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FINDING VIETNAM'S OPPORTUNITIES AND CHALLENGES THROUGH PATENT ANALYSIS

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    This paper discussed Vietnam's opportunities and challenges through patent analysis. Information of granted and applied patents could overview the trends of the technology development. The number of patent applications and patent grants in Vietnam intellectual property office are increased from 2009 to 2018. The non-resident patent applications and patent grants are 8 times of resident patent applications and patent grants in Vietnam. These non-resident patent applications are coming from the international companies in Vietnam for their production and market. However, resident patent applications are increased from 258 to 646 and resident patent grants are increased from 29 to 205 through these years till 2018. It indicated that technology development of Vietnam becomes growing and strengthening in the beginning phase.

    The number of USA patents till 2020/3/28 for Vietnam applicants or Vietnam inventors are 797 but Vietnam applicants only are 172 by using WIPS database. It means that most Vietnam inventors work for the international companies. The top 10 key players are NIKE (shoe company, USA), PERSONIFY, INC. (video streaming, USA), MYLAN GROUP (Chemical, Vietnam), CENTRE NAT RECH SCIENT (French Research Inst., France), SAMSUNG (Semi, Korea), TON DUC THANG (university, Vietnam), VIETTEL GROUP (Network, telecom, Vietnam) RYNAN TECHNOLOGIES PTE. LTD (Printer, Singapore) ACTIVE-SEMI, INC. (Power management, USA) and MARVELL INT LTD (digital Storage, USA). Although only three applicants are from Vietnam, the Vietnamese inventors helps these international companies in advance technology fields (shoe, biotech, power management, video streaming, digital storage and semi. industry). The growing number of Vietnamese inventors indicated the success of the technology transfer.

    The top three local key players, MYLAN GROUP, TON DUC THANG and VIETTEL GROUP, are important to indicated the technology develop trends on chemical and network fields in Vietnam.

    Vietnam is making significant economic progress because of its efficient labor market (70% of population, mainly on low-skilled labor). The economic growth helps not only living standard but also technology transfer. According to the patent analysis, the innovation is on the very beginning phase and grows rapidly. Like Hsinchu science park, Taiwan was built and developed by Taiwanese inventors from Silicon Valley, USA. More and more Vietnam inventors found in international companies could be the resources for future inventions in Vietnam. Vietnam's opportunities and challenges are on its innovation. When the labor needs are from low-skilled to high-skilled then to innovation, the economic growth of Vietnam will be not only increased but also sustainable.

1. Introduction

Could Vietnam to be another China? What are the opportunities and challenge of Vietnam? This paper would review it from the patent analysis. Vietnam is one of South East Asia's fastest-growing economies and its economic growth rate was 7.08% in 2018, the highest growth rate since 2008 (Fig. 1). The exports grew 13.8% (US $ 243.5 billion), import growth 12.1% (US $ 236.7 billion), the approval of foreign investment was US $ 35.465 billion, a decrease of 1.2%. The Consumer Price Index (CPI) was 3.54% and kept below 5% since 2014 (Fig.2). Vietnam has experienced consistently high annual rates of economic growth and reasonable CPI growth which have helped to raise living standards and have enabled the more rapid development of infrastructure.

Vietnam population reached 97 million in 2018 (up from about 60 million in 1986). 70% of its population is under 35 years of age, the highest among countries in the region at similar income levels (Fig3). Vietnam is making significant economic progress because of its efficient labor market (mainly on low-skilled labor).

GDP, CPI and labor market indicates that Vietnam has a nice chance to continue it progress to be a developed country as China. How about innovation? The Global Innovation Index (GII) [1] is a ranking of world economies based on innovation capabilities. The rankings of Vietnam over the past three years, are from 47 to 42. Viet Nam performs better in Innovation Outputs (37 in 2019 better than 41 in 2018) than Inputs (63). Vietnam produces more innovation outputs relative to its level of innovation investments. Except GII, indicators of technology development and innovation could be suggested by patent analysis [2-5]. China has been investigated by patent data analysis for its technological development and innovation [6-9].

Thus, this paper provides a more detailed view of the innovation trends in Vietnam by using patent information.

2. Data and Methodology

The Vietnam local patent statistic data was from WIPO website and it Vietnam IP office annual reports [10-11]. The USA patent data examined was mainly USPTO by using WIPS database and its tool. WIPS provides a search for patents registered in various patent offices. To extract on patents from Vietnam (VN) from USPTO (USA), this study filtered the patent search on WIPS based on applicant nationalities (APC) and inventor nationalities (INVC). The period for patent search is from 1981/01/01 to 2020/03/28. The search revealed that of the 172 patents obtained by applicants from Vietnam, 127 were published-only patents and 45 were registered patents. There were 764 patents obtained by inventors from Vietnam, 491 were published-only patents and 273 were registered patents. However, there were 33 patents obtained by applicants from Vietnam but not Vietnamese inventors.

The patent rules analysis method is used widely to identify relationships among large data sets including patent data [12,13]. IPC codes of patents on database could be used for technology forecasting and technology convergence relation [14,15].

3. Results and Discussions

Patents are localized and only works for those area which are granted. The patents applied for in the local patent office of Vietnam provide valuable information on technological innovation such as technological trends. Moreover, as valuable technologies are generally applied for in the major international patent office such as USPTO (USA).

Data on Vietnam was sourced from the World Intellectual Properties Office (WIPO) and the annual reports of the National Office of Intellectual Property of Vietnam (NOIP). The trend of patent applications at local patent offices is shown in Fig. 4. Around 85% of applicants in total applied patents is from foreign applicants. This indicates that Vietnam provides a better technology market and attracts technology providers from other countries. Except the USA, the top foreign applicants at the NOIP were from Asia, including Japan, Korea,

China and Taiwan. Japan and Korea are two countries which made a lot of production site in Vietnam. Samsung is a biggest investor in Vietnam (about 17 billion US dollars). The revenue of Samsung almost equal 30% of the GDP of Vietnam. This may be related to their geographic location or the manufacturing base for exporting to Europe and USA due to the benefits of signed exporting agreements. The top five technology classification fields are electrical machinery, audio-visual technology, telecommunication, digital communication, and basic communication process [11]. They are all IT and telecommunication related.

The number of Vietnamese applicants is increased steadily and ranked second at its own patent office. It means that the innovation of Vietnam is growing at the beginning phase and becoming a competitor in this innovation game.

Next, we will examine the valuable patent applied on USPTO. The top 6 of Vietnam Key players are Mylan Group, Ton Duc Thang University, Vettel Group, Loan Kim Thi Pham Nguyen Chi Co., Ltd and Hoya Group (Table 1). The first key player Mylan Group only had applied 12 patents since 2010 but Vettel Group applied 8 patents just . It means that the key players could easily be replaced by the new comer.

By category, they are from different industries. The total patents were classified by IPC code and shown in Fig. 5. Through the IPC code analysis, the patents for Vietnam were discovered for its technology trends. The first 2 classes G06 and A61 stand for the class of COMPUTING; CALCULATING; COUNTING and the class of MEDICAL OR VETERINARY SCIENCE; HYGIENE, respectively. The "C" classification, which involves chemistry. In this classification, "C08," "C07," and "C09" indicate organic polymeric compounds and paint or coating compositions. The Mylan Group was the first key player that focused on this class.

Table 1 *Vietnam Key players for USPTO*

Company	Applied patents	Category Descriptions
Mylan Group	12	lithographic printing material, adhesive
Ton Duc Thang University	9	patient transport(6), smart home(1), software(1), waste water treatment (1)
Vettel Group	8	transmission, detection, robot, laser optical system
Loan Kim Thi Pham	6	devices for spinal diseases
Nguyen Chi Co., Ltd.	4	wind energy
Hoya Group	4	glass substrate for magnetic disk

If we extended the Vietnam to inventors' nationality, the patent number increased to 797. The key players become: NIKE(USA), PERSONIFY, INC.(USA) MYLAN GROUP(Vietnam), TON DUC THANG UNIVERS.(Vietnam). SAMSUNG ELECTRONICS C. (Korea). VIETTEL GROUP (Vietnam) RYNAN TECHNOLOGIES PT. (Singapore). MARVELL INT LTD (USA), VENTANA MED SYST INC (USA), CENTRE NAT RECH SCIEN. (France). It means that Vietnamese inventors work for these international companies and get the technology transfer. The first 2 classes are G06 and A61 same as the first two classes of patents from Vietnam applicants.

Nike and Samsung made their manufacturing plants in Vietnam; therefore, many Vietnamese workers are from low-skilled labor force to skilled engineers. However, the international companies could not only depend on Vietnam labors or engineers but also their innovation. It indicated that technology transfers from international companies to Vietnamese were more than Vietnam local companies. More and more Vietnam inventors were spread all over the world. IPC classifications show that the technology transfers are high techs, such as telecommunication, software, semi-conductor and medical science industry.

For example, Samsung Electronics announce that will build a R&D center that provides 2200-3000 researchers before the end of 2022[16]. It means that international companies notice that

Vietnam is transition from labor and engineering to innovation.

4. Conclusion

By patent analysis, we found opportunities and challenges of Vietnam are patents applied growing but only a small number (172) in USPTO. Therefore, the challenge is that it is in very beginning phase of innovation but the first opportunity is that it will grow rapidly. The second opportunity is that Vietnam inventors are found in the international applicants. This is an indicator for a transition from labor work (low-skilled labor or skilled engineer) to innovation work. Recent years, lots of international companies move their manufacturing plants in because its efficient labor market. The growing economy and international activities are not only improving their life needs but also transferring lots of technology to Vietnam. These technology transfer made innovation in Vietnam booming. If the innovation growth continues, Vietnam could transfer its labor market into a high profit innovation market. When the labor needs are from low-skilled to high-skilled then to innovation, the economic growth of Vietnam will be not only increased but also sustainable.◆

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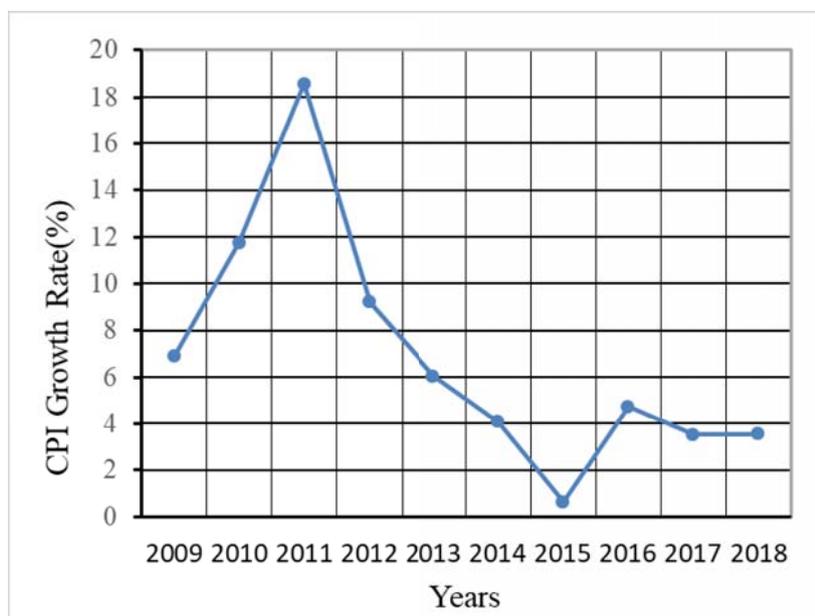15. M.J. Shih, D.R. Liu, M.L. Hsu, Discovering competitive intelligence by mining

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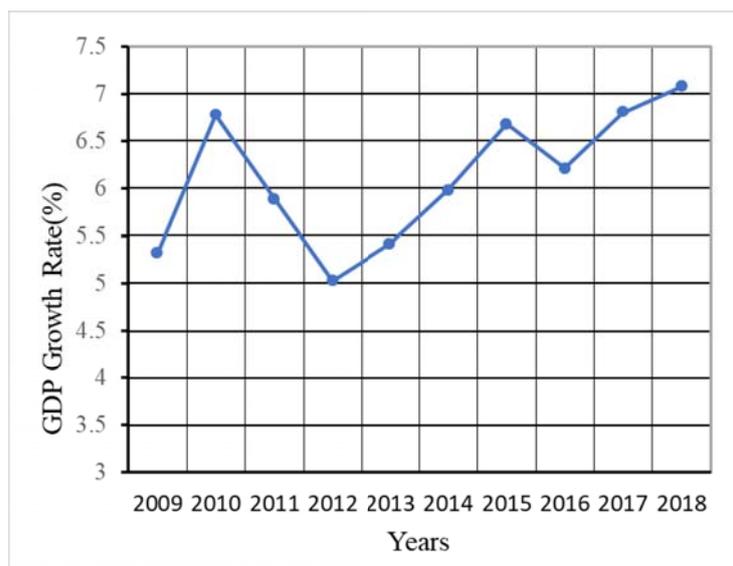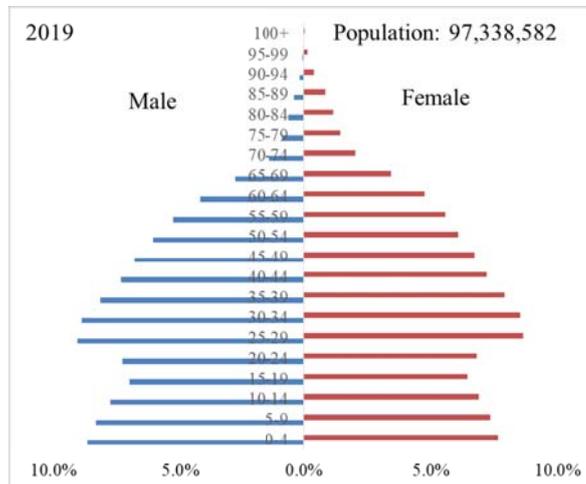
Source: the world bank

Figure 1. *The GDP of Vietnam*

Source: the world bank

Figure 2: *The CPI of Vietnam*

Source: The world bank

Figure 3. *The population distribution of Vietnam*

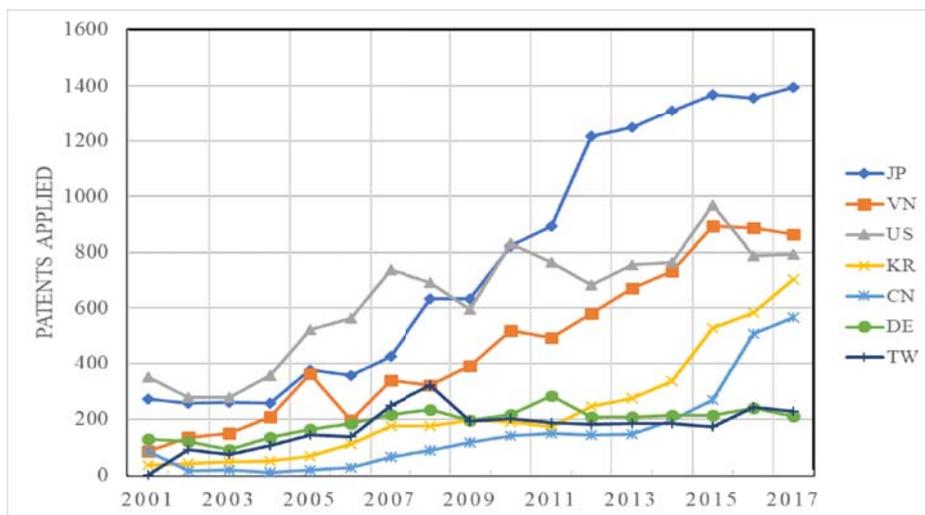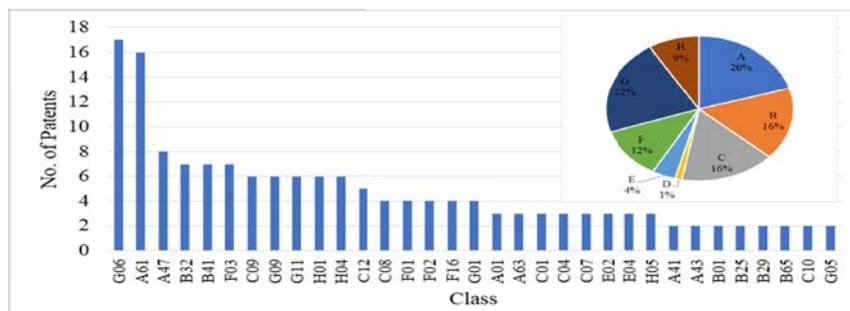**Figure 4.** *the patents applicants of the office of Intellectual Property of Vietnam*

Figure 5. *The classifications of USPTO patents by Vietnam Applicants*