs to apply and develop science, technology, and innovation in all activities.

Promote international cooperation to take advantage of resources from abroad to develop science, technology, and innovation in the country; Actively and effectively participate in the regional and global innovation network./.

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