

Impact of Innovative Capacity on Intellectual Property: Literature Review

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Abstract:

In the era of international integration in economy, innovative capacity is the most important factor that creates the competitiveness of each nation's economy. Since 2007, innovative capacities of nations have been measured and compared on global scale using the Global Innovation Index (GII) contribution of Intellectual Property (IP) to GII.

Keywords: *Global Innovation Index, Intellectual Property, innovative capacity.*

1. Introduction

In the era of international integration in economy, the capacity of innovation is the most important factor that creates competitiveness of each nation's economy. National innovative capacities are measured by different tools. Traditionally, national innovation index includes measurements are number of published research articles, international patent applications, expenditures on research and development, etc. Current Competitiveness Index is a tool set for assessment of overall competitiveness. In recent decades, innovative capacities of nations are measured and compared on global scale through the Global Innovation Index (GII), which was brought into use by the World Intellectual Property Organization (WIPO) in 2007. The GII aims to capture the multi-dimensional facets of innovation and provide the tools that can assist in tailoring policies to promote long-term output growth, improved productivity, and job growth. The GII helps to create an environment in which innovation factors are continually evaluated. It provides a key tool and a rich database of detailed metrics for both micro-economy and macro-economy. The GII is considered to be better, more diverse and more justifiable compared to traditional measurements.

2. Literature Review

Regarding IP and GII, there are two main research streams, namely: GII- specific researches, IP-specific researches. Researches on the IP and GII together should also be the third main stream.

a, The GII-specific researches and other researches on instruments of measuring innovative capacity and competitiveness of economies are found among researches on science and technology. This is because innovation is a matter of science and technology policy. The following are good examples:

(i) (Trang, D., 2020) Science, Technology and Innovation Policies in Developed and Developing Countries- Scientific papers have pointed out the following:

Due to differences in political, economic, cultural and historical factors, developing and industrialized countries may have used different approaches in the S&T policy making process. But no matter which approach is used, the Science, technology and innovation (STI) policy is not outside the common goal of comprehensive socio-economic development, opening and enhancing national competitiveness.

STI policy is a type of public policy. In essence it is a systematic collection of Science and technology policies, education policies, industrial policies, finance, commerce, etc. The main objective of this policy is to identify innovative systems that mean knowledge systems, which have the power to compete in the market, to bring prosperity to the nation. Government plays a key role in planning and implementing STI policies.

Given the identified challenges and barriers, STI policy planning and implementation should be extremely prudent and selective, due to resource constraints as well as institutional and operational barriers. On the other

hand, even the choice of how to allocate resources under the specific socio-economic and political conditions of each developing country needs to be very wise and careful. However, the author has not shown which measurement tools (GII) to use to assist the government in planning and organizing the implementation of STI policies and specific tools to help put those policies in practice.

(ii) Ministerial-level scientific and technological tasks in 2019 “Study the suitability and limitations of the Global Innovation Index (GII) applied in Vietnamese conditions”, by Hoang Minh, Nguyen Vo Hung, Nguyen Thi Phuong Mai, Bui The Duy, Institute of Science and Technology Strategy and Policy. The study pointed out a few reasons that contributed to Vietnam's rise of 12 places in the global creative index ranking in 2017. By analyzing some of the GII indicators of Vietnam in 2017, the study has proposed some solutions to improve the indexes that Vietnam has been ranked in the group of low rating level, or in decreasing trend in recent years. However, the study did not analyze IP-related indicators in the 2017 global innovation index, or mention the potential for future growth for these indicators. Therefore, the study also could not provide solutions to improve GII by IP tools.

(iii) Ministry of science and technology task report no. 06/HD-DT/VCLCS.17 “Research compliance with Vietnam's conditions and the disadvantages of the global exciting indicator (GII) application in Vietnam conditions”, by Nguyen Thi Phuong Mai, Institute of Science and Technology Strategy and Policy. The report analyzed: method of calculation of GII indicators; relation between the judgement of GII in the stage 2012-2017 and special characteristics of Vietnam economy; and proposed recommendations of using GII as a tool for innovation policy appropriate for Vietnam. However, the report does not prove a direct relationship between IP and GII.

b, There are plenty of IP-specific researches on diverse aspects because the field has been developed for more than a century. Recently, there appear new researches on economy related aspect of IP, to prove the role of IP as a tool for economy development.

(Irid K., 2009) summarizes a series of papers on topic of the economics of IP, which were commissioned by renowned international economists from all regions. They review the existing empirical literature on six selected themes relating to the economics of IP, identify the key research questions, point out research gaps and explore possible avenues for future research.

c, Although GII- specific researches listed component IP-related indicators, there is not yet any in-depth study of IP in relation with GII. A difficulty resulted from lacking of research on relationship between IP and GII in Vietnam is that although benefits of IPR are estimated in quite a lot of researches, the positive effects of them on GII have not been proven. Remain unanswered questions include what IP-related indicators in GII are, how the role of IP in the national innovative capacity (NIC) is reflected in by GII and if it is possible and how to enhance Vietnam's NIC through IP, particularly through such IP-related indicators.

3. Theoretical Background

3.1. National innovative capacity

Definition of innovation

The term "Innovation" is defined in different ways in different times.

(Eurostat and OECD, 2005) defined innovation as the introduction of a new product (good or service) or a significantly improved product, or the introduction and implementation of a new technological process, a new marketing method, a method. new organizations in business activities, in workplace settings or in external relations. Innovation often requires many types of activities, not only research and development (R&D), but also other activities such as organizational changes, training, testing, marketing and especially design. This

definition distinguishes four types of innovation, including: (i) Product innovation; (ii) Process innovation; (iii) Marketing methods innovation; and (iv) Business activities organization innovation.

To be considered innovation, changes must have an "unprecedented" level or some new level. (Eurostat and OECD, 2005) distinguishes three new levels: new for enterprises; new to the national or regional market or new to the world. This thesis takes into account only national innovation level.

The Global Innovation Index (GII) adopts a broad notion of innovation, originally elaborated in the Oslo Manual developed by the European Community and the OECD: "An innovation is the implementation of a new or significantly improved product (good or service), a new process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations". This definition reflects the evolution of the way innovation has been perceived and understood over the last two decades.

Previously economists and policy makers focused on R&D-based technological product innovation, largely produced in-house and mostly in manufacturing industries. This type of innovation was performed by a highly educated labour force in R&D-intensive companies. The process leading to such innovation was conceptualized as closed, internal, and localized. Technological breakthroughs were necessarily 'radical' and took place at the 'global knowledge frontier'. This characterization implied the existence of leading and lagging countries, with low or middle income economies only catching up. Today innovative capacity is seen more as the ability to exploit new technological combinations; it embraces the notion of incremental innovation and 'innovation without research'.

Interest in understanding how innovation takes place in low-income and middle-income countries is increasing, along with an awareness that incremental forms of innovation can impact development. Furthermore, the process of innovation itself has changed significantly. Investment in innovation-related activity has consistently intensified at the firm, country, and global levels, adding both new innovation actors from outside high-income economies and nonprofit actors. The structure of knowledge production activity is more complex and geographically dispersed than ever.

A key challenge is to find metrics that capture innovation as it actually happens in the world today. Direct official measures that quantify innovation outputs remain extremely scarce. For example, there are no official statistics on the amount of innovative activity—defined as the number of new products, processes, or other innovations—for any given innovation actor, let alone for any given country (see Box 1, Annex 1 of Chapter 1 in the GII 2013). Most measures also struggle to appropriately capture the innovation outputs of a wider spectrum of innovation actors, such as the services sector or public entities.

The GII aims to move beyond the mere measurement of such simple innovation metrics. To do so will require the integration of new variables, with a trade-off between the quality of the variable on the one hand and achieving good country coverage on the other hand.

For example, the timeliest possible indicators are used for the GII 2018: 31.9% of data obtained are from 2015, 42.5% are from 2014, 13.0% are from 2013, 6.3% from 2012, and the small remainder (6.3%) from earlier years.

Definition of National Innovative Capacity (NIC)

The innovation system considers innovation as the center, the result of interactive learning, through accumulation, capacity building, science-based learning, and experiential learning. The innovation system focuses on clearing information, increasing interaction between entities, developing institutions that support learning interaction, developing a friendly environment for innovation, and increasing system's capacity to response to opportunities or changes.

Innovation systems are considered according to different focuses and coverages. The national innovation system focuses on examining organizations and institutions that have a macro influence on entities within national borders. The regional innovation system focuses on the interaction of entities in a geographical region with a focus on businesses in the same industry, business clusters and related supporting organizations, local and regional institutions and customs. The innovation system focuses on the core technology issues of the industry, links along the value chain, but supplier-producer-customer interaction.

Creative innovation comes not only from research and development, but also primarily from the process of working, using and interacting. Enterprise interactive learning plays a central role in the creative innovation system. According to this approach, in addition to S&T, the creative innovation system also has social institutions, macroeconomic governance, financial systems, education and communication infrastructure, and market conditions.

(Lundvall, Chaminade and Vang 2009) propose the definition of the national creative innovation system: "The national creative innovation system is an open, evolving and complex system, including the relationships within each organization and between socio-economic organizations, institutions and structures, regulating the speed and direction of innovation as well as building professional competencies resulting from a science-based and a learning based process experience".

(Furman, Porter and Stern, 2002) propose the definition of the NIC: "The national innovative capacity is defined as country's potential - as both an economic and political entity - to produce a stream of commercially relevant innovations".

Determinants of NIC

Factors on which NIC depends on are determinants of innovation process. (Furman, Porter and Stern, 2002) point out that "NIC is not the realized level of innovative output per se but reflects more fundamental determinants of the innovation process. Differences in NIC reflect variation in both economic geography (e.g. the level of spillovers between local firms) as well as cross-country differences in innovation policy (e.g. the level of public support for basic research or legal protection for IP)". More specifically, those determinants include institutional framework (i.e. political, regulatory and business environment), human capital and research of a country (level and standard of education and research activity), infrastructure (general infrastructure information and communication technologies, etc.), market conditions (credit, investment, trade, etc.), business conditions (knowledge level of workers, business and university collaboration on R&D, absorbing and diffusing knowledge, etc.).

(Furman, Porter and Stern, 2002) suggest that public policy plays an important role in shaping a country's national innovative capacity. Beyond simply increasing the level of R&D resources available to the economy, other policy choices shape human capital investment, innovation incentives, cluster circumstances, and the quality of linkages. Each of the countries that have increased their estimated level of innovative capacity over the last quarter century—Japan, Sweden, Finland, Germany—have implemented policies that encourage human capital investment in science and engineering (e.g. by establishing and investing resources in technical universities) as well as greater competition on the basis of innovation (e.g. through the adoption of R&D tax credits and the gradual opening of markets to international competition).

(Furman, Porter and Stern, 2002) divide determinants of NIC into three categories: the common pool of institutions, resource commitments, and policies that support innovation across the economy; the particular innovation environment in the nation's industrial clusters; and the linkages between them. The overall innovative performance of an economy results from the interplay among all three. Common innovation infrastructure are certain most important investments and policy choices that support innovative activity have broad impact throughout an economy. While the common innovation infrastructure sets the general context for innovation in an economy, it is ultimately enterprises, influenced by their microeconomic environment, that

develop and commercialize innovation. Thus, NIC depends upon the microeconomic environment present in a nation's industrial clusters. The relationship between the common innovation infrastructure and industrial clusters is reciprocal: for a given cluster innovation environment, innovative output will tend to increase with the strength of the common innovation infrastructure and vice versa.

Measurement of National Innovative Capacity

Innovation is important for driving economic progress and competitiveness for both developed and developing economies. Many Governments are putting innovation at the center of their growth strategies. What they needed was a measurement that captured the richness of innovation in society.

(Furman, Porter and Stern, 2002) states that measuring of NIC require measures of its three determinants, i.e. a nation's common innovation infrastructure, the innovation environment in its industrial clusters, and the nature of the linkages between these elements. For the common innovation infrastructure, a number of relatively direct measures are available; however, direct measures of the cluster innovation environment and the quality of linkages are not available for international data. The common innovation infrastructure consists broadly of a country's knowledge stock, the overall level of human and capital resources devoted to innovative activity, and other broad-based policies and resource commitments supporting innovation. The common innovation infrastructure also encompasses national policies and other resource commitments that broadly affect innovation incentives and R&D productivity throughout the economy.

(PORTER and STERN, 2002) say that NIC is inherently difficult to measure for several reasons. First, measures of innovative output are imperfect (only certain types of innovation can be measured) and subject to some random fluctuations. Second, traditional data sources make it difficult to develop measures associated with the more nuanced drivers of innovative capacity, such as innovation policy and the cluster-specific innovation environment.

15 years ago, people measured innovation based on a relatively narrow set of typical science and technology metrics like the number of researchers, the number of patents, the number of publications and venture capital in a country. Those metrics are still equally valid today but innovation has become much more broad-based in society. Therefore, in order to get success in innovation, a country needs to be able to excel in providing the right kind of institutional framework, the right kind of investments in broad-based education in the country and also be successful in creating innovation outputs that go beyond traditional science and technology. From this need, GII was created as a toolkit for leaders, policymakers at both national and business levels so they could evaluate innovation to find opportunities in the new era.

3.2. Global Innovation Index

Definition of Global Innovation Index

The Global Innovation Index (GII) is a toolkit for measurement by scoring and ranking NICs, constructed by the school of economy INSEAD (France) in 2007 jointly with WIPO and Cornell University (US). The GII project was launched with the simple goal of determining how to find metrics and approaches that better capture the richness of innovation in society and go beyond such traditional measures of innovation as the number of research articles and the level of research and development (R&D) expenditures. Therefore, GII is considered to be better, more diverse and more justifiable compared to traditional measurements.

There were several motivations for setting this goal. First, innovation is important for driving economic progress and competitiveness—both for developed and developing economies. Many governments are putting innovation at the centre of their growth strategies. Second, the definition of innovation has broadened—it is no longer restricted to R&D laboratories and to published scientific papers. Innovation could be and is more general and horizontal in nature, and includes social innovations and business model innovations as well as

technical ones. Last but not least, recognizing and celebrating innovation in emerging markets is seen as critical for inspiring people—especially the next generation of entrepreneurs and innovators.

The GII helps to create an environment in which innovation factors are under continual evaluation, and it provides a key tool for refining innovation policies.

The GII is not meant to be the ultimate and definitive ranking of economies with respect to innovation. Measuring innovation outputs and impacts remains difficult, hence great emphasis is placed on measuring the climate and infrastructure for innovation and on assessing related outcomes.

Although the end results take the shape of several rankings, the GII is more concerned with improving the ‘journey’ to better measure and understand innovation and with identifying targeted policies, good practices, and other levers that foster innovation. The rich metrics can be used - on the level of the index, the sub-indexes, or the actual raw data of individual indicators - to monitor performance over time and to benchmark developments against countries in the same region or of the same income category.

Drawing on the expertise of the GII’s Knowledge Partners and its prominent Advisory Board, the GII model is continually updated to reflect the improved availability of statistics and our understanding of innovation. In 2019, the model continues to evolve, although its mature state now requires only minor updates.

Dimensions of Global Innovation Index

The GII conceptual framework

The GII is an evolving project that builds on its previous editions while incorporating newly available data and that is inspired by the latest research on the measurement of innovation. This year the GII model includes 128 countries/economies, which represent 92.8% of the world’s population and 97.9% of the world’s GDP (in current US dollars). The GII relies on two sub-indexes—the Innovation Input Sub-index and the Innovation Output Sub-index—each built around pillars.

In GII system, there are totally seven pillars, each of which is divided into three sub-pillars, each of which in turn is composed of individual indicators, for a total of 82 and 80 indicators in 2018 and 2019 respectively. The dimension of GII is shown in Figure 1a below.

GII Annual Report

Four major measures calculated

There are four major comprehensive indexes in GII Report that reflect the overall picture of NIC, namely:

- (i) Innovation Input Sub-Index: Five input pillars capture elements of the national economy that enable innovative activities;
- (ii) Innovation Output Sub-Index: Innovation outputs are the results of innovative activities within the economy. Although the Output Sub-Index includes only two pillars, it has the same weight in calculating the overall GII scores as the Input Sub-Index;
- (iii) The overall GII score is the simple average of the Input and Output Sub-Indexes;
- (iv) The Innovation Efficiency Ratio is the ratio of the Output Sub-Index to the Input SubIndex. It shows how much innovation output a given country is getting for its inputs.

GII Annual Reports pay special attention to presenting a scoreboard for each economy that includes strengths and weaknesses, making accessible the data series, and providing data sources and definitions and detailed technical notes. Adjustments to the GII framework, including a detailed analysis of the factors influencing year-

onyear changes, are detailed. In addition, since 2011 the GII has been submitted to an independent statistical audit performed by the Joint Research Centre of the European Union.

3.3. Intellectual Property

Definition of Intellectual Property and related concepts

Definition of IP

IP is a category of property that includes intangible creations of the human intellect, in the form of legitimate rights over of such creations. The main contents of such right is economic right, namely the right to exploit commercial value of the intellectual creations. The nature of such property right is reflected by the term IPR although IPRs also include moral rights of the authors, inventors, designers. Therefore, the terms IP and IPR (IP right) are often used interchangeably. Beside, from the term IPR flows a narrow meaning of the term IP, namely the object of the right, i.e. the intellectual creations such as literary and artistic works, inventions, industrial designs etc.

However, in the boardest sense, IP means the whole IPR protection system, that covers IPR itself and anything related to IPR, from IPR protection institution (legal protection regime, administration and enforcement organisation), IPR objects, IPR applications and grants, IPR transaction (assignment and licensing), IPR exploitations (products and services embodying IPR subject matter), etc.

IPR categories

IPRs are categorized by subject matters of legal protection, which include the rights as relating to “Literary, artistic and scientific works; performances of performing artists, phonograms, and broadcasts; inventions in all fields of human endeavor; scientific discoveries; industrial designs; trademarks, service marks, and commercial names and designations; protection against unfair competition; and “all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields.” (Convention Establishing the World Intellectual Property Organization, Signed at Stockholm on July 14, 1967; Article 2, § viii)

IPR branches

IPRs can be divided into two main branches according to the industry sectors, namely (i) copyright to literary, artistic and scientific works and copyright-related rights to performances, phonograms, video recordings, broadcasts and encrypted program-carrying satellite signals; (ii) industrial property rights to inventions (patents, including utility models/solutions), industrial designs, layout-designs of semiconductor integrated circuits, trade secrets, trademark (including service mark), trade names and geographical indications. The right to plant varieties may be isolated as the third category in some countries, eg. in Vietnam (Articles 3 and 4, IP Law) or may fall in the category of industrial property rights.

IPR groups

IPRs can be grouped by the fields of use, namely:

- (i) Entertainment creation: Copyrights and Related rights. The main social purpose of protection of copyright and related rights is to encourage and reward creative work to enrich people cultural life. The copyright protection is copying- prevention right given untill the author’s death plus 50 years thereafter.
- (ii) Technology creation and industrial design: Patents, Utility models/solutions, Trade secrets (technical knowhow), Layout design of semiconductor integrated circuits, Plant variety rights and Industrial designs. The protection is primarily to stimulate innovation, design and the creation of technology. The social purpose is to provide protection for the results of investment in the development of new technology, thus giving the incentive and means to finance research and development activities and to facilitate the transfer of technology in the form

of foreign direct investment, joint ventures and licensing. The protection is typically an exclusive right given for a finite term, for example 20 years in the case of patents.

(iii) Commercial indications: trademark (including service mark), trade names and geographical indications. The protection of these distinctive signs aims to stimulate and ensure fair competition and to protect consumers, by enabling them to make informed choices between various goods and services. The protection may last indefinitely, provided the sign in question continues to be distinctive.

The role of Intellectual Property

(Goldstein P. and Reese R.A., 2008) The main purpose of intellectual property law is to encourage the creation of a wide variety of intellectual goods. To achieve this, the law gives people and businesses property rights to the information and intellectual goods they create, usually for a limited period of time. This gives economic incentive for their creation, because it allows people to profit from the information and intellectual goods they create. (Rod Falvey and Neil Foster, 2006) These economic incentives are expected to stimulate innovation and contribute to the technological progress of countries, which depends on the extent of protection granted to innovators.

The essential value of legal protection of IP is giving exclusive property rights over intangible assets, for a certain period of time. It enables enterprises to exploit his asset that can often be traded in the market place. If the innovative creation of an enterprise are not legally protected by IP rights, then these may be freely used by any other enterprises. Consequently, the innovative enterprise can lose in the market because of unfair competitors. However, when the innovative creation are protected by IP rights, they acquire concrete value for innovative enterprise as they become property rights which cannot be commercialized or used by competitors without authorization. Enterprises over the world are getting more and more aware of the value of their IP assets and starting to undertake regular technology and IP audits. IP assets are in fact worth more than physical assets. That make more and more enterprises target on IP-intensive business.

(Idris, 2003) IP is a "power tool" for economic development and wealth creation that is not yet being used to optimal effect in all countries, particularly in the developing world. Using those intangible assets, such as knowledge, information, creativity and inventiveness - that are rapidly replacing traditional and tangible assets - such as land, labour and capital - as the driving forces of economic health and social well-being.

Nowadays it is common understanding and widely underlined in international trade agreements that the protection of IPR is essential to maintaining economic growth. (WIPO, 2004) There are two reasons for legal protection of IPR: One is to give statutory expression to the moral and economic rights of creators in their creations and the rights of the public in access to those creations. The second is to promote, as a deliberate act of Government policy, creativity and the dissemination and application of its results and to encourage fair trading which would contribute to economic and social development.

The science and technology innovations play a vital role in development of the economy, where IP is back born of technology innovation and a measurement of technology level. Patent is one of the most effective types of IPR for achieving economic development, because it encourages technology breakthroughs.

4. CONCLUSION

Vietnam State has constructed a quite modern legal system of IPR protection, and keeps pace with the upgrading of the international standards in the world wide free trade era. It is common understanding that having an appropriate IP system is an effective way to enhance creativity, promote technological innovations, improve trade and enhance competitive power. In practice, it is not easy to see whether the current IP system does or does not give effective and appropriate fuel to the economy. Appropriate tools to measure the effectiveness of IP system need to be found or improved. GII is a tool being used by many countries over the world. Vietnam Government put many efforts in accelerating the use of GII as tool to see and enhance the innovation

competence of the country. These efforts include promulgation of policy and administrative instruments. Their implementation has gained certain fruits with some instruments and has been started with some other. The thesis systemizes the theoretical background of innovation system, innovation index, especially GII, particularly IP-Related GII indicators and analyzes practice of GII in Vietnam, showing the growth of GII, contribution of IP to innovation index and points out what have been done to improve innovation index and what need to be done. After all, the thesis proposes certain solutions to improve innovation index in Vietnam./.

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