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Patent Trend in Research Centers at Cibinong Science and Technology Park Surrounding for Determining Technology Focus

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Abstract. Focusing in a specific technology sector would be a great strategy for early developed Science and Technology Park (STP) especially in Indonesia. Each STP has its own concept considering the resources and technology supply. This should be main considerations in determining STP focus. Cibinong Science and Technology Park (CSTP) is surrounded by 4 research centers, and Center for Innovation. Their patent database within 5 years has been studied to determine CSTP focus. By using qualitative method and descriptive analysis, the results showed that the top priority is agriculture, followed by pharmaceutical. Moreover, the strategic areas for development in agriculture sector include: soil working; horticulture; preservation of bodies; and biocides. And in pharmaceutical sub sector includes: preparations for medical, dental, or toilet purposes; specific therapeutic activity of chemical compounds or medicinal preparations; and heterocyclic compounds. Furthermore, China can be a benchmark for technology development in agriculture, while US for technology development in pharmaceutical.

Keywords: *Technology focus, patent trend, CSTP surrounding, research center, STP*

1. Introduction

In many countries, Science and Technology Park (STP) has known as an accellerator for economic growth, and an effective tool to promote new technology oriented firms, and facilitating the commercialization of scientific research (Colombo & Delmastro, 2002; Link & Scott, 2003). Furthermore, each country has its own concept and uniqueness regarding the development of STP, some prefer as a "generalist", while other focus on few technology sectors. For example, South Korea developed 4 Innopolis, 12 Techno Park (TP), and 6 National Techno Park (NTP), most of them are generalist (facilitated more than 4 technology sectors) (Hidayat, 2015). They are capable in facilitating many technology sectors because they have enough resource and infrastructure. In terms of technology supply, most of TP in South Korea rely on University's inventions.

Meanwhile in China, during 1988 until 2008 there are 54 Science and Technology Industrial Parks (STIPs) have been established by the Chinese government (Zhang & Sonobe, 2011). These parks are largely focused on electronic, information technology, new material, and biomedicine industrial sector (MIG, Inc., 2011). Zhongguancun Science Park (Z-Park) as the oldest and largest park in China, focused on Information Technology (IT) sector. Now, Z Park has become a very successful park and a home for over 20,000 companies and 950,000 employees.

On the other hand, Indonesia has already planned to established 100 STP/TP/SP from 2015 until 2019 (Bappenas, 2015), but the concept and development guidelines is not yet clear. Until 2016, 60 parks were established but not in a complete form, and most of them are generalist. Largely, these

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parks have similar difficulties, which are: lack of supply of technology, lack of human resource (researchers, technology transfer officers, and business managers), lack of funding for construction, and lack of commitment from stakeholders.

One of STP that has been established in 2015 was Cibinong Science and Technology Park (CSTP), this park was managed by Center for Innovation LIPI. This park is different with most park in Indonesia, it has reliable entities as technology provider, which are research centers that located in CSTP surrounding. Recently, CSTP has difficulty in acquiring funding for construction and development of its 15 ha area. Meanwhile, CSTP is a generalist park, it facilitated 9 industrial sectors to grow in this park, which are: food, health and medicine, environment and water treatment, new and renewable energy, marine, advanced material and manufacture, transportation, information and communication technology, defense and security (Center for Innovation LIPI, 2015).

To be a generalist park, CSTP requires more funding, area and resources, on the contrary the availability is very limited. Difficulties that faced by CSTP in completion of its facilities are : limited construction, machineries and equipments procurement budget from central government (required 34.978.467 US$), minimum political advocacy and commitment, requires large number of employee, requires a special policy regarding private sector to establish facilities in the park / government owned land.

So, focusing in few industrial sector would be a crucial policy that need to be taken by top management of CSTP and policy maker in LIPI. This study is trying to identify what industrial sector that CSTP should focus, by investigate patent trend and population using LIPI's and International paten database. The scope of this research is to see the focus of technology on CSTP implementation through supply technology aspect provided by research center in the form of technological / patent invention.

2. Literature Study

Science and Technology Park (STP) is an area designed and used to create cooperation in innovating. The goal is to advance science and promote technological and economic development. The science and technology park is a platform that allows an enterprise to innovate in an open system with their network of Universities, research laboratories, start-ups, SMEs and Large Companies (Yildirim, 2016). STP is an open innovation catalyst. The global factors used in STP are Governance, Growth, Sustainability and Future trends & External Factors (Wasim, 2014).

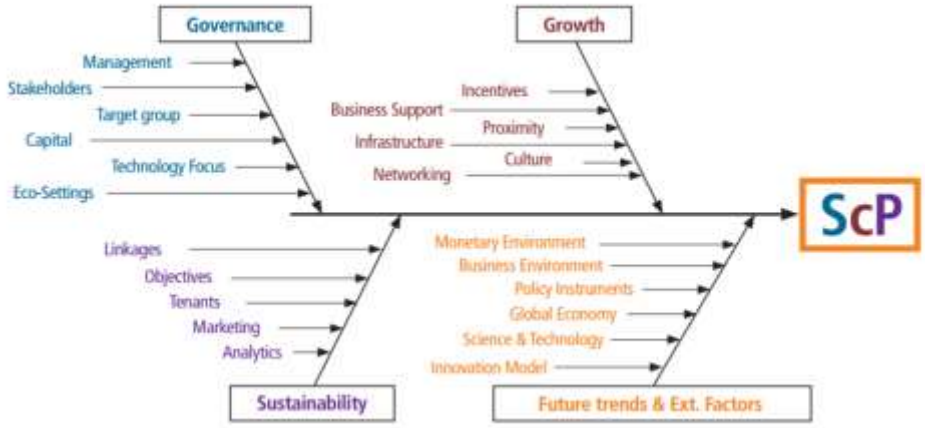

Figure 1.
Factors for Science Park (SCP) Planning *(Wasim, 2014)*

Governance is one of 4 important factors that needs to be defined in the STP. STP governance consists of environmental planning and preparation, Stakeholders, Target groups, Capital, Technology Focus and Eco-Settings. The selection of technology focus will determine the whole concept of STP, it will affect on its infrastructures design, resources, and businesses. The choice is whether it will have a strong technology focus or a general one.

Meanwhile, STP growth mostly influenced by its services. These services include the provision of sophisticated infrastructures, networking, access to business opportunities, economic incentives, access to leading organizations and cultural establishment with entrepreneurship. The sustainability of an STP is measured by how STP can measure its performance through the evaluation of objectives, linkages, and tenants periodically.

The last factor that determines STP growth is STP should be able to generate economic trends, technology trends and foster innovations that can create a profitable business environment. In addition, other external factors that may affect STP growth are policy instruments and monetary environment that can significantly influence.

According to Kharabsheh in the paper "Critical Success Factors of Technology Parks in Australia", STP has a role to connect research, technology, capital and knowledge to create entrepreneurship, accelerate the development of new technology-based enterprises, and accelerate the commercialization of technology (Kharabsheh, 2012). Factors influencing the success of STP are 1) The risk-taking culture of "entrepreneurship"; 2) Independent park management independent of university officials and government bureaucrats; 3) Attendance of knowledge workers and skilled workers in tech park environments, availability of appropriate communications and real estate infrastructure, availability of IP offices within technology parks; 4) The critical mass of internationally renowned innovative companies, and finally 5. A shared vision among stakeholders of technology parks. The first factor is more emphasis on generating innovation and intellectual property (Kharabsheh, 2012).

Ramezanpour (2014) ranked 5 critical success factors in Science and Technology Park consisting of 1) support and services factors; 2) management factors; 3) location factors; 4) external factors; and 5) human resources factors (Ghasem Ramezanpour Nargesi, 2014).

Not much different from the success factors that have been identified by Moudi (2011) is the success factor in science and technology park is 1) location; 2) facilities and providing the necessity; and 3) support mechanisms (Moudi, 2011).

3. Methodology

This research is using qualitative method with comparative study and descriptive analysis. LIPI's and International Patent database within 5 years period (before 2016) is being used to visualize patent population and trend. At first, patent from CSTP surrounding (research centers) were listed and clustered in targeted industrial sector. There are 9 sectors and 56 subsectors referring to Jakarta Stock Industrial Classification (JASICA) Index (IDX, 2010). Furthermore, the highest populated cluster of patents in CSTP surrounding will be compared with international patent trend using World Intellectual Property Organisation (WIPO) Patentscope. As result, recommendations can be drawn by using descriptive analysis.

4. Findings and Discussion

CSTP was surrounded by 4 research centers, 1 training center and also Center for Innovation itself (figure 2). The 4 research center are: Research Center for Biology, Research Center for Limnology, Research Center for Biotechnology, and Research Center for Biomaterial.

Figure 2.
Institutions in CSTP Surrounding *(Center for Innovation LIPI, 2015)*

In total, there are 47 registered patents in CSTP surrounding. This number is about 10% from total LIPI's registered patent. In term of patent productivity, the Research Center for Biotechnology has the highest number (40%), followed by Research Center for Biology (26%) (Figure 3).

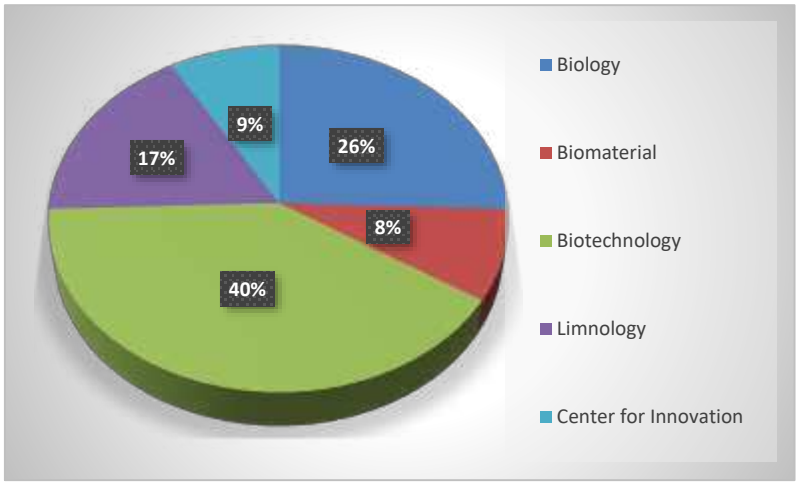

Figure 3.
Patent productivity within 5 years in CSTP surrounding

The patents that have been listed were classified by industry sector and sub sector. The classification is refer to Jakarta Stock Industrial Classification (JASICA) (Table 1.). For this initial classification, author is not using International Patent Classification (IPC) is because the database was not provide IPC information for each LIPI's patent. Moreover, the patents were classified by using JASICA to be more applicable and easier to see the target market for each patent.

As result, the highest number of patent in CSTP surrounding classified by industry sector is agriculture (17 patents), followed by consumer goods (15 patents) and basic industry and chemical (12 patents) (figure 4.). While if the patents breakdown in more detail classification (sub sector of JASICA), the highest number for patent by industry sub sector classification is pharmaceutical (13 patents), followed by food crops and fishery (figure 5.). This means, on technology supply aspect, CSTP should focus in the agriculture sector and/or in pharmaceutical sub sector. While the top 3 can be a good alternative sector also.

Table 1.
Jakarta Stock Exchange Industrial Classification Index (IDX, 2010)

Sector	Sub Sector	JASICA	Systematic
1		AGRICULTURE	Primary Sectors
	11	Crops	
	12	Plantation	
	13	Animal Husbandary	
	14	Fishery	
	15	Forestry	
	19	Others	
2		MINING	Primary Sectors
	21	Coal Mining	
	22	Crude Petroleum & Natural Gas Production	
	23	Metal & Mineral Mining	
	24	Land / Stone Quarrying	
	29	Others	
3		BASIC INDUSTRY AND CHEMICALS	Secondary Sectors
	31	Cement	
	32	Ceramics, Glass, Porcelain	
	33	Metal & Allied Products	
	34	Chemicals	
	35	Plastics & Packaging	(Industry & Manufacturing)
	36	Animal Feed	
	37	Wood Industries	
	38	Pulp & Paper	
	39	Others	
4		MISCELLANEOUS INDUSTRY	Secondary Sectors
	41	Machinery & Heavy Equipment	
	42	Automotive & Components	
	43	Textile, Garment	
	44	Footwear	(Industry & Manufacturing)
	45	Cable	
	46	Electronics	
	49	Others	
5		CONSUMER GOODS INDUSTRY	Secondary Sectors
	51	Food & Beverages	
	52	Tobacco Manufacturers	
	53	Pharmaceuticals	
	54	Cosmetics & Household	(Industry & Manufacturing)
	55	Houseware	
	59	Others	
6		PROPERTY, REAL ESTATE AND BUILDING CONSTRUCTION	Tertiary Sectors (Service)
	61	Property And Real Estate	
	62	Building Construction	
	69	Others	
7		INFRASTRUCTURE, UTILITIES & TRANSPORTATION	Tertiary Sectors (Service)
	71	Energy	
	72	Toll Road, Airport, Harbor And Allied Products	
	73	Telecommunication	
	74	Transportation	
	75	Non Building Construction	
	79	Others	
8		FINANCE	Tertiary Sectors (Service)
	81	Bank	
	82	Financial Institution	
	83	Securities Company	
	84	Insurance	
	85	Investment Fund / Mutual Fund	
	89	Others	
9		TRADE, SERVICES & INVESTMENT	Tertiary Sectors (Service
	91	Wholesale (Durable & Non Durable Goods)	
	93	Retail Trade	
	94	Restaurant, Hotel And Tourism	
	95	Advertising, Printing And Media	
	96	Health Care	
	97	Computer And Services	
	98	Investment Company	
	99	Others	

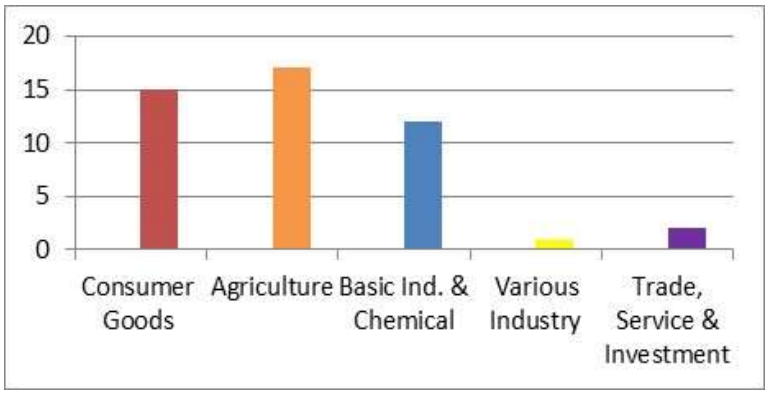

Figure 4.
The Number of Patent in CSTP Surrounding Classified by Industry Sector

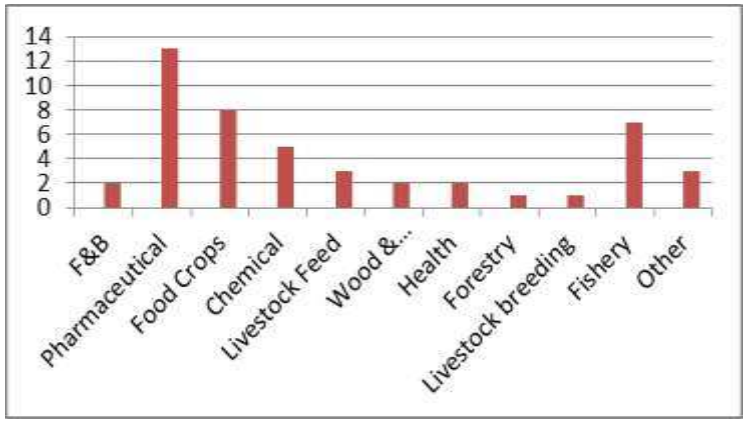

Figure 5.
The Number of Patent in CSTP Surrounding Classified by Industry Sub Sector

So based on technology supplies from RC in the park surrounding, CSTP has 2 priority option for its technology focus, which are agriculture and pharmaceutical. As the alternatives there are consumer goods, basic industry-chemical, food crops and fishery (figure 6).

Figure 6.
Priority in Technology Focus for CSTP

Furthermore, the result on CSTP technology supply analysis is being compared with the international trend. The trend can be showed by utilising WIPO Patentscope database analysis, and the main keywords for this analysis are "agriculture" and "pharmaceutical" (within 5 years before 2016).

As a result, the analysis by using keyword "agriculture" showed that there are 3.830 patents. The highest number for patents amount classified by country was China, followed by United States and Republic of Korea (Figure7.). These 3 countries should be main target as technological benchmark for agriculture.

Moreover, the top 3 number of patent related to agriculture by IPC are (Figure 8.):

- A01B : Soil working in agriculture or forestry; parts, detail, or agriculturel machines or implements, in general.
- A01G : Horticulture; cultivation of vegetables, flowers, rice, fruit, vines, hops, or seawed; forestry; watering.
- A01N : Preservation of bodies of humans or animals or plants or parts thereof; biocides. E.g disinfectants, peticides or herbicides.

Inline with the market, patents in these 3 most populated IPC has the biggest potency to be commercial. These 3 will be suitable as target for CSTP in agriculture sector.

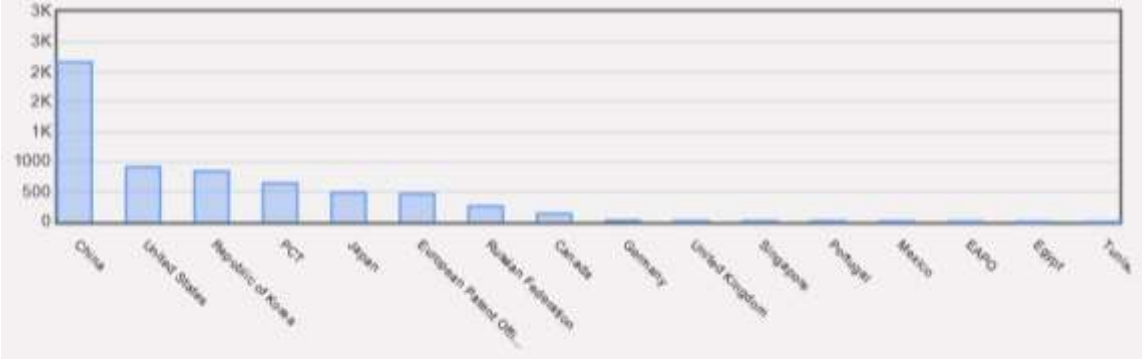

Figure 7.
The Number of Patent Related to Agriculture Classified by Country

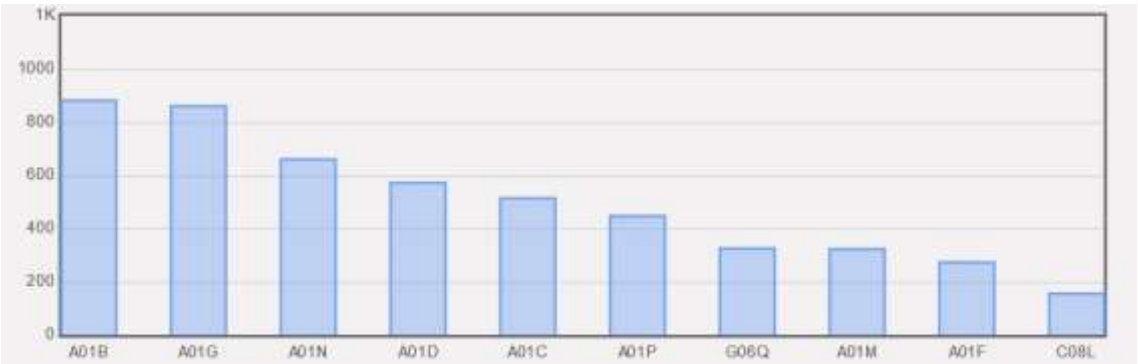

Figure 8.
The Number of Patent Related to Agriculture Classified by IPC

The result for analysis using keyword "pharmaceutical" showed that, there are 111,812 patents. The highest amount of patents classified by country was from United States, European countries and Canada (Figure 9.). International patents or patents registered through the Patent Cooperation Treaty (PCT) has the second most number of patents. But PCT is not included in the assessment in this study because PCT can come from several countries, although on the other hand PCT has a global market.

CSTP should do benchmark in term of pharmaceutical invention to US, European countries and Canada. These 3 are countries with the most advanced pharmaceutical inventions and industries..

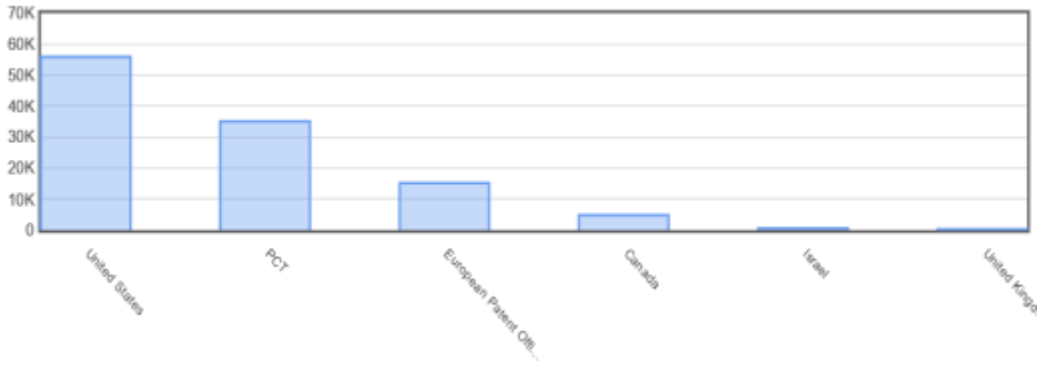

Figure 9.
The Number of Patent Related to Pharmaceutical Classified by Country

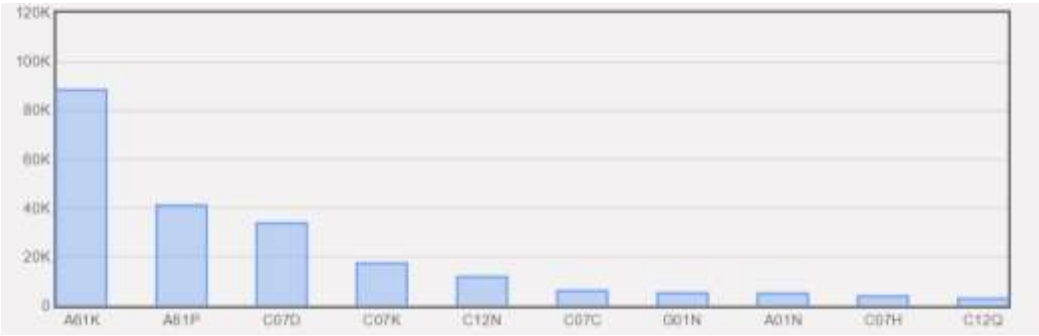

Figure 10.
The Number of Patent Related to Pharmaceutical Classified by IPC

Moreover, the top 3 number of patent related to pharmaceutical classified by IPC are (Figure 10.):

- A61K : Preparations for medical, dental, or toilet purposes (devices or methods specially adapted for bringing pharmaceutical products into particular physical or administering forms; chemical aspects of, or use of materials for deodorisation of air, for disinfection or sterilisation, or for bandages, dressings, absorbent pads or surgical articles; soap compositions)
- A61P: Specific therapeutic activity of chemical compounds or medicinal preparations
- C07D: Heterocyclic compounds

Conclusions

As a conclusion of this study, the top priority for CSTP regarding technology focus is in agriculture sector. The other alternatives are consumer goods and basic

industry and chemical sector. Meanwhile, in more specific sub sector CSTP can determine its focus on pharmaceutical, and food crops and fishery as alternatives.

In more detail, the strategic areas for development or commercialisation project in agriculture sector should aim for: (1) soil working (fertilizer and machineries); (2) horticulture and cultivation; and (3) biocides (disinfectants, peticides or herbicides). While in pharmaceutical sub sector includes: preparations for medical, dental, or toilet purposes; specific therapeutic activity of chemical compounds or medicinal preparations; heterocyclic compounds. China can be used as benchmark for development of technology in agriculture sector, while US as benchmark for pharmaceutical sub sector.

Research Implications, Limitation and Further Study

The result in this study recommends CSTP to focus in agriculture and pharmaceutical. Furthermore, the implementation of this study can change the majority of existing CSTP concept from generalist (facilitate 9 sector) into a specific "park". But it still not too late to change the concept while CSTP still in early stage of development. This will help CSTP utilised its limited fundings and resources to optimize its services and facilities in 1 or 2 technology sectors not 9. This study limits the analysis and aim on helping CSTP which operated by Center for Innovation, implementing the study for other "parks" will require more observation and analysis. Further study is required to map the external environment of CSTP that highly related to its development, such as: natural resources, human resources, local industries, and market.

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