# AN INQUIRY OF GOVERNMENT'S EXTENDING THE ROLE OF STATE-OWNED ENTERPRISES FOR THE INTEREST OF SCIENCE, TECHNOLOGY, AND INNOVATION POLICY: CASE STUDIES FROM INDONESIA

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by

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## Abstract

Only a very few recent studies have examined the formation of the role of state-owned enterprises (SOEs) in science, technology, and innovation (STI) policy. Of the view academic references, Belloc (2014) has proposed a theory that SOEs may have a crucial impact on building inter-firm collaborations (Belloc, 2014). The first part of this research identifies real-world cases of SOE leadership in inter-firm collaboration. Although the result is mixed, we find that some SOEs are playing such a significant role. Nonetheless, the findings also identify SOEs that perform poorly, in this regard this could be the result of STI policy failures at the government-owners of the firms. Indonesia is the subject of the exploration of the reasons for the firms' inability to create a network of knowledge creations. The selection of the subject dictates the methodology. Many studies of Indonesian STI policy have emphasized the democratization of the country, and, the methodology of this study also emphasizes the issue of democracy. Examinations of interview data from interviews with representatives of 10 research units of Indonesian ministries, and from four comparison discussions, reveals four varieties of government perceptions of STI policy, of which two are originating in the old authoritarian era.

In the last section of the study, data are analyzed for an understanding of the linkage among the Indonesian governments and the SOEs and the impact on innovation. The study uses an audio record of a focus group discussion (FGD) of the representatives of both types and institutions. The interesting discovery is in the democratized Indonesia, the SOEs have a tangible motivation for doing innovation namely to create profit that they can return to the state. However, the government once again has been found to nurture obsoleted paradigms from the authoritarian era that makes them unable to provide strong support to the SOEs. The mismatch interest in innovation makes the relationship between the government and the SOEs in Indonesia cannot form the companies' leading position in inter-firms collaborations as Belloc (2014) prescribed (Belloc, 2014). Aside to confirm the accuracy of the theory of Belloc (2014) (Belloc, 2014), the additional contribution of this study, therefore, is its illuminating the importance of studying the broader coherence of STI policy governance for revealing the cause of an identified weak role of SOEs in national innovation systems.

## Dedication

*I hope before I die I could see somehow being myself useful for Indonesia, as my mother wished when she was expecting me (that is how I got my name before I was born, as my mother's prayer that someday I could follow the footsteps of Prince Faisal of Saudi Arabia who was known as the person who modernized his country in the 20th century).*

*So, this is for Indonesia and all the colleagues around the World that receive the privilege of the burden to make their countries better. All the best for us.*

## Summary

The first study uses datasets widely available, therefore it is easy to be replicated. The study subjects are Fortune 500 SOEs. The study motivation is to learn how the firms extend their research partnerships in producing scientific articles. Using Scopus data, the study presents a scientometric analysis of the three most productive SOEs of the group, namely Sinopec China, Petrobras Brazil, and Statoil ASA Norway. The SOEs are compared to Royal Dutch Shell, a traditionally leading privately-owned enterprise (POE) in the sector. The research shows that Statoil has been growing to behave more similarly to Shell, namely by their decreasing in creating co-authorships (that is as the indicator of collaboration) with individuals coming from domestic institutions. Meanwhile, Petrobras and Sinopec remain to heavily concentrate to intensify the collaborations with local partners. The findings suggest that although SOEs may not have adequate attention towards R&D, their government-masters may, in fact, direct the companies to take the role as "innovation enablers" to other national actors. Nonetheless, this function may disintegrate once the firms experience privatization.

The subsequent studies then move to answer why governments may not use SOEs to hold a distinctive position in their national innovation systems. The research uses a country subject of Indonesia. In the previous section, the author found SOEs in the country do not produce a significant amount of internationally-published scientific articles. The low scientific productivity indicates the entities have weaker capabilities to absorb or diffuse new knowledge. This study uses a qualitative case-study

methodology to discuss STI policy governance in post-democratization Indonesia. The importance of studying national conducts is to understand how the government assigns SOEs to materialize their interests in innovation issues. The case study included seven semi-structured and three written interviews with five senior scientists and six mid-level managers/officials, all representing ten government R&D units or institutions. The targeting of the institutions was made with the consideration of their receiving national R&D budget and with the relevance to the national government budget cycle processes. Triangulations were made using interviews with a senior scientist/entrepreneur working in a private sector, a researcher working in a research and development (R&D) unit outside the targeted institution, and officials of the Indonesian Ministry of Research, Technology and Higher Education (Ristekdikti). In this research, each of the R&D units of a ministry or a national-level agency is considered as the main promoter of knowledge creation of the respective government sectors it administers. Hence, the research took on the meso/macro-levels perspective of the government. Previous literature related to the Indonesian post-democratization STI policy governance has been less clear in reporting that after the fall of the dictatorial regime of President Suharto in 1998, the STI governance of the nation has been fragmented. A more detailing investigation then found that government institutions have been in varying degrees of evolvement in their receptiveness to interact or collaborate with external entities. Despite some government ministries have developed significant advancements in defining the rationale and methodology in conducting knowledge creation, some government ministries admit to experiencing retrogressive roles to what they enjoyed in Suharto's era. Furthermore, the research also investigates how Indonesian "superior ministries" (in this case, the Ministry of

Finance and the Ministry of National Development Planning or "*BAPPENAS*") and the political parties have contributed in the knowledge creation system of the country. Using the findings coming from those ministries, the research eventually comes to a predictive conclusion that in the condition where there is an absence of a unifying actor of the national innovation system, the future expansion of Indonesian innovation capability is ambiguous. Additionally, despite in the surface, Ristekdikti seems to convey the nation's highest authority in administering Indonesian STI sectors, the current study found that the R&D operations of varying national-level government institutions are common to be completely detached from the authority of Ristekdikti. The finding gives an implication that although some government sectors are more vigorous to mobilize the partnership of industries (including the SOEs) and the academia, in today's democratic environment of Indonesia, some public sectors may not always create such configuration network. In other words, the democratization of the country itself may or may not bring a positive influence to emphasize the SOEs' role in Indonesian national innovation system. However, the democratic cycles have been evidenced to bring the possibility for future reformations to occur.

In the last study, the research continues to use the subject of Indonesia while maintaining the contextualization of the country's expanding its democratization progress. The study scrutinizes record data of an event where the leaders of the SOEs directly interacting with government officials to discuss their potential role in national innovation policy. The analysis found that SOEs may eager to advancing their cognitions in innovation specifically to help their own businesses. Meanwhile, the study again found the old vision of past autocratic authority may endure. The survival of the obsoleted vision creates a cognitive disconnection between the government and

the SOEs. This brings a thought supposedly generalizable to other developing countries that their top-leaders must first create effective sociotechnical imaginaries or national vision before the government able to engage the role of their SOEs in their national innovation system realms.

The findings of the studies suggest we can say indeed an SOE can have a constructive position in a national innovation system. But in order to shape the role, the government must first create a coherent vision about the function of STI policy. That while SOEs may be maturing in their pragmatic attitude towards “innovation”, as it has been repeatedly shown here, the government can actually become the cause why the firms have less effective for other entities, including the POEs.

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To others that may hope I would mention their names specifically here but I do not, please apologize, *mohon maaf*. But who am I to receive such honor to state your names? But, for you, I would say here: thank you for your assistances and good wishes, *terima kasih sekali atas segala bantuan dan doanya*.

# Chapter 1

## Introduction

Unlike the institutional subjects of the university, public research organizations, government, and privately-owned enterprises (POEs), scholars have long neglected the discussion about state-owned enterprises (SOEs) in the subject of science, technology, and innovation (STI) policy studies. As a consequence, the public discussions about the expected role of SOEs in national innovation systems have been very scarce. As the subsequent chapter of this study report will unveil, some countries can seemingly completely unaware of the potentials of their SOEs in their own national system of innovation. This disregard is astonishing because as recent as around 2010-2011, the sales value of the largest SOEs in the world was larger than the Gross National Incomes (GNIs) of the United Kingdom, France, or Germany: equivalent to almost 6% of world's Gross Domestic Product (GDP) (Kowalski, Büge, Sztajerowska, & Egeland, 2013, p. 6). Indeed, SOEs are important in both developing and advanced economies. In developing countries, SOEs are important to address the fundamental problem of the shortage of entrepreneurial talents (Chang, 2007). Meanwhile, the largest SOEs in advanced countries such as France, Germany, and Swiss working in energy, post, railway sectors would have a significant political position as in 2013 they hired millions of labors (Rentsch & Finger, 2015). There, although the SOEs' management enjoys a certain autonomy, practical ideas often come from the government-owners (Rentsch & Finger, 2015). The realities imply the universal importance of the study of

the SOEs' role in STI policy, specifically to aid governments to maximize the role of the firms in their enhancement of national innovation systems.

The intricacy of the authority relationship between the government-owners and the managers of SOEs can bring real challenges in the observation, hypothesis development, and theoretical development/testing of the firms. As countries have different conditions in public policy processes and political-economy traditions, that SOEs sometimes can behave similarly to POEs, it is impossible to develop a universally-accepted theoretical definition of SOEs (Indreswari, 2006; Vernon R. , 1979; Shirley M. M., 1999; Estrin, Meyer, Nielsen, & Nielsen, 2015). The lack of a universal definition of SOEs stimulates analysts to make study innovation by using external reliable references[1] in order to make a reliable identification of which companies that are SOEs that they can select as study subjects. Such a technique was taken in this study, namely by using the selection reference coming from the distinguished "*Fortune 500*" list. The selected SOEs then got compared with a strong POE subject in order to illuminate the business and publicly-charged aspects of their innovation endeavors. The analysis has been reported here in Chapter 3. The study was accomplished by tracing the extent of the scientific collaboration of SOEs with other national actors. The result is some SOEs of several countries, reinforced by the supporting policies, are seemingly more focus on making scientific partnerships with domestic research organizations, universities, and POEs. Using the reference of the collaboration behavior of a leading POE, we can estimate business-wise such partnership-creations of SOEs with local actors is unnecessary. The behavior suggests it

[1] For example, Kowalski and colleagues (2013) uses the reference of the well-known Forbes© Global 2000 list (Kowalski, Büge, Sztajerowska, & Egeland, 2013).

is the government's policy direction that assigns SOEs to have a more accommodating role in research collaborations with various actors in a national system of innovation. On the other hand, the contrasting behavior of SOEs that do not seem to perform a recognizable role in the national innovation system produces a valuable inquiry of how their government-owners fail to see the potential of SOEs in their national innovation system. The inquiry was addressed by assessing the structure and processes of STI governance of a country that has been found of having an SOE not to assume a significant role in the national innovation system, namely in Indonesia.

Today, the size of the assets of the Indonesian SOEs is approximately half of the size Indonesian economy. The massive presence makes it is difficult to assume that the government stakeholders in STI policy are not aware of the potential economic of SOEs. As the government institutions embody the owner's position of SOEs, we can guess that the government's failure is the origins of the identified weak role of the SOEs in Indonesian's innovation system. Here, there are two studies that asses such assumption. The first study (Chapter 4) focuses to collect and analyze interview data with representatives of the government institutions (without including the SOEs). The interviewed subjects representing government institutions that are managing national research and development (R&D) budget and with relevance to the national government budget cycle processes. This study, accordingly, tries to understand the structure and function of the government stakeholders in the latest political background of the country. The study results show how the existing structures and function of government institutions in STI policy are fragmentized. This fragmentization then leads to their failure to synergistically create meaningful policy directions that SOEs later can take as STI policy instructions from their owners. The government stakeholders produce

incoherent STI policy directions. The contribution of this study in the specific studies of Indonesia, therefore, is in mapping out the institutional setting of Indonesian STI policy and in the description of the power dynamics that bind the rationalities of those institutions. The failing effect is exemplified in the following study (Chapter 5). The study uses an audio recording data of a meeting between representatives of government stakeholders and the SOEs discussing innovation policy issues. This meeting produces useful evidence of the expressed priorities of both the government and the SOEs. For Indonesian SOEs, the data shows that their interest in "innovation" mainly related to the firms' concern to create profit that they can return to the state as part of national income. On the contrary, as found in the previous study (Chapter 4), the study again found that the government has been incapable to create a combined effective STI policy vision that SOEs can later carry. Therefore, the study demonstrates that SOEs can have independent interests in innovation that is tied up with profit-creations. The SOEs' innovation behavior is only to serve their self-interests. So we can predict that the government's failure is the major cause of an identified SOEs' weak role in the national innovation system. That although the SOEs are ready to play a greater public role in STI policy, their government-owners may be the major reason why they do not perform an adequate role in the national system of innovation.

Although the studies altogether have made a compelling effort to describe how SOEs can indeed have a leading role in the national innovation system, the chosen major country subject is Indonesia which is a developing country. Nonetheless, the studies also include the advanced economies subjects such as Japan (Chapter 2, Chapter 3, Chapter 4, and Chapter 5), Norway (Chapter 3), and the United States (Chapter 5). The advantage of using cases of developed nations is they have more reliable data

sources and historical evidence to show the importance of STI policy in economic development while developing countries will have to emphasize the more abstract endeavors of technological catching-up (Fagerberg, Srholec, & Verspagen, Innovation and Economic Development, 2010). The advantage of using Indonesia is unlike the advanced countries, the political commitment to maintain SOEs are stronger hence we can have more straightforward observations of the behaviors of the companies interacting with their government-owners. On the contrary, the historical occurrences of SOEs' privatization in Japan and Norway will make the observation of firms there more opaque. The problem will be greater if the investigation takes place in the United States where SOE business occupies a much smaller fraction (Galambos, 2000, p. 275). Hence, Indonesia offers a more ideal place to illuminate the relationship between the SOEs and the government, and how the connection fails to encourage the firms to play as leaders in the system of national innovation. However, by its novelty, the study here requires the inductive methodology as the existing theories in the economics of innovation is inadequate to explain the phenomenon of how the government does not seem to direct their SOEs to play greater roles in the innovation system of Indonesia. So, the developed methodologies that are using fundamental theories from sociology[2] and science, technology, and society (STS) scholars[3] can still be perceived as unconventional for the practical-minded STI policy communities that are largely inclined by the economic angle. Still, STI policy scholars can be benefitted from the study as it produces a broader understanding of the breakdown of an STI policy

[2] In this case, the Durkheimian methodology (*see* Chapter 4).
[3] Here, "sociotechnical imaginaries" (*see* Chapter 5), is instrumental to understand how the interaction between the government and the SOEs has led to the condition where the SOEs do not have a strong role in Indonesian national innovation system.

intention. Therefore, this material is useful for enriching the scholarship of STI policy studies.

To sum up, this study intends to understand the potential role of state-owned enterprises (SOEs) in a national innovation system. To attend such a direction, there are three accomplished study aspects, which are as follows:

1. The comparability of SOEs in various countries to a leading POE working in the same sector (Chapter 3);
2. The bounded rationality of the government institutions as the representative of the "state", i.e. the owner of SOEs, in viewing STI policy (Chapter 4);
3. The interaction between government institutions and the SOEs on the issue of innovation (Chapter 5).

The initial focus of the comparative study (Chapter 3) is to identify the possible influence of R&D output of SOEs as traced through their internationally-published scientific publications. Then, the emphases of the study move to interpret how the shifting political structures influence the process rationality of government institutions (i.e. the owners of SOEs) in viewing innovation policy (Chapter 4). In the wrapping-up segment, the analysis aims to understand how the interaction of SOEs and their government-owners drove the companies to produce trivial R&D output as the first part of the study has shown (Chapter 5).

## 1.1 Background and Motivations

For the author, the most straightforward driving force of this study is the massive presence of SOEs to the economic activities of Indonesia. Respectively, there is a substantial amount of scientific publications from Indonesia that are related to SOEs.

Specific to the pertinence issue of technology or innovation, many authors have developed the analysis of Indonesian SOEs within the discipline domains of engineering[4] or management[5]. Those reports bring the universal portrayal that indeed scholars can create superficial analytical frameworks where SOEs are treated as independent agencies, unconnected to the government. But even so, the interest of this study is to answer the analytical inquiry how the governments as the owners of the SOEs interact with the companies in the states' undertaking their policy aims in science, technology, and innovation (STI) sector? This is an essential topic because for long we know governments regularly assign achievement targets for SOEs to contribute to social welfare in rendering their planning (Vernon R. , 1981). The public-serving character as attached to the mission of governments makes SOEs dissimilar to POEs as business firms which are not established solely for profit-seeking intentions (Vernon R. , 1981). Although having the extraordinary feature, prior convincing studies that interlinking social welfare to "innovation" mainly took POEs as the research subjects, or, at least not directly contextualized on SOEs. A strong example comes from the work of Porter and Kramer (2006) that labels "corporate social responsibility" as the tangible form of social welfare improvement activity that companies can independently create a business strategy in which they may build a value-sharing relationship with universities to develop new technologies (Porter & Kramer, 2006). It is worth our attention, such prescriptive theory would require incentives for industries (Porter & Kramer, 2006, p. 14), indicating the entailed conceptualization that assumes firms as part of free-

[4] *See* for example Shihab, Furqon, and Hidayanto (2015) (Shihab, Furqon, & Hidayanto, 2015), or, Prilianti and Hikmat (2018) (Prilianti & Hikmat, 2018).
[5] *See* for example (Pardyanto & Fontana, 2017)Sedyowidodo, Basbeth, and Sule (2017) (Sedyowidodo, Basbeth, & Sule, 2017), or, Soewarno and Mardijuwono (2018) (Soewarno & Mardijuwono, 2018).

enterprise setting instead of a part of government's lawfully propriety. Theoretically, in the economy of free-enterprise, patent or another form of intellectual property rights protection provides the incentive for POEs to utilize their R&D outputs for creating profit (Arrow, 1962, p. 617). However, it has been conventionally recognized that the disincentive of the entailed risks may cause free-enterprises to underinvest in R&D (Arrow, 1962, p. 619). Therefore, profit-seeking POEs are not reliable in the issue of social welfare improvement when the purposed activity is technological R&D. On the contrary, states can deal with the problem. In doing so, the challenging part is to accurately calculate the scales of government intervention, especially when adding uncertainty factors (Arrow, 1962, p. 623). In this, Belloc (2014) argues SOEs may take a pivotal role (Belloc, 2014, p. 835). Belloc (2014) argues the support of the government on SOEs makes the companies more superior to POEs to generate active inter-firms research coordination, for opening the public access of information exchange and intellectual property rights of the companies (Belloc, 2014, pp. 835-836). By using the theoretical arguments of Belloc (2014), we can conjecture further that the optimal role of SOEs in national innovation systems will have the precondition on the authority's ability in minimizing corruption and malicious political abuse (Belloc, 2014, p. 839). The theoretical arguments of Belloc (2014) on the SOE's side are wide, covering common dimensions such as the selection of managers based on abilities, the well-defined definition of duties of the managers, and the employee representativeness on the corporate control (Belloc, 2014, pp. 840-842). Although the article is very convincing, it is lacked with convincing evidence to show that some governments in real-world settings – at least from countries that have a better reputation in managing corruption – have actually been directing their SOEs for assuming such principal role in

knowledge creation (Belloc, 2014). As Belloc (2014) convincingly argues corruption, even when it is translated as merely the obstruction by the conflict of interest, weaken the SOEs' performance to convey specific government's task in innovation (Belloc, 2014). Although in theory the emphasizing of corruption is an established interest of the studies of public policy, we need to reinvestigate whether *every time* corruption actually becomes the source of government's failure to accentuate the role of SOEs in various national systems of innovation. Corruption may not the only source of government's failure.

To summarize, the background of this study is to explain how governments may mold the position of SOEs in their national innovation systems. Meanwhile, the motivation is to understand how the contemporary Indonesian policy advancements have been accomplishing in such direction.

## 1.2 Theoretical Background

The previously-mentioned theoretical argument of Belloc (2014) on the ideal position of SOEs has long been in the contestation with argumentation frameworks that see market mechanisms, especially in competitive sectors, are always perfect (Belloc, 2014, p. 823). It is then interesting to notice in the theorization of Belloc (2014), the more vital theoretical role of SOEs are in industrial coordination and not in the relevance of efficiency and distribution of goods that according to neoliberal economics, governments can induce through effective execution of anti-trust laws (Belloc, 2014, pp. 835-836; Stiglitz, 2018). In other words, Belloc's argument expands more attune with the belief of welfare economics that views the market as not perfect due to industrial actors' fearing to handle the risks in investments in innovation (Stiglitz, 2018, p. 6). Be

it as it may, Belloc's theory is also not entirely fitting with welfare economics model as it does not necessarily entirely meets the Rawlsian ideal principle of social justice (Stiglitz, 2018, p. 7). As the standpoint of Belloc (2014) is not immediately raising the position of the weakest members of the society, in spite we may assign a premise that the SOEs' contribution can improve the welfare of the more unfortunate (Ralws, 1971, 1999, p. 68; Belloc, 2014). Now, to recall that Belloc (2014) in his proposal to illuminating the potential role of SOEs was heavily contingent to the act of "*patent-sharing and cross-licensing simulation*" (Belloc, 2014, p. 825), it implies that his theory-building will attune not to the famous Rawls theory of justice but to Nozick's distributive justice theory (Nozick, 1974). That while under competitive environments, governments may not enforce POEs to bear the risk of the uncertainty in R&D for the purpose of reaching socially-desirable standing. Therefore, the manifested circumstance where the SOEs have an amplified role will require the free participation of actors that are able to be involved in the market for knowledge. Governments cannot force POEs to participate in the knowledge market in which SOEs play a leading role. This knowledge market is thus naturally flawed and narrow mainly because it has the prerequisite for the involving actors to have the existing capability to be able to determine the value of the circulated information (Rosenberg, 1990). In other words, as Nozick (1974) argues, the state will need to guarantee POEs that are involved in Belloc's model to make voluntarily participation and *not* considering to aid others (Nozick, 1974). Therefore, the model of Belloc (2014) is adaptable to the competitive or meritocratic environment of which SOEs will not demonstrably respond to the Rawlsian need to create social protections for the weakest societies (*see* Stiglitz, 2018) (Belloc, 2014). Instead, SOEs are instrumental in bringing a sense of justice in distributing deeper opportunities for the

members of societies who desire to join in developmental dimensions that are intertwined with the race of technological competitions.

The description right above shows that there is a conflicting of conservative philosophical tenets that will inhibit scholars to discuss the role of SOEs in national innovation systems. That should be the additional reason why the basic theory of Belloc has come as late as 2014 despite almost three decades earlier scholars have expressed their belief that SOEs are well-understood subjects (Vernon R. , 1981). For it has been historical evidence that the governance of Thatcher that rose after the oil shocks of the 1970s produced the intensification of the unfriendly outlook of the intellectual and ideological climate of state intervention (van de Walle, 1989). Those combining factors made scholars were less favoring with the task of developing strong theories that interlink the issue of innovation and SOEs. At present, in a publication of a national innovation system that STI policy scholars regularly cite[6], SOEs already have been over-simplistically defined as:

1. A variation of the type of ownership of to POEs, although they may behave similarly (Chesnais, 1993, p. 193);
2. The type of company that may receive a dedicated R&D assignment adding to the responsibility to distribute technology or innovation capacities (Chesnais, 1993, pp. 203, 215);
3. As a type of company of which the government's propriety upon it can be transferred to private sectors (Kim, 1993, p. 363).

[6] The points come from the book of "National Innovation Systems", edited by Nelson (1993) (Nelson, 1993).

If we accept the three points as sufficient to describe the position of SOEs as equal to POEs, it will permit for one to directly use the firms when discussing STI policy theories, such as the widely-accepted "*Triple Helix*" configuration (Etzkowitz & Leydesdorf, 2000). Still, to make a trustworthy positioning, one needs to first investigate the prospect of such insertion – or straightforward substitution of "industries" by "SOEs" fits with the worldwide realities. That means, if one finds credible evidence that an SOE in a country is not behaving similarly to POEs, then his or her subsequent task is to refine the theory to explain why SOEs government-owners elsewhere are not directing the companies to do the same thing. For it is irrational to assume any government will allow the underutilization of its propriety especially for the purpose of social welfare improvement. Consequently, such lost role should be the concern of STI policy studies if we accept, as theoretically described by Belloc (2014), that SOEs has a strong potential function in providing industrial coordination in knowledge creation (Belloc, 2014). In other words, we can see the major problem in using the above three-points definition of SOEs is in their containing arguments that hide the fundamentally different characteristics of SOEs to POEs. This vagueness will inhibit our describing the ideal theoretical function of the publicly-owned companies as Belloc (2014) described (Belloc, 2014).

It is worth mentioning that the task of distributing social welfare is distinctly the primary function of government, *not* SOEs (Fitriningrum, 2015). In providing the social welfare, political argumentations become more appealing than profit measurements for governments in preserving the role of SOEs specifically in the scenario concerning with market-failures or monopoly market (Boardman & Vining, 1989). It means the government will not use profit variables in justifying the task of the

firms in providing positive external effects of social welfare (Vickers & Yarrow, 1991). In the context of this study, it thus is more sensible to argue governments will be interested in assessing the impact over the SOEs' knowledge-creation activities to other actors in national innovation systems as a representation of how the SOEs they own bring social welfare improvement. The task to measure the social welfare creation is vital to consider governments are more conceptual than concrete subjects. To distinctly demonstrating the impact of SOEs on the public is crucial to maintaining their publicly-owned status (Shirley M. M., 1999). Therefore, again by looking into the theoretical work of Belloc (2014) (Belloc, 2014), the required direction in the studies of STI policy is to develop a framework that demonstrates where SOEs have more essential status among a specific network of knowledge-creating actors to validate the SOEs are certainly producing social welfare improvement.

In summation, the body of literature suggests that following the subsequent general trend among scholars, STI policy academics have been viewing SOEs generally as typically indifferent to POEs. The hasty-generalization that has been widely accepted explains why the studies so far have been ceasing to explain how the public can obtain their societal rights in STI policy through the operations of SOEs. Meanwhile, the latest theory development clearly points out that the difference between SOEs and POEs is the former entities have more superior capacities in dealing with R&D risks hence making them the ideal actor to lead a network of knowledge creators. A successful demonstration that SOEs' in actual fact are undertaking some leadership roles, therefore, will bring the indicating mark the firms are in reality can produce a sort of improvements that are important for the expansion of STI policy studies. However, the theory still needs more convincing justifications. This study shall seek to fill such a gap.

The study incorporates SOEs from various nations although principally linked with the context of Indonesia. That is to say, the analysis adapts its direction to understand the relationship between the Indonesian government and the SOEs they own. Such reciprocal relationship is important to explain the cause of the specific manifestation of Indonesian SOEs in the country's national innovation system.

## 1.3 A Concise Discussion on Indonesian SOEs

The presence of Indonesian SOEs in the Indonesian economy today is hard to ignore. According to the Indonesian Ministry of State-Owned Enterprise (2018a), in the country, there are 115 SOEs along with their 148 child companies (Indonesian Ministry of SOEs, 2018). In 2016, the total assets of the Indonesian SOEs were about 56.9% of the national gross domestic product (GDP) (Kim K. , 2018). On the other hand, according to the calculations of the Ministry of Finance (2016), in 2017, the portion of SOEs' profit sharing to national income is only 2.34% (Indonesian Ministry of Finance, 2016). Throughout 1998–2013, the total share of a number of scientific publication of the companies to the national tally is also insignificant, 3.65% (Manurung, 2014). Notwithstanding, up to now, SOEs enjoy domineering positions in various in airport operations, construction, electricity, financial services, mining, petrochemical, telecommunication, toll road, railway, seaport, and a wide manufacturing sector (Kim K. , 2018). Thus far, their dominant position does not seem to be receding. Upon entering the tenure in 2014, President Joko Widodo has engaged the SOEs to be more vigorous in national development thus unlike previous cabinets since the economic crisis of 1998, he has been avoiding the issue of privatization (Kim K. , 2018).

Historically, the idea of establishing SOEs in Indonesia emerged before the independence of the nation (Sutter, 1959). The inherent problem was the former colonial masters had long barred the vast majority of indigenous Indonesians to formally participate in any capital accumulation business (Sutter, 1959). Consequently, the Indonesian government bureaucrats would have an amplified obstacle to process the intellectual property rights (IPR) assets as an intangible concept that is essential in developing STI policy because their capitalistic aptitude generally has been stunted. It also means the Indonesian government will not be able to appreciate the importance of sharing and cross-licensing of the patent (one type of IPR assets) that Belloc (2014) suggests as important to form a system where SOEs could shoulder a leadership role (Belloc, 2014). That could explain why later in the authoritarian era that ended in 1998, the president used SOEs as a means to demonstrate the symbol of his imagination to modernize the country (Amir, 2013). In the recent period of democratization, the decades of the authoritarian era of creating the symbols of modernity through government's high technological programs seemingly has been strongly shaping of the conscience of Indonesian societies, prompting the policy-making government and SOE elites preserving to use hypes of technological endeavors to garner media support (Simandjuntak, 2014). Despite this, it is interesting to notice that even scholars also notice that in a post-authoritarian Indonesian SOE, the leader of such firm would admit that profit-seeking is the motivation of innovation creation (Simandjuntak, 2014). Actually, profit-creation was also the motivation of the Indonesian SOE elite in the authoritarian era to do innovation (Amir, 2007b). The dissimilarity is only *after* the authoritarian era, the government emphasizes all SOEs to accurately measure their achievements by the indicators of profit and efficiency as a way to implement rigorous

corporation principles (Fitriningrum, 2015). To put it another way, the profit-seeking intention of SOEs' doing innovation is unnecessarily depending on patrimonial relations to the government that was widespread in the authoritarian era. These situations bring a critical inquiry about the government's outlook on STI policy of which they need to consolidate to the SOEs as the institutions that supposedly bear a corresponding fraction of government's assignment to distribute the social welfare.

There is no publication today that have deeply examined how the government in the democratic era of Indonesia assigns SOEs for doing their STI policy interests. Unlike all Indonesian SOEs today that are encouraged to create profit (Fitriningrum, 2015), the Indonesian government is not carrying the mandate to make a profitable business. Furthermore, the democratization of Indonesia which has obsoleted the need to an authoritarian figure brings an associated knowledge gap regarding government's adjusted cognition in grasping the direction of STI policy of the nation. This is the gap the study aim to fill. Namely to comprehend how the democratized-era of Indonesian government institutions make a combined synthesizing of the public interests in STI policy of which they may expect SOEs to act as the government's representatives. By the distinction of the two entities, the gap area is to investigate how the government-masters interact with the business-oriented SOEs they own in materializing STI policy concerns. The dynamic background explains the motivation of the study of how government molds the specificity of public interests in STI policy, particularly in a democratized environment.

## 1.4 Research Areas

The purpose of this section is to line up theoretical boundaries that enclave the problem aspects of the present studies. The literature that fundamentally influences the entire study scopes is the article of Belloc (2014). The publication illuminates nearly pure theoretical description of the potential advantage of SOEs for the state to more easily coordinate the intra-industrial changes (Belloc, 2014, pp. 824-825). To make a more convincing confirmation of his theory requires an empirical study that uses at least several countries settings before drawing conclusions to support or reject the said Belloc's theory. To put it another way, to develop inductive study is a necessity. The most important matter in doing inductive study is in deciding the number of observations to make a compelling conclusion that is reliable for wider generalizations (Walliman, 2011). Another crucial factor is in the selection of situations and how the observation condition parallels to the described locus so the study can produce correct conclusions (Walliman, 2011).

The article of Belloc (2014) provided some important clues to address those two basic demands in the inductive study (Belloc, 2014; Walliman, 2011). First, SOEs are business entities with objectives, primarily in manufacturing sectors, do not differ to POEs in term of character and measurements (Belloc, 2014). The atypical feature of SOEs to POEs is in the former's holding specific rights – involving to conduct monopolies – from their government-owners (Fitriningrum, 2015). The problem in separating SOEs to POEs from a particular bunch of international candidates of companies is there is no universally-accepted definition of the term "*state-owned enterprise*" (Indreswari, 2006, p. 96). For this reason, we can only inductively express the characteristics of SOEs in real-world settings (Indreswari, 2006, p. 96). It is very

likely for researchers to make cherry-picking distortion[7] when applying *a priori* classification between SOEs to POEs when the study context come from several nations. For a legal definition of SOEs in one country may not similar to the definition of the companies elsewhere. To mitigate the challenge, researchers can take the names of SOEs and POEs from a reputable inventory of companies in deciding the exact number of observations. That way, the researchers do not rely on their own definition of SOEs. Applying those arguments, the first study made a comparison analysis of SOEs from varied countries that used a reference of the distinguished "*Fortune 500*" list. From the clear mechanism of the identification the subjects of SOEs in learning the government's policy behind them, the remaining part of this section shall explain the specific analysis areas of the study.

### 1.4.1. Collaboration as an Indicator of Inter-Organizational Partnership

The fundamental problem in the theory of Belloc (2014) is in the confirmation whether there are actually SOEs that produce specific knowledge for other institutional actors to adapt. To do it, we can conduct a study of knowledge diffusion that takes form in patent or publication analysis (Chen & Hicks, 2004). In order to make more efficient verification of SOEs interfacing with other actors, this study analyses the firms' conducting R&D collaborations for showing the evidence that companies can indeed take the effective coordinating role of a network of knowledge creators. That is to say, the collaboration analysis is useful to illuminate an instance of risk-sharing in R&D activities by SOEs as Belloc (2014) denotes in showing the greater potential function of

[7] See Johnston (2006) to learn more about what the author means here with the phrase of "*cherry-picking*" falsification (Johnston, 2006).

SOEs (Belloc, 2014). Here, the variable that indicates collaboration is articles co-authorship. A co-authorship implies a knowledge producer's cognition in choosing the more promising research partners at the expense of losing other potential collaborators (Li, Liao, & Yen, 2013). Therefore, the benefit of studying the R&D co-authorship profile of SOEs as collaboration indicator is two-fold, namely:

1. To demonstrate the manifested roles of the knowledge creation by SOEs following the support or alliances with other R&D actors;
2. To transpire both the intended and latent policy direction of the government-owners in driving the agenda of SOEs to build R&D activities that other institutions appreciate.

Here, it is important to bring to mind that the existence of SOEs is to participate in carrying the major task of social welfare improvement that their government-owners convey. This context of the study describes that the government is the one that controls the larger picture (*see* as Belloc (2014) (Belloc, 2014)). In other words, this study argues SOEs conducting scientific collaboration is to convey the government's macro decisions in STI policy than carrying the business interests of the firms themselves.

### 1.4.2. The Governance of STI Policy in the Democratic Era of Indonesia

A point often disregarded is the owners of SOEs are the government that represents the position of the "state". With this in mind, scholars have pointed out that the evolutionary structure of SOEs in Indonesia corresponds with the historic path of government's changing in giving an assignment to the SOEs (Fitriningrum, 2015). Provided that government of the state is the subject cause of the behavioral shifting of

SOEs, hence it is imperative to learn about contemporary STI policy governance in Indonesia in order to understand the firms' manifested role in the country's national system of innovation. On the broad subject of the government of Indonesia, the incident of the fall of the authoritarian leader in 1998 that opened the door to democratization or the expanding representations of more extensive social issues by the politicians and bureaucrats has been the core attention of the scholarly studies (Rosser, Roesad, & Edwin, 2005; Ngusmanto, 2016), including in the matter of the control over SOEs (Achwan, 2014). Scholarly observations seem to infer that Indonesia's contemporary problem is how to increase its democratic qualities (Mietzner, 2012; Lim, 2017)[8]. Therefore, it is incorrect to predict the Indonesian today is shifting to return to individual authoritarian commands because social science scholars will clearly report or discuss it in their publications. It is thus surprising to learn that specific to STI policy sector, scholars seem to suggest the old dictatorial ideas remains popular among the general members of the society while also influencing the structural methodology of government officials and the SOEs (Amir, 2007; Amir, 2010; Simandjuntak, 2014). Regardless, the existing scholarly literature has not been surfacing the fact that Indonesia's democratized government has not been conducting the process of STI policy governance in an exact way as the country's authoritarian era. In the authoritarian era, the government processes entirely followed the taste of the autocratic leader, comprising the exploitation of the role of SOEs (Amir, 2013). Meanwhile, the

[8] Scholars may intuitively stretch the meaning of "democracy" by applying some adjectives as an inappropriate shortcut in adding the weight of their arguments (Collier & Levitsky, 1997). Readers may capture the actual definition of democracy that an author actually intents to use (Collier & Levitsky, 1997). In this case of the study report writing, the author maintains an assertion that the latest academic articles that assigns democracy as the main discussion topic on Indonesia – for example, the cited ones here – generally are not attempting to overstretch the form of government. On contrary, their directions are in the constructive tone of improving the quality of democracy in Indonesia.

democratization process brought the clarifying government ownership of SOEs under one specialized body of the Ministry of SOEs that must operate under other dozens of ministerial regulation authorities (Fitriningrum, 2015). Correspondingly, the latest ruling regime has progressed its interpretation on the public resources utilization that associates scientific research more to human resources development (Indonesian Ministry of Finance, 2014) whereas in the authoritarian times it was concerning with the president *vis-à-vis* a political figure he entrusted (Amir, 2013). Additionally, completely distinctive to the authoritarian era, in national level policy design today, there is a multitude of national-level government organizations that manage resources for R&D that is not necessarily linked to manufacturing sectors[9]. Under those circumstances, at present, the structure of a much more multifaceted government will shape the processes of the role of Indonesian SOEs in the country's national innovation system. Hence, the study of the inter-institutional government views in STI policy is important to create a refined understanding of the materialization of the public role of SOEs in Indonesia's innovation system in its democratic era. That also signifies the gap area this study aims to fill in order to evaluate whether Indonesian SOEs today can play the leading role as Belloc (2014) suggests (Belloc, 2014).

### 1.4.3. The Interaction between the Government and SOEs in Contemporary Indonesia

The conventional theoretical explanation universally predicts the managers of SOEs as in the perpetual need to heavily negotiate with their government-masters in

[9] To validate the statement, one can see the explanations of national budget management that the Ministry of Finance annually publishes. For example in Ministry of Finance (2014) (Indonesian Ministry of Finance, 2014) that relevant to President Joko Widodo that begun his tenure in 2014.

conducting their business operations for politicians regularly create the determining decisions (Raiffa, 1981). The logical portrayal has persuaded scholars to have the partiality that SOEs as a mere straightforward political tool for the elites to materialize some STI policy goals. The same condition happened in the Indonesian context. For instance in the declared hypothesis of the study of Simandjuntak (2014) that took the background of the democratic environment of Indonesia (Simandjuntak, 2014). However, proper theoretical construction of the SOEs needs to consider the *reaction* of companies in receiving the government's task because the firms need to guard their own business (Raiffa, 1981). Belloc (2014) actually has considered such reaction of the SOEs in his cautioning the hazard of governments' overly penetrating the commercial decision-making process of the companies (Belloc, 2014, p. 840). In spite of that, to reconstruct the instance of interaction between the government and SOEs for conducting scientific research is not a simple task. The difficulty level becomes larger when we take a context of a democratic nation of which the government must deal with multidimensional public-sectors as happen in present-day Indonesia. It is valuable asserting that Simandjuntak (2014) has attained partially of such orientation, although her emphases were in the one-sided section of SOEs while she took the proposition the government as "*soft state*" (Simandjuntak, 2014). However, her writing did not discuss the progress of STI governance. For that reason, this study resides a literature gap of the description of how government interacts with SOEs to shape the firms to assume a specific role in a national innovation system.

## 1.5 Research Methodologies

The ultimate concern of this study is to empirically infer whether governments actually have been using SOEs as their institutional STI policy instrument as Belloc (2014) theorizes (Belloc, 2014). Corresponding to such attention, the complementary study goal is to formalize a prescription of how in the future the Indonesian government can optimize the function of their omnipresent SOEs in the country's national innovation system. This section dedicates itself to explain the author's methodologies for accomplishing such study targets.

### 1.5.1. Scientometrics Study on SOEs' R&D Collaboration Profile

This first phase of the verification study requires quantitative study over a publicly-available dataset in order to increase its chance of research reproducibility, thus strengthening its verification value over the work of Belloc (2014) that is profoundly theoretical in conceptualizing the potential governments' task-assigning for SOEs (Belloc, 2014). It is important to remember, to synthesizing SOEs' performing a specific governmental task as in the proposal of Belloc (2014) demands the primary justification that the companies are undeniably not only actively conducting R&D but the firms also are collaborating with other institutions (Belloc, 2014, pp. 835-836). In this study, the measurement of R&D activities and the firms' research collaboration use primary data of scientific publications from the database of the Scopus database.

While the evidence of R&D activities are straightforwardly coming from the counts of publications, co-authorship is apportioning here as the indicator of collaborations including international partnerships (Melin & Persson, 1996; Wagner, Park, & Leydesdorff, 2015). The study preserves the behavior of international

collaboration to indicate a sort of R&D activities that predominantly come from the SOEs' business interest. In bringing the issue of "business interest", the analysis incorporates a reference of one leading POE that operates within the same industrial sector of which all the investigated SOEs exist in. The POE reference is important to estimate the motivational substance of R&D activities, i.e. driven for seeking commercial ventures (by its imitating the collaboration pattern of the referred POE) or originates largely by the government (by becoming dissimilar to the partnership design of the selected private company). Using the POE reference, the study argues *domestic collaborations as a more accurate indicator or variable of the manifestation of the directives of the respective government* by its geographical boundary affiliation to the public of the corresponding state. Moreover, as the exhibited collaboration behaviors produce time-series patterns, they serve as pointers to create snowball literature studies for tracing the possible public policy-related backgrounds that have influenced the SOEs to display a business or publicly-orientated R&D partnerships. Such discovering study of policy background is important to obtain the portrayal of how governments in real world-setting may or may not use SOEs as the institutional instrumentation to achieve their STI policy interests. To summarize, the combination of quantitative-qualitative study methodologies in this phase of the study involves:

1. Non-parametric or simple statistical analysis to specify domestic (public-oriented) or international (business-oriented) of the R&D partnerships of the investigated SOEs. *The scientometrics variable of co-authorship denotes the instance collaboration* that later causes the analytical parity of international or domestic R&D partnership clustering;

2. Literature studies to insinuate how governments shape certain SOEs to manifest the pattern of collaboration behaviors.

Those study steps address the request questions that profoundly have roots in the theoretical inferences of Belloc (2014), namely (Belloc, 2014):

1. Are SOEs purposefully producing scientific knowledge through R&D activities?
2. In doing the R&D endeavors, do the SOEs exhibit behavior similar to POEs?
3. How does the government shape such knowledge-creation behaviors?

It is important to mention here the subsequent finding of this study that while some countries seem more successful in activating the role of SOEs, some of SOEs of other countries do not generate R&D outputs inconsistent year-to-year productivities. These less dynamic SOEs thus cannot suitably represent the prescriptive model that Belloc (2014) recommends (Belloc, 2014). The drawback, in point of fact, informs the government localities where the model fails. Strictly speaking of this case of study, the weaker countries are India, Indonesia, Malaysia, Thailand, and to some degrees, China. While the more successful country is Brazil and, again, China. The most successful country subject here is Norway. Consequently, as there are more countries fail to meet the ideal theory, the remaining study areas effectively lie in the direction to answer a more urgent question why governments are failing to mobilize the position of SOEs in their national innovation systems?

### 1.5.2. Durkheimian Analysis: Collective Consciousness of Government Institutions in Viewing STI Policy

The owners of the SOEs, as explained beforehand, are governments which are not concrete beings. The proposition of the abstract character of governments is more

suitable in conversing non-autocratic states. Also as previously pictured through the case of Indonesia, governments in non-autocratic states may have a busy public sectors connection of STI policy interests. In the context where the captured role of SOEs in national innovation systems is negligible, the study task is to objectify the vague national interest in STI policy. Using the case of Indonesia, that is the aim of this study, namely to understand the collective awareness of government institutions on their own reflections on STI policy. The identification of the research gap follows the publications of Sulfikar Amir (Amir, 2009; Amir, 2010) and Simandjntak (2014) (Simandjuntak, 2014) that all have been in the connection to the autocratic or post-autocratic settings of the state. We must keep in mind the authors did not discuss the structurally complex government of the democratic era of Indonesia.

The current analysis adopts Durkheimian methodology to inductively study the collective behavior of the government institutions related to the enactment of macro STI policy while each is responsible for their own government sectors. The central gravity of Durkheimian methodology is in the accepting the objectivity of "social facts" as a forceful societal source to exerting external constraints to a member of society (Durkheim, Lukes, & Halls, 1982). For that reason, the concept is advantageous for categorizing the present-day structure and process of Indonesian STI policy. The identification of the bits of social facts of the linked institutions is more useful to produce a simplified mosaic portrayal of each government institution. It is worth mentioning a Durkheimian paradigm asserts that the written law does not automatically tell how the government governs (Neumann, 2008, p. 131) whilst the relationship among government institutions marks the governance performance (Durkheim E. , 1984/1933). The meant conjectural "law of interdependence" in Durkheimian paradigm

is again what has been potent to create a normative analysis to unravel the chaotic interconnectivity of STI policy among government sectors. Durkheim paradigm, therefore, is useful to create wordings that are meaningful in predicting the precise potential innovation function of SOEs in various public sectors. In this study, the unit analysis is government institutions of Indonesia that are managing (as to manage or use) the sectors of national R&D budget.

The interpretation of social facts process addresses the research question of what are the social facts of Indonesian government institutions in their viewing the social welfare improvement pertain to their sector concern. In other words, the study questions how do the government of national-level organizations perceive their sectoral role or function in the STI governance? Such a question is highlighting the public policy perception of government bodies of which continuously under control of *their own* interpretation of a law. The form is what we can qualitatively capture. As the subject government comes from Indonesia, the country that has been failing to underscore the role of SOEs, the study demands the knowledge of the country's shifting from applying authoritarian rules to running the democratic principles. Correspondingly, the study design is to depict the changes in the *modus operandi* of government institutions. Furthermore, the study originally intended to cover the entire population of government institutions currently implicated in the process of STI policy of Indonesia by their receiving the mandate to co-manage the national R&D budget. Considering the originality of the research question that other studies have not covered, the study creates a primary data collection through interviews. To probe the interaction between one institution and the changing political regimes of autocratic to democratic principles, the study uses semi-structured interviews to gather views of senior scientists or higher-level

bureaucrats of how their respective organizations have been adapting with the new democratic environment in term of STI policy affairs. The observational points of the face-to-face and email correspondence interviews come from the highly-cited publication of Swyngedouw (2005) (Swyngedouw, 2005). The matching areas in each of the discussions are:

1. Entitlement and status;
2. The structure of representation;
3. Accountability;
4. Legitimacy;
5. The scale of Governance;
6. Orders of Governance (Swyngedouw, 2005).

Those elaborated points are fundamentally dissimilar to the power concentration of autocratic authorities. But more importantly, the details are important to perceive the instances where the opaque network procedures of democratic government bodies and its systematic ways to limit the power of the elites are ironically failing to operate the envisioned pluralist principles and codes by restraining the transfer of competencies in the design of the network itself (Swyngedouw, 2005). In order to maintain reliability, this study also covers triangulation interviews with figures external to government and from other government bodies. The "other government bodies" here means the representation of government institutions that are despite operating within the domain of STI policy, the law provisions made them not managing the national R&D budget. Chapter 4 of this study report will explain the details of the study on the institutions' cognition of Indonesian STI policy of its contemporary democratic era.

### 1.5.3. The Interaction between Government institutions and SOEs

The study phase explained right above entails the additional coverage on discussing the public-oriented government interaction with the business-oriented SOEs. Then, the subsequent study objective needs to resolve the problem of how the government has contributed to the weak performance of SOEs in a national innovation system. The reference of Belloc (2014) expects one to explain the condition of which SOEs cannot take a function within inter-firm collaborations scenarios (Belloc, 2014, p. 836). The empirical challenge is to answer how the sponsorship of the state is not guarantying SOEs to receive meaningful supports from R&D agencies or to have innovative relationships with other actors although the firms do have operative R&D systems (*see* Belloc, 2014, p. 836). Simandjuntak (2014) actually has partially covered this issue, although she took the main perspective from the SOEs' view (Simandjuntak, 2014). A demonstration of the interaction of governments and SOEs will help the future research to explore the categorical condition as Belloc (2014) described. For this reason, the third phase of study concentrates to investigate how the link of government and SOEs produces an undesirable result as the scientometric study has previously shown.

The final phase of this study used data of an audio recording of a focus discussion group (FGD) meeting of Indonesian Ministry of Research, Technology, and Higher Education, Republic of Indonesia (Ristekdikti) that summoned representatives of the Indonesian government ministries and the SOEs executives. The FGD's main topic was to determine the problem of the policy of market supply and demand for the SOEs to drive innovation, while the second theme was to grasp the cognitions of the SOEs on innovation. The analysis heavily uses the concept of "sociotechnical imaginaries" of Jasanoff and Kim (2009) that is well known among science, technology and society

(STS) scholars in determining norms, main topics, the debates, representation, and cultural or institutional habit (Jasanoff & Kim, 2009) of innovation activities of each incorporated party in the FGD. It is vital to mention Ristekdikti also availed additional data in the form of presentation slides that the FGD participators use, making the validation of the verbal information simpler.

As subsequently suggested, the research question of this part of the analysis is in the context of the country that has not been successful in refining a manifested role of the SOEs in their innovation system. The question is how do the government interact with the SOEs? This is an important section as the article of Belloc (2014) that becomes the main reference of this study, uses the arguments that are contrasting the benevolent or malevolent governments without explaining the specific condition where the firms-owners (i.e. the state or the governments) may have to struggle very unique challenges such as national identity-building through technological endeavors (Amir, 2010; Amir, 2013). As the first section of this study already shows SOEs can indeed play the function as Belloc (2014) advocates (Belloc, 2014), then its confidence-increasing challenge is to explain how developing countries can reduce the over-complication in governments' process of STI policy so they can emulate a more ideal model from elsewhere. The second section of this study has clarified the government's thinking of STI policy in contemporary democratic Indonesia. The missing element is to explain how such cognition interacts with other awareness that in this context refers to the vision of SOEs.

The operation of the study follows the sociotechnical imaginaries theory to the link between R&D (of SOEs) and authority institutions (Jasanoff & Kim, 2009).

Nevertheless, the high novelty of this study of government-SOEs direct interactions[10] makes the study hard to prepare précised hypothesis. The study instead tries to find new or unpredictable results. Therefore, the investigation path mostly becomes inductive analysis for collecting the idealism of the government institutions and SOEs as policy implementation or business decision. The literal multiple interactions of government institutions and the SOEs that the data of this study contains are advantageous to bring an explanation why governments and SOEs fail to synergistically produce a continuous combined effort to attend the market-failure problems (Belloc, 2014). From the final study, a more specific prescription is given for Indonesia or other developing countries that are evolving its democratic principles. The prescription describes how their authorities can see the actual problem of government and SOEs interfaces before the firms can have a comprehensive role in their respective national innovation systems.

## 1.6 Chapters Development

The rest of the study report is organized as follows:

1. Chapter 2 reviews the relevant literature in order to construct the problems that this study may able to attend;
2. Chapter 3, using Scopus data, the study tries to understand the varying output of scientific publications of SOEs of different nations with similar large sizes in one business sector. Those SOEs are all new business contenders that the governments must create from the sketch. The result is mixed. One SOE is very successful while some are much less successful than others, indicating that their respective

[10] Most scholarly publications, including in Belloc (2014) relies on theoretical assumptions to describe the interaction between the government and SOEs, namely to explain the aspects of managerial monitoring or market discipline (Belloc, 2014).

government-owners may have different standing in viewing the potential STI policy role of the SOEs. The bottom line is some governments may have in the least expanded vision pertaining to the association of SOEs to STI policy;

3. Chapter 4, using the Durkheimian theory of social facts, the study tries to understand how government actually define their role in STI policy. This aim is important to understand how government institutions do not seem to assign any public mission in STI policy for SOEs to carry;
4. Chapter 5, this section reports the study to capture the interaction between SOEs and the government-masters. In the case of where SOEs have been found not creating plausible innovation decisions, how can we determine the main contributor of such weak performance? Which one is the weak link: the SOEs, their government-owners, or both?
5. Chapter 6 wraps the findings that have been discussed in Chapter 3 to Chapter 5.

# Chapter 2

# Literature Review

## 2.1 Introduction

The previous chapter has claimed that recent literature has a gap in the discussion of state-owned enterprises (SOEs) as a distinctive actor in the national innovation system. The claim comes from the literature of Belloc (2014) that was published more 20 years after scholars began to discuss "*national system of innovation*". The late emerging is counterintuitive because the conceptual connotation of the national innovation system is highly intertwined with the Listian nationalism arguments that SOEs intensely associated (Belloc, 2014; Freeman C. , 1995). Furthermore, the center of attention of the earlier part of this study comes from developing countries[11]. However, in advanced economies, SOEs also often occupy significant economic presence. For example, in France, Germany, and Swiss, the ten largest SOEs in 2013 have a total of 1,701,232 employees (Rentsch & Finger, 2015). At the same time, Deutsche Bahn (DB), the railway SOE that is fully-owned by the State, employs 300,000 labors (Rentsch & Finger, 2015) while openly admits having supervisory of political figures (Deutsche Bahn, 2018). Therefore we can say it is less compelling than the large SOEs privatization history in Germany's unification era (Wengenroth, 2000) has completely shut the question over the companies' potential leading role in German's

[11] Kowalski (2013) predictably reports, "*the majority of large SOEs are active internationally and engaged in trade and some emerging country governments pursue explicit policies of SOE internationalisation*." (Kowalski, Büge, Sztajerowska, & Egeland, 2013), meaning the developing economies are indeed extending the policy approaches of SOEs by their corresponding dependence to the sector.

innovation system by the active political controls on the companies. Comparably, the same inquiry is applicable to the wholly state-owned SNCF, judging by the conduct of bureaucrat figure that is leading the company (SNCF, n.d.; Rentsch & Finger, 2015). By a similar token of proximity to public interests, the Swiss government channels public subsidies to bring major revenues of SOE railway group that the Federal owns (CFF/SBB/FFS) (Le News, 2015; Rentsch & Finger, 2015). For we remember knowledge is a public good, thus the ownership of the public in SOEs should bring social welfare improvement in term of knowledge creation and diffusion for the national privately-owned enterprises (POEs).

## 2.2 Background and Motivations

The purpose of this the literature review is to present the complexity and multi-faceted nature of SOEs, for then one may develop appropriate research questions in the context of science, technology, and innovations (STI) policy studies. Outside the context of STI policy, scholars have long been able to determine the character of SOEs in carrying public interests, namely to absorb employment during economic slumps, would separate it to privately-owned enterprises (POEs) (Egle, 1947). The closer political association of SOEs to government and political cycles has made such entity dissimilar to POEs (Vernon R. , 1984). For developing economies, the immature regulations that confuse the differentiation between the role of POEs and SOEs complicate the pricing justification that signifies the scarcity of the distributed goods and services (van de Walle, 1989). If a good is scarce, then how far the government must avail subsidies for an SOE to produce and distribute the good to make it artificially cheap for public consumption? Nevertheless, it is common economic wisdom that POEs

holding a monopoly power in an unregulated market will give harmful effects to pricing. Indeed, the nearer resemblance of POEs to SOEs can happen when the former grows its size large enough to coerce political or economic issues of the public (Melby, 1950). Nonetheless, the size of SOEs may be naturally hard to challenge especially when it manages large-scale public utility (Harrison, 1963). In the turn of China and Soviet Union intensifying socialist philosophies, the two entities becoming substituting competitors of which SOEs are expected to win (Thomas, 1950; Fensterwald, Jr., 1950). Meanwhile, for a foreign economic actor entering a nation, the doubt on the government is whether they will maintain fair competition and justice in the market where the SOEs are prevailing (Walker, Jr., 1956; Vonneuman, 1960; Grossfeld, 1963). The wariness is sensible as SOEs – even in the context of an underdeveloped nation, the political structure may force the firms to exaggeratedly perform as if they are as competitive as the corporations of industrially-advanced nations (Presthus, 1961). On contrary, it has long been observed that when government distanced itself from the SOEs, the firms of such less-advanced nations may acquire managerial sophistication through collaborations with companies from more advanced economies (Zelnik, 1965). As the socialist principle influence went waned and the trading globalizations have demanded fairer competitions, then why governments keep their ownership on SOEs?

History reasserts in both developing and advanced economies, ideology certainly adds the weight of the importance in the debate of maintaining SOEs or privatizing them (van de Walle, 1989). In this, we should recall that the construction of economics has an internal bias against SOEs. Therefore, it is not surprising to learn classical economics theories that stemmed to study the self-interest activities of POEs eventually inclined to produce a theorization of treating SOEs to be more “private-like”,

for instance through de-politicization of the firm's operations (Nutter, 1967). This brings the impact of making the connotation of SOEs became negative. The claim of Amankwah-Amoah (2014) exhibits such a negative association by mentioning three schools of thoughts that can explain the relationship between the government and the SOEs they own (Amankwah-Amoah, 2014):

1. Developing countries establish a market-distorting preference to SOEs because POEs have limited access to financial resources;
2. Firms are not demanding from the government the freedom to compete through innovation;
3. Governments generally now are dissatisfied with SOEs, hence they are reducing control level over the companies and seeking substituting actors that are more applicable to address the need of the market and the general public (Amankwah-Amoah, 2014).

Nonetheless, being under state ownership is not telling the cause of those three problems as the government can still improve the setting and mode of attaining of the SOEs' goals and objectives (Shirley M. M., 1983; Vernon-Wortzel & Wortzel, 1989). On the other hand, history also tells that a government may argue their establishing SOEs is in order to bring more competitions of a market domain that has been comprised only by POEs (Weston, 1968, p. 1305). To put it differently, the rationale of government in founding SOEs may, in reality, reside in the profit-seeking frameworks of classical economics. Those inferences bring the impetus to seek alternate perspectives to revise the scholarship understanding of SOEs.

Thus far, we already see the important meaning of SOEs is in the denotation of governments' control, that to build a strong theorization upon it may be challenging[12]. As a matter of fact, there is no precisely decisive collective definition among different governments of what is "state-owned enterprise" (Indreswari, 2006, p. 96; Vernon R. , 1979; Shirley, 1983)[13]. Therefore, it is difficult to downright accept the scholarly suggestion in bracketing the SOEs in the issues of economic ineffectiveness. For, in fact, SOEs is relevant to broader public aspects, such as ideology, politics, social implications, and the global context (Irianto, 2004). Understandably, the skeptical overtone is still coherent to the long-standing observation that SOEs are prone to political pressures (Vernon R. , 1979). Even so, SOEs are not the only type of business entity that is dealing with the problem of fragile institutions. In a corrupt environment, the privatization of SOEs has been found only reinforces corruption and heightens organized crime (Black, Kraakman, & Tarassova, 2000). On the contrary, a nation that has strong clean governance may avoid damages in state ownership by restricting managing power of government institutions and elected politicians on SOEs that increase professional responsibility of the managers (Christensen & Lægreid, 2003). Given these points, it is difficult to do a proper study and theory development on how governments can direct SOEs as an actor of a national innovation system by using "hard" variables such as profitability or growth rate that economists regularly utilize in analyzing POEs (Belloc, 2014; Aharoni, 1981). Accordingly, the remaining part of this

[12] To learn more about theory development in social science, *see* King, Keohane, and Verba (1994) (King, Keohane, & Verba, 1994).
[13] For the sake of theory development, the later parts of this study will point the superior position of government to the firms as the basic meaning of SOEs that made the firm different to POEs.

literature review shall explain the connection between governments ownership to SOEs in analyzing the firms' role in national innovation systems.

## 2.3 The Problem of the Ownership of Government and Mission of SOEs in STI Policy

The previous part defines SOEs as a phenomenological entity that instituted within the society through a political decision for the government to address an identified market failure. A key question that scholars initially extended was whether the managers of the organization may actually play a distinctive part in conveying public role, thus the firms are superior to pursuing such orientation than their POEs counterparts (Dornstein, 1976; Aharoni & Lachman, 1982; Vernon R. , 1979; Vernon R. , 1984). The very basic question that the scholars ask is who is exactly that controls a SOEs so they can serve the public need. This is a genuine question, especially to notice today there are SOEs from both developing and advanced nations that conduct cross-border investments, that potentially opens the inquiry over the firm's business practice (Knutsen, Asmund, & Hveem, 2011; Cuervo-Cazurra, Inkpen, Musacchio, & Ramaswamy, 2014; Kowalski, Büge, Sztajerowska, & Egeland, 2013). International expansion of public undertaking is an extraordinary orientation as domestic milieu already entails high difficulties namely in preserving justice in serving society and interacting with other market actors (Vernon R. , 1984). Additionally, democratic processes continually experience increasing conflicts and uncertainties in the determination of government's objectives in both advanced and developing countries hence complicate SOEs to execute public demands while struggling to behave according to market rules (Vernon R. , 1984). The major complications above are

perhaps what made analysis on SOEs become much more complicated on STI policy studies as it is very common for the scholarly community to undermine the firms (Benassi & Landoni, 2018, p. 2; Belloc, 2014; van de Walle, 1989). So far, research publications in STI policy mostly advocated the argumentations over the importance of the learning of SOE in STI policy[14]. But to recall the governments of developing countries are dealing more with the problem of limited private investments in R&D signifies the importance of the theorization over the potential function of the SOEs in national innovation system that incorporates cases from those nations. All in all, the difficulty in developing suitable theory supposedly can be reduced if one can identify a nation subject that is known with the ability to make strong coordination. Ideally, as Vernon (1984) explained, such a country needs to have "*extraordinary institutions*" and "*habits of operation*" (Vernon R. , 1984).

Vernon (1984) actually directly pointed Japan as the good candidate to offer models in SOEs studies although he did not contextualize it in STI policy framework (Vernon R. , 1984). Not only spanning its developing phase but in Japan, the account of technological public policy has also been existing since its ancient times. Since 718, the country already had the laws on the usage of water-powered quern or grinding the machine to polish rice that later became ineffective by the invention of superior machines in Meiji-reformation (Minami R. , 1987). In this developing phase of the Meiji era, the government created SOEs in a specific sector to bring the curiosity impulses and commercial incentives for POEs to adopt the Western technologies (Minami R. , 1987). Later, the Japanese government applied a policy that made SOEs

[14] *See* Belloc (Belloc, 2014), Tõnurist and Karro (2016) (Tõnurist & Karo, 2016), and Benassi and Landoni (2018) (Benassi & Landoni, 2018).

assume a leading function in the technological progress of industries, particularly through the assignments on Nippon Hoso Kyokai (NHK) or National Broadcasting Corporation and Nippon Telegraph and Telephone Corporation (NTT) to each sponsor R&D to accomplishing government's procurements (Sakakibara, 1997, p. 966). Mentioning NTT, in the early 1960s, the SOE collaborated with researchers from the government and POEs to develop a model of electronic technology that caused Japan to be able to control 38% of the volume of component industry supply in the mid-1990s (Kimura, 1997). Also, aside to NTT and the aforesaid NHK, the Japanese government also regularly delegated the procurement-related duties to Japanese National Railways (JNR) (the former SOE that manufactured and operated railroads) and Japan Airlines (JAL), an airline SOE (Odagiri & Goto, 1996). In spite of having such substantial historical records, the political decisions in the 1980s have driven the privatization of telecommunication and railway SOEs (Takano, 1992). The privatization itself has an interesting outcome in STI policy as the law of Japan preserves NTT as a POE with an unique duty among others of *"to conduct research activities related to telecommunications technologies that would form the basis of telecommunications*", while the government took special measure of changing the laboratory unit of JNR as a public institution a year before the privatization of the company (Japan Ministry of Internal Affairs and Communications, 1984 (2005); Soejima, 2003). That is to say, the government position in STI policy of the companies has been continuing even after their experiencing privatization. But rather more importantly in concerning to this study, those accounts seemingly justifies the theory of Belloc (2014) as correct (Belloc, 2014). Nevertheless, the privatization episodes obscure the model. We can ask, if the Japanese authorities are satisfied with the innovation role of NTT and JNR, then how do they

actually manifested the intended policy direction of innovation coordination after the privatization of the firms (*see* Belloc, 2014)? Here, the inquiry is not serving as a research question to the current study but rather marks as a study limitation that future studies can elaborate.

Additional to Japan, China may offer a good modeling candidacy because in today's scientific publications published using the key phrase of "*state-owned enterprises*" mostly take the setting in China. The problem with advancing STI policy analysis using a singular Chinese account is the publications on SOEs on the country rarely discuss the role of government institutions. The related publications, as a matter of fact, annul the position of government and SOEs in its conclusion (Goess, de Jong, & Ravesteijn, 2015), or in contrast, reassures government's inclinations to the firms while POEs are performing better (Wu, 2017; Jin, Lei, & Yu, 2016). The contradiction is predictable because although China has been irrefutably performing a very speedy technological catching-up, the country inherits government principles that a not long ago has been becoming antiquated in treating SOEs in the context of national management of innovation system (Motohashi & Yun, 2005). For this reason, China has a problem in the disequilibrium in the country's governance of STI policy. It is then worth reminding that Tõnurist and Karo (2016) has advised the political and institutional disparities in China and other Asian countries as the cause of the extreme difficulties to do a comparative analysis of the aspect of the governance STI policy on SOEs (Tõnurist & Karo, 2016, p. 627). So, using the two cases of Japan and China that both are in stark disparity in term of the extents of the duration of government's awareness in viewing the position of SOEs in their respective national innovation systems, we can predict that a country cannot represent the universal policy approach in

a real-world setting. That is to say, if the theoretical description of Belloc (2014) is correct, then in reality governments' intervention policy in giving the task for SOEs as the R&D leader in manifesting intra-industrial change (Belloc, 2014, p. 836) will have various design characters and success standings. Those two aspects of the success level and policy structure of governments are the main focus of this study. By making a convincing measurement of the success level of government's STI policy on SOEs (Chapter 3), we can find important study direction to empirically explain how some countries are failing to the advocate of SOEs superior role as Belloc (2014) suggests (Chapter 4 and Chapter 5) (Belloc, 2014).

## 2.4 Analyzing STI Policy Impact on SOEs

After predicting that there are divergent policy approaches and standings of the innovation role SOEs, we can deal with the more vital question of how to capture the varied outputs of such schema as Belloc (2014) theoretically foretells (Belloc, 2014)? The theorization of Belloc (2014) stresses the SOEs as being collaborating with other actors as the most vital incidence an investigator need to clarify. In various contexts of countries, scholars in concerning to STI policy studies already regularly handle with the specific subject of multi-institutional actors collaboration investigation using quantitative analysis of scientometrics[15,16]. But even so, when previous reports of scientometrics analysis mention the inclusion of subjects of SOEs, the study

[15] Scientometrics is a systematic quantitative study to investigate the progress of science that mainly focus on quantity (i.e. scientific productivity), quality of research (as valued by members of scientific community), and pattern of distribution among scientific community (Serenko, 2013).
[16] *See* the examples from more convincing papers of Khan and Park (2012) (Khan & Park, 2012), Choi, Yang, and Park (2014) (Choi, Yang, & Park, 2015), and Rupika, Uddin, and Singh (2016) (Rupika, Uddin, & Singh, 2016).

methodologies fail to the illuminate the government background on the companies[17]. This means such methodologies are insensitive to detect the influence of STI policy in generating SOEs to manifest a distinctive position within a business network. Following the theory of Belloc (2014), SOEs need to behave similarly to POEs in term of making independent business decisions in order to make them be able to estimate R&D topics that free enterprises value highly but calculate as risky to handle (Belloc, 2014). Considering the tacit character of knowledge (Nonaka, 1991), the deep business experience of SOEs will be significant for them to have a superior R&D position that POEs can appreciate (Belloc, 2014). At the same time, we also need to remember SOEs as being in relevance to comprehensive social aspects (Irianto, 2004). In other words, it is necessary to complement the quantitative feature of a scientometrics analysis with an additional qualitative study to illuminate how SOEs' business decisions and government's public interests are interacting to conceive a policy impact as Belloc (2014) suggests (Belloc, 2014).

Specific to social interests in STI policy, the ideal significance of the theoretical representation that Belloc (2014) advocates is it is being attuned with the requirement to measure the effectiveness of state's resources usage to give the desired economic effect of the perpetual increment of knowledge stock of the public (Belloc, 2014; Stephan, 1996). That means, if a scientometric analysis is not showing strong evidence that SOEs are not expanding their R&D collaboration activities with other

[17] The research report of Lei and colleagues (2012) offers a good representation of how scholars make simple analytical construction of SOEs as in a par to government using the argument of ownership (Lei, et al., 2012). By using the assumption, the study hence abandons the fact that the firms are business entities with their own managers. Another example comes from Liang and colleagues (2012) that completely fail to connect the fact a company under their investigation is a matter of fact an SOE, which perhaps the reason they admit to not being able to draw a clear conclusion over the behavior of the company (Liang, Chen, Wu, & Yuan, 2012).

R&D actors, then it indicates the government is failing to make a credible STI policy on the firms. This again shows the importance of qualitative analysis, especially to make an empirical assessment to explain why governments may fail to build policies for assigning SOEs to take leading roles in the national innovation system. Accordingly, as the rest chapters will show, such complementary qualitative analysis is instrumental to explain the root problem in STI governance over a scientometric marking of the lower scientific productivity of SOEs in Indonesia.

## 2.5 Chapter Summary, Research Gap, and Research Questions

This chapter has shown that a proper empirical analysis of SOEs should altogether cover the social and business aspects of the firms. While the former feature is the organic consequence of government's ownership, the latter is important to meeting the scholarly skepticisms on the significance of the public propriety on commercial enterprises. This chapter also argues the demanding multi-dimensional topographies as the barren ground for the flourishing STI policy discussion of SOEs. Until recently, scientific publications have been mostly silent with the inclusion of SOEs although the companies in reality still comprise significant portions of both developing and advanced economies. Amid the scare epistemic progress of SOEs, Belloc (2014) gave a noteworthy theoretical contribution to advocate the potential role of SOEs namely for channeling the support of the government in a networked industry to do the collective technological upgrade (Belloc, 2014). That theory, thus, fits well the general criteria of a proper analysis of SOEs in covering both social and business aspects.

The crucial evidence of the operationalization of SOEs by the governments to establish their STI policy intentions clearly happened in the history of Japan. But the

political progressions of Japan that once ordered the privatization of some large SOEs apparently became the reason why well-accepted theories of the positive role of SOEs did not come from the nation. Then, the rise of China has contributed to the re-arising of the scholarly interests towards the topic of SOEs, including in the area of STI policy studies. Conversely, the academic interest of China that is triggered by its speedy economic transformation also indicates the country is still progressing rapidly. The speedy progress made it incompatible for the intellectual endeavors to create robust theories of SOEs that universally represent the firms' ideal role in the national innovation system. Furthermore, we can say while the recent theory of Belloc (2014) on the potential role of SOEs' leadership (Belloc, 2014) on the surface gives a correct explanation of the past history of Japan, the proposed concept still needs to be validated in the context of China and other countries. The flexibility of the theory is it allows the distinction between the successful or less successful countries, namely in governments' enhancing the leading position of SOEs among other actors in national systems of innovation. This study aims to advance the theory of Belloc (2014) (Belloc, 2014), to elaborate the incidences of states that are successful or less successful in driving the role of the SOEs they own as national innovation system leaders. The evidence demonstration is something that Belloc (2014) (Belloc, 2014) did not discuss, hence it becomes the major research gap the current study aims to fill. Then, as mentioned in the first chapter, the thesis also intends to fill a research gap on the studies of Indonesian STI policy. The two targeted research gaps satisfy the abovementioned two layers of the specification of business and social areas on doing a proper study on SOEs. On the context of illuminating business aspects, scientometrics analysis can clarify SOEs' conducting collaboration that can clarify the propensity of the firms to do R&D

partnership with POEs and other actors. By showing the extent of SOEs position on a manifested the R&D network, accordingly, we can have a reason to question how the government has used its propriety on the firms in order to create a continuous growth of public stock knowledge. For knowledge is a unique type of public good that peculiarly tends to increase after consumption (Stephan, 1996), SOEs must help the government to create continual knowledge growth. With this in mind, we can predict SOE's R&D collaborations with other domestic parties that the scientometric analysis illuminated as a measure of the firms' functioning in a national innovation system. The key variable of co-authorship shows the indication of the firms' participation in producing knowledge as a public good. Finally, this literature review drives the emphasis on addressing three main research questions, which are:

1. *How do SOEs expand their research collaborations?*

   Through scientometrics studies, Chapter 3 shall show an SOE, in reality, can behave similarly to a leading POE by escalating their international scientific network *after* establishing domestic R&D linkages. Meanwhile, some SOEs in other countries are continuously deepening their research linkages more domestically. As the entirety business sector has been known as universally not depending to the normal Triple Helix formation of industry-university-research organization configuration, both types of performance indicate that government can indeed assign SOEs to do special duties in term inducing knowledge diffusion to other domestic actors. Altogether, such evolutionary behaviors of these SOEs plainly indicate that Belloc (2014) description of the superior potential role of those type of companies as correct (Belloc, 2014). But other findings also show some SOEs have been performing rather poorly in term of R&D activities. The weak R&D productivity of these SOEs

thus suggesting the weak STI policy actualization of their governments' owners that make the companies are not conveying an identifiable scientific task. That negative phenomenon becomes the reference for the second research question of this study.

2. *Related to the term of SOEs that are not showing plausible R&D performance, how do their government-masters view the public interest in STI policy?*

   Governments, the owners of SOEs, are carrying more expansive tasks in improving social welfare. The democratization of Indonesia will give the impact of the expanding public concerns that its government correspondingly needs to pay attention to. As the investigated Indonesian SOE is showing poor R&D performance, we can predict the government is not making adequate evolvement in STI policy that made them not assigning a contributory task for SOEs to carry. In this study section, the focus is to investigate how the cognitive of the government institutions in term of STI policy. The empirical knowledge of the government's cognition on STI policy amid its handling the more complex social issues can provide a clearer justification to test the hypothesis that the government is the cause of the poor R&D performance of SOEs.

3. *Related to the term of SOEs that are not showing plausible R&D performance, how do government and SOEs interact in term of exchanging their respective concerns in STI?*

   As explained in this chapter, we can argue SOEs need to have their own business cognitions in order to be able to assume a specific task as Belloc (2014) advocated (Belloc, 2014). Correspondingly, we can make a logical hypothesis that if the SOEs are not producing strong R&D outputs, the SOEs themselves are also contributing to the weak performance. Again, using the case of Indonesia, this study will test such a

hypothesis. The study finding gives a surprising insight that SOEs in the real world do have their own business motivations to do R&D despite their producing poorer scientific output than their international SOEs and POEs cohorts. This signifies the problem of the weak scientific performance of SOEs may not mainly originate from themselves but from their government masters. Moreover, the finding also adds the theoretical portrayal of SOEs weak role in national innovation system is not necessarily associated with corruption or malevolent as Belloc (2014) argues (Belloc, 2014). That government's ignorance of STI policy issues greatly contributes to the complication of the problem.

# Chapter 3

# An Exploratory Scientometrics Analysis of Scientific Publications of Fortune 500 (2017) State-Owned Enterprises

## 3.1. Introduction

Despite the academic community since the 1980s in the Western world have admitted being contented with their level of knowledge and skepticism on state-owned enterprises (SOEs) (Belloc, 2014; Vernon R. , 1981), the scholarly interest towards the subject remains continually growing. Typically among the Western societies, now it is difficult to shift the skepticism in the generalization on SOEs. The peculiarity of SOEs is in their having layers of leadership which have conflicting managerial orientations of serving the public or following self-interests. This character actually signifies a cognitive attribute that may be desirable for big corporations to cultivate[18]. The closeness of the SOEs to the government may be the cause of their becoming the object of hyper-utilization in formal politics or even politicians misconducts (Mazzolini, 1980). Ultimately, the attributes degrade the firms' reputation in the standpoint of Western scholars. Meanwhile, among developing countries, SOEs often still act as sole providers of public services that regularly account for between 25% and 50% of the output of urban economies (Kane & Christiansen, 2015). This is a dilemmatic situation because the government's utilizing SOEs as the main social welfare providers could impede the reformation process for the firms to be more competitive (Bai, Li, Tao, & Wang, 2000). Although the problem appears unexciting, in general, the astronomical

[18] *See* Dornstein (1978) (Dornstein, 1978)

economic growth of China where the central government owns over 51,000 SOEs with a combined value of more than USD 29 trillion (OCED, 2017) has helped SOEs to recover the popularity as a research topic. From the Scopus database[19], we know now there are 3,011 items of scholarly articles written in English that mentioned the term "*state-owned enterprise*" (Scopus, 2018). Scopus[20] informs from those documents, only 31.32% (943 documents (Scopus, 2018)) were coming from outside of Chinese contexts. Align to this, in conducting a literature review on the justifications and governance of SOEs, Tõnurist and Karo (2016) recently stated the political disparities of China or Asia political to other nations impede intention of creating the study of SOEs in an identical fashion (Tõnurist & Karo, 2016). But that statement triggers the question, how if we put Chinese SOEs in the same framework of a scientometrics[21] analysis with other similar SOEs from other nations? The question is important to understand the function SOEs in the development of a national innovation system.

The complication in measuring the performance of SOEs comes not only from the matter of building a suitable methodology. But also, as mentioned above, in our expectation that the SOEs' conveying the duty to build up social welfare rather than generating profit would give them the conflicting problems between resource maximizing or complying with government's assignment (Aharoni, 2000). In other words, to properly use data coming from an SOE requires us first to develop finer

[19] using the search query of "TITLE-ABS-KEY(state-owned AND enterprise) AND DOCTYPE (ar) AND PUBYEAR < 2018 AND (LIMIT-TO(LANGUAGE , "English"))"
[20] Adding "AND NOT (china)" and ""AND NOT (chinese)" to such inquiry text as mentioned in the footnote above.
[21] In this paper, we define "*scientometrics*" as the utilization of the properties of literature as the tangible output of science and technology for the study wider ambit of the practices of researchers, governmental policies, the socio-organizational structures, and so on (*see* Hood & Wilson, 2001) (Hood & Wilson, 2001).

assumptions on how the SOEs interprets their own missions. The risk of using such an approach is we may not be able to make a comparison among SOEs of different countries as every SOE may have a unique description of the assumed task. By using data from outside the firm, scientometrics analysis can help to bring effective, relatively inexpensive, nonintrusive, statistically more reliable and replicative assessment tool (Katz & Martin, 1997) to measure SOE's functioning in developing a stock of knowledge to innovate. Scientometrics analysis accordingly deals with the "softer" aspect of adaptability of these types of firms named in the factors that are not residing in "hard" indicators such as profitability or growth rate (Martin, 1996; Aharoni, 2000). To understand that scientific knowledge is expanding in within international networks, scientometrics may produce valuable insights on how national governments – especially from developing countries – to drive SOEs to expand research collaborations to monitor innovations that are growing elsewhere for then to utilize them domestically (*see* Leydesdorff and Wagner (2008) (Leydesdorff & Wagner, 2008)).

From the discussion above, it is therefore surprising to find very few publications on scientometrics actually put SOE[22] as the center part of the attention. When they do, papers that use Chinese setting predictably dominate the examination. Using data from Chinese National Knowledge Infrastructure (CNKI), Liang and colleagues (2011) brought such rare topic to analyze the collaborations of two Fortune

[22] In this paper, the differing character of SOEs to privately-owned enterprises (POEs) is their major interest to survive is to carry the interests of the owning/supervising government that assign them to make business decisions. The SOEs-governments contractual connection thus forms perpetual principal-agent relations that POEs will not experience unless they enter into a specific agreement with the government. Consequently, it is assumed here that SOEs are not of necessity to conduct an "innovation" policy, or else, the governments may not all similarly equipped with adequate knowledge or authority or political support in enacting "innovation" policy in supervising the firms (see the pertaining discussion of the principal-agent model in Moe (1984) (Moe, 1984)).

500 SOEs from China with universities (Liang, Chen, Wu, & Yuan, 2012). Even though they brought SOEs as the control variables, Liang and colleagues (2012) admitted they were puzzled and were not able to explain an interesting finding that the contributors from the selected SOEs significantly have the less possibility of becoming the first authors, indicating most contributors of SOEs brought smaller shares in the writing process (Liang, Chen, Wu, & Yuan, 2012). The question then, why SOEs are reluctant to contribute more in their R&D collaborations? The inconclusive outcome of Liang and colleagues (2012) demonstrates that to choose SOEs only from one nation, in this case, China, as Tõnurist and Karo (2016) inferred, does not necessarily benefit the study processes of scientometrics study on SOEs. On the contrary, taking research subjects of SOEs from more diverse nations may illuminate a more revealing finding. This leads the current study to alter the research design of Liang and colleagues (2011) (Liang, Chen, Wu, & Yuan, 2012), specifically to widen the selection criteria of SOEs to not employ the limitation rule of a single country or geographical-based origin albeit maintaining the corresponding company revenue sizes[23].

### 3.2. Research Question and Hypothesis

In spite of the scholarly publications on the relationship of SOEs in science, technology, and innovation (STI) policy have been scarce, Belloc (2014) provides an interesting theory on how SOEs have a potential superiority than the privately-owned enterprises (POEs) (Belloc, 2014). Belloc (2014) predicts with the support of the state and its research agencies, SOEs can have stronger power in strengthening the network

[23] The well-known classification of strategy of innovation investigation of Pavitt (1984) identifies company size as an important factor of analysis (Pavitt, 1984). In discussing the innovation features of these Fortune 500 SOEs, consequently, it is difficult to omit that their massive sizes as an irrelevant factor.

of relations with other firms (Belloc, 2014). On the other hand, Belloc (2014) also spends a significant portion in his paper to address the skepticism on the SOEs of which he contends malevolent governments contribute considerably in the formation of the negative image on SOEs (Belloc, 2014). To shape the potential role of SOEs requires the government to have many initiatives for transferring the risk in R&D on POEs, such as financing basic science studies, leading research consortia, redistributing control ownership of the intellectual property rights that the state owns, and so on (Belloc, 2014, p. 824). In bolstering these policies, governments may need to deal with other legal provisions such as the prevention of using unrestricted budgets or competition policies (Belloc, 2014, p. 829).

While structuring multi-layered policies are already burdensome, Belloc (2014) also conspicuously warned over the presence of malevolent governments (Belloc, 2014, p. 830). Belloc (2014) referred to these malicious governments as corrupt politicians and the bureaucrats or managers of the firms (Belloc, 2014). Then Belloc (2014) convincingly brought the counterargument that the rule of law is in the relevance to the progress of lawmaking and law enforcement which is of necessity to for both SOEs and POEs (Belloc, 2014). Belloc (2014) then mentioned the case of Finland where the government has a high reputation in the quality of government of which SOEs there have been actively conducting R&D activities and producing high technology commodities (Belloc, 2014). Corruption according to Belloc (2014), demonstrates a defective incentives mechanisms (Belloc, 2014, p. 833). We can respond that while the theoretical portrayal of Belloc (2014) seems believable, he, on the other hand, did not mention the real examples of how governments actually shape the SOEs to assume a leading role in inter-firms collaborations. This gap is the direction of what

the current study aims to fill. Then, a theoretical explanation of Belloc (2014) comprises the broader problem in government, i.e. malevolent governments will hinder the superior collaboration function of SOEs. We can say it bring signal the importance of investigating the existing internal R&D intensities. Otherwise stated, the SOEs'actively conducting do R&D will reflect the government's interest in directing the SOESs to lead other actors in its national innovation system configuration. To rearrange the declarations of problems in this passage, the two research questions and their corresponding hypothesis are:

1. *Are there differences in the R&D intensities among SOEs?*

   The hypothesis answer for this question is yes, namely to callback the explications of Belloc (2014) that SOEs depend to the macro policy designs and executions by the governments which in turn will be the characteristics of nations (Belloc, 2014).

2. *How do SOEs expand their research collaborations?*

   It is difficult to make a very predictive hypothesis responds to this research question. Then again, to recall the theoretical portrayal of Belloc (2014) that the superior potential of SOEs is in the aspect of "*building inter-firm collaborations*" (Belloc, 2014), we can logically infer that such function denotes to the firms' activating partnerships domestically instead of internationally. In other words, we can predict for countries that are attempting to make their SOEs have a superior function for the public, the governments will judge such intentions locally. To put it differently, we can predict SOEs will choose to emphasize in making domestic than international collaborations in its conveying certain STI policy tasks from the government.

## 3.3. Methodology

### 3.3.1 Firms Selection

A central issue that Belloc (2014) brought is the severe skepticism of the scholars towards the issue of SOEs (Belloc, 2014). In this study, the firms' selection is an important part of the research strategy. To make a convincing firms selection is significant for convincingly showing how various national governments associate to different turnout in nurturing SOEs role in national innovation system developments. Here, the study selects SOEs that come from Fortune 500[24] (2017) list of petroleum refining category (FORTUNE, 2017). The lineup enlists 29 companies of both privately-owned enterprises (POEs) and SOEs. Fortune avails freely-accessible company profiles of each indexed company that is useful for performing the first step of identifying the ownership status of each indexed companies. To ensure validity, the study conducted an examination through the internet pages of each company to validate the ownership position of the firm. For example, Fortune does not specify the control status of Petrobras (FORTUNE, n.d. (b)) and PTT (FORTUNE, n.d. (d)) in their respective company profile pages. Nevertheless, on their website, Petrobras declared that the Federal Government of Brazil reserves 50.26% of their capital ownership by February 28, 2018 (Petrobras, 2018). Another example, PTT from Thailand refers to itself as "*a state-owned enterprise*" (PTT, 2017, p. 61). In other words, given the fact that the involved companies are coming from different countries that each may have distinctive legal classifications of "state-owned enterprise", the study tries to completely

[24] Fortune 500 companies are a list of revenue rank of firms that are "*incorporated in the U.S. and operate in the U.S. and file financial statements with a government agency*" (FORTUNE, n.d. (a)).

avoid discernment fallacy of ownership status by applying external definition as Tõnurist and Karo (2016) did by referring to the definition of OECD on SOE (Tõnurist & Karo, 2016). From such processes of validation, the author found the companies that publicly admit their own attributes as SOEs are (alphabetically ordered):

1. Bharat Petroleum, India;
2. China National Petroleum Corporation, China;
3. Hindustan Petroleum Corporation Limited, India;
4. Indian Oil Corporation Limited, India;
5. Pertamina, Indonesia;
6. Petrobras, Brazil;
7. Petronas, Malaysia;
8. PTT, Thailand;
9. Royal Dutch Shell, the Netherlands;
10. Sinopec, China, and;
11. Statoil ASA, Norway.

Established in 1953 (Petrobras, n.d.), Petrobras is the oldest SOE on the list. Founded in 1957 (Pertamina, n.d.), Pertamina follows as the list's second continuously longest-running SOE. This means a private operation in the area preceded SOEs by approximately a century-old gap of experience[25]. In that case, we can straightforwardly say that to reduce risk failure of decision-making, those SOEs would need to emulate

[25] Fairbank Oil, Canada, begun their commercial activities in 1861, in the site that became the location where first modern oil industry was born (Fairbank Oil, n.d.).

the innovative behaviors from the already established POEs from the same sector[26]. For anyhow, it is very rational to predict firms will follow others that are perceived as having superior information in dealing with ambiguous situations to reduce the potential negative outcomes (Lieberman & Asaba, 2006). Nonetheless, supposedly the number of specialists in global or national labor-market is scarce, then the relatively new-entrants of SOEs would face a greater barrier to generate internal knowledge base similar to those leading POEs. This barrier then would lead them to be more reliant to external sources[27]. From this projection, we could say that the modes of co-authorship or co-publication with other organizations will bring interesting information on how SOEs will (or will not) emulate a leading POE. The predictions trigger the need to pick a potential leading POEs from the Fortune 500 that the SOEs may choose as a reference in making business decisions. However, such direction has its own obstacle as many top Fortune 500 POEs deprived with a steady history. Many have experienced merging with other companies or becoming the subject of dissolution by legal stipulation. Meanwhile, we need to keep in mind that each of the discussed SOEs here has been continuously working as an intact company. TOTAL S.A., for instance, was incorporated in 1924 and has acquired some other companies (TOTAL S.A., 2008). Additionally, BP (BP, 2008), ExxonMobil (ExxonMobil, n.d.), and Chevron (Chevron, n.d.), all have experienced similarly. We can predict the mergers will affect the innovation capabilities of the firms (Koenig & Mezick, 2004; Bretizman, Thomas, & Cheney, 2002). For this reason, the

[26] DiMaggio and Powell (1983) convincingly argued that organizations experiencing similar institutional circumstances tend to transform to becoming more similar (DiMaggio & Powell, 1983). They stated, "*Organizations tend to model themselves after similar organizations in their field that they perceive to be more legitimate or successful*" (DiMaggio & Powell, 1983, p. 152).

[27] Following the conceptual and methodological explanation of Malerba (2002), we can say SOEs in the petroleum refining sectors of Fortune 500 will demand or undergo similar learning processes, competencies, beliefs, and so on their POEs counterparts (Malerba, 2002).

choice of POEs that have the experience merger or separation phase is less practical as it obligates additional investigation of isolating the parts of experiences before we can readily compare them with SOEs. With this in mind, a blessing in this current topic being pertinent to the oil sector is its historical association to "the Seven Sisters". The name denotes to the oil cartel that happened in 1928 to 1960s (Alhajji & Huettner, 2000). Royal Dutch Shell – hereinafter the naming of the company will be simplified as "Shell", was one of the Seven Sisters (Alhajji & Huettner, 2000). The earnings of Seven Sisters that were up to triple of other industries represent the high effectiveness of the cartel (Alhajji & Huettner, 2000). In Schumpeterian point of view, the participation of Shell in an explicit cartel would bring them the advantage of having a sheer size of capacity to absorb the R&D risks and to apply market control for reaping innovation repayments (*see* Teece (1992) (Teece, 1992)). Furthermore, the merger of two of its former companies in 1907 formed Shell (Royal Dutch Shell, n.d. (a)), making it substantially an enduring POE out of the other former members of the Seven Sisters. In view of those features of Shell, the POE here is selected to play the role as the comparison subject to the SOEs.

Despite the main logical assumption here is that all SOEs will try to copy the management of the best performing POE, it is hard to dismiss the fact that the included SOEs come from eight countries. Those countries are dissimilar in economic development levels, economic sizes, and political traditions. As scholars often view the operations of SOEs as politically-induced organizations (Jefferson, 1998; Ramamurti, 1999; Menozzi, Urtiaga, & Vannoni, 2012), then we may argue that whatever the SOEs attain mainly reflect the interpretation of the SOEs' leaders on the demands of their government masters. Realizing that political consideration, unless we could first

determine a more clear-cut of political interests of the governments on innovation issues, it is difficult to predict that we may carry scientometrics exploration on SOEs coming from different nations similar to the way we do such analysis in the context of POEs[28]. To put it another way, if we find the insubstantial scientometrics performance of SOEs, such result will give direct information that the respective government generates weaker interventions or guidance in order to strengthen the knowledge base to stimulate the development of the concerned sector. This brings the implication that the importance of the current study is to investigate the dimension of quantity, instead of the quality of SOEs' R&D. Can we convincingly say they have any R&D any activity at all? Or, we should say, do government-masters assign SOEs to take on research-based innovation goals?

### 3.3.2 Co-authorship as the Variable to Denote Collaboration

The current study uses data from the Scopus database. First, to ascertain the premise that a POE actor regularly produces internationally refereed publications, the data collection begin with focusing on Shell on publication date range up to 2017. The Scopus data tells that Shell[29] begun to intensify producing scientific publications around post World War II (Scopus, 2018). Correspondingly, this model-shaping inspection gives the noticeable finding that the Netherlands headquartered company (Royal Dutch Shell, n.d. (b)) produced only handful materials in the Dutch language, a contrast to their 99.46% English-written publications (Scopus, 2018). Additionally, 62.4% of the documents take the form of articles. These results signal the detailing attributes on data

[28] Wang, Zhang and Wu (2011) provide a good example of patent analysis on Fortune 500 (Wang, Zhang, & Xu, 2011), wherein they completely leave concerns in politics.
[29] The Scopus Institution Code (SIC) for Shell here is 60030496.

retrieval of the SOEs that would help to lessen country-specific partiality. Namely, it only seeks scientific publications that are written in English and published only in the format of the article. That is to say, the study limits its attention to original research or opinion materials that were written in English [30] of the examined SOEs. Another important point we can draw from the rapid assessment of Shell publications is the fact that the POE habitually produces a considerable number of publications, signifies the sector of oil refinement is indeed has a higher level of science relatedness[31]. In that case, the current idea in using Scopus, instead of a patent database, to do a rather inexpensive explorative investigation on how SOEs in the sector cultivate a connection to the network of the scientific community should be acceptable. Here we can easily find the evidence that a POE has a significant place within a scientific network. Meanwhile, economists may overlook such scientific linkages as they are not ruled by "dollars" signals. On the contrary, the members of the scientific community are charged more to receive respect from the scientific community for being "*the first*" (Stephan, 1996). Accordingly, economists might ignore to scrutinize the R&D aspect of the sector-related SOEs. To see the knowledge that the scientific community produces has the public good characters or a form of enabler of production activities that are (at least can be made as) non-excludable and non-rival good, will open the debate that SOEs as a publicly-owned entity must maintain a commitment to promote innovation by making self-engaging in

[30] The short definition of "articles" according to Scopus is "*Original research or opinion*" (Elsevier, 2017).

[31] For learning the historical account of process innovation in petroleum refining, see Enos (1962) (Enos, 1962). The author stated the greater size of a company will bring the advantage of having bigger capacities to apply innovation more extensively (Enos, 1962, p. 313). We can predict, in these larger petroleum-refinement firms have the bigger propensity to finance permanent research and development units (Enos, 1962, p. 313).

the science network[32,33]. That means, as the function of scientific research is omnipresent throughout the development process of industry and in reality, most modern firms sit within particular value-chains, SOEs will have much of potential to assume the role of knowledge supplier to other actors in their environment. In short, we need to assess how SOEs scientifically collaborate with other institutions. To put it in scientometrics perspective, the major interest of current study here is to find some patterns of co-authorship of varying SOEs that will bring a clearer signal of the scientific collaboration of the SOEs with other organizations. Scholars have found that the propensity of companies to collaborate increases with the employees' size although the impact of R&D intensity is not necessarily significant ((König, Licht, & Staat, 1994) *as cited by* (Fritsch & Lukas, 2001, p. 301)). Also, not all collaboration will produce co-authorship or sometimes an author does not actually contribute to the research (Melin & Persson, 1996). However, even co-authorship delivers only a rough indicator of scientific collaborations (Melin & Persson, 1996), we can still see it as the process of knowledge expansions (Newman, 2004). Also, co-authorship is still the most recognized indicator of international collaboration (Wagner, Park, & Leydesdorff, 2015). Consequently, the usage intention of co-authorship variable here is to understand the R&D collaboration of SOEs with other organizations both domestically and internationally as mentioned in the research questions. In this study, the data of co-authorship also came from the Scopus database. It is important to note the analysis steps

[32] To view the debate on the economics purview of the public good character of "knowledge", see Callon and Bowker (1993) (Callon & Bowker, 1994).
[33] To avoid confusion by the profuse publicly available definition of "innovation", in this case, the definition of term follows the concept of Kline and Rosenberg (1986) (Kline & Rosenberg, 1986), hence the author rejects the linear description that innovation evolves from inventive research to development, production, and lastly to marketing (Kline & Rosenberg, 1986).

on the study here are not pursuing the goal of discovering a new technique of scientometrics. Preserving the scholarly tradition in viewing SOEs, this study sees the political surroundings of SOEs will override the conventional assumptions in scientometrics. That we cannot conventionally see SOEs' enlarging the number of co-authorship on their scientific publications merely as "*the addition of new authors to the database*" (Barabási, et al., 2002, p. 591) nor chasing the merits of professional scientists (Beaver & Rosen, 1978)[34]. Instead, it uses the logic of scientometrics in order to obtain evidence to do inductive-empirical analysis to understand the general patterns of government-backed SOEs in expanding their scientific networks.

## 3.4. Findings and Discussions

### 3.4.1 Publication Counts

In the first phase of the simple count, the unforeseen result came from the fact that some of the SOEs do not appear to follow the assigned POE reference of Shell in term of the productivity of publishing scientific articles written in English (see Table 3.1 and Figure 3.1). It is sensible to say that the SOEs that have a lower level of productivities have been making adequate R&D investments. These companies clearly are *not* the ones that Belloc (2014) described as the SOEs that have leading positions in inter-firm partnerships (Belloc, 2014). Furthermore, in the last decade of the investigated years of 2007 - 2017, some of the less-productive SOEs were making more compelling progress. This indicates a recent shift of paradigm the respective government and/or leadership of the SOEs (see Table 3.3). Bharat Petroleum India,

[34] Again, see Liang and colleagues (2011) (Liang, Chen, Wu, & Yuan, 2012).

Pertamina Indonesia, PTT Thailand, and Petronas Malaysia are the SOEs that are making fresh transitions despite their overall outputs are still in a lower degree than their institutional peers. The changing newness will make them ambiguous subjects for the subsequent analysis[35]. If in a few years those SOEs create a more sustainable number of scientific publications, then they will become more stimulating as research subjects. Although some SOEs are showing promising improvements, Hindustan Petroleum India is the company that has been consistently making inconsistent growth in both permanent and latest periods. We can directly say government-masters and the managers of Hindustan Petroleum India assign less attention for the SOE to absorb the latest scientific progress as a leading POE does. It is important to remember that the rationale of the government to establish SOEs is more practical than conceptual, namely to create some roles of which POEs are unwilling or unable to attend (Vernon-Wortzel & Wortzel, 1989). The government's assigning the managers of SOEs to meet such intention that often clouded with public concern is what distinguishes the SOEs to POEs (Vernon R. , 1984). For such reason, we can say the lower performance of Hindustan Petroleum India is expected to happen in most SOEs in developing countries. However,

[35] In their Annual Report of 2017, Bharat Petroleum India did state of availing R&D expenditure during 2016-17 approximately 0.02% of its gross revenue (Bharat Petroleum, 2017, p. 82). During nearly the same period, Petronas (Group) Malaysia, devoted around 0.04% for its research and development expenditure (Petronas, 2017, p. 190). These portions of are much lower than the approximately calculated allocation of 0.30% proportion of revenue to R&D of Shell in 2017 (Shell, 2018, p. 138) or 0.27% that Sinopec China in 2017 (Sinopec, 2018, p. 26). Meanwhile, even though Pertamina Indonesia and PTT Thailand both amply mentioned the term of "research" in describing the organizational activities in their respective annual reports (Pertamina, 2017; PTT, 2018), none declared the amount of their research budget. The lower or invincibility of R&D budget of these SOEs will bring a cue to explain their lower accumulated share of scientific papers as Table 3.1 depicts. More importantly, these accounts suggest that the guidance of the governments on Bharat Petroleum India and Petronas Malaysia, even more to the case of Pertamina Indonesia and PTT Thailand, up to recent times still assert relatively lower formal priority towards innovation that the SOEs must carry as corporate strategies. We must be careful in absorbing the figures of R&D expenditures of petroleum firms as the leading companies may capture the budgetary of scientific activities of the sector's exploration activities under different financial subtitle ( (Acha V. L., 2002) *as cited by* (von Tunzelmann & Acha, 2005, p. 410)).

here, some SOEs are seemingly more consistent in behaving more comparable to the leading POE. That suggests the corresponding management and government-owners of SOEs have been making more strenuous attention towards R&D. Also, it is worth noting even though the Chinese Sinopec is performing very extraordinarily, its fellow Chinese SOE China National Petroleum has only lately been boosting its scientific output. As such evolvement is only making the two companies are heading into a matching trajectory, we thus could assert the authorities of China has been recently making a more comprehensive policy impact. By those accounts, the study is moving to focus on the instances of China, Brazil, and Norway that are more consistent in materializing their innovation policy direction on their SOEs.

### 3.4.2. Institutional Variation of Affiliated Co-Authors

Scientific publication is an essential outcome to establish a higher status in a scientific community (Stephan, 1996). Furthermore, it has been an empirical argument to state that co-authorship reflects subjective appreciation and acknowledgment of a member of scientific society to another member over intellectual contribution in a way that enables of the study of his or her social activity and influence in the community (Stokes & Hartley, 1989). In spite of that, as the scientific endeavors of SOEs must obey with the directives of their government-masters, the researchers in SOEs may have more irregularities in observing rewards through co-authorship. To rephrase it, as the main interest of SOEs researchers will come from the government's direction, the SOEs' perception towards scientific collaboration will be largely influenced by such political control. As previously mentioned, the finding of Liang and colleagues (2012) showed only 22.8% of the co-publication of Sinopec-university brought the authors of the SOEs

the position as the first author (Liang, Chen, Wu, & Yuan, 2012). The smaller contribution indicates the SOE's scientists persistently decide to take smaller parts of the collaborative research works *or* the SOE avails less incentive for their scientists to lead study partnership (*see* Laudel, 2002 (Laudel, 2002)). In such a more minimized structure of scientific reward[36], the valuable question is who are the partners of the researchers of the SOEs? To illuminate the partners will help to inform the orientation of the SOEs in doing research, specifically in viewing the preferred subject collaborators of which the researchers of the SOEs desire to support (*see* Laudel, 2002 (Laudel, 2002)).

Scopus database provides data of authors' affiliations that published articles collaborating with the authors of the investigated SOEs. So, in this study, each record of the partnering affiliation name is stored in an *a priori* categorization. The institution classification conducted using a number of references, including the firm's website, "*Affiliation details*" of Scopus, and information of company profiles from Fortune. An additional record input of an institution that does not have an identical institutional form to any of the previously generated clusters will join a new field of the institutional category. Using the simple categorization approach, an immediate conclusion we can take is Sinopec – the biggest amasser of English-written article publications among the investigated SOEs – has expanded the variations of the partnering institutions while maintaining the center of gravity within domestic domains (*see* Table 3.4 and Table

[36] It is reasonable for researchers to strategically to make strategic decision on opting for specific partnership for the attention of increasing quality, credibility, or impact (Schmoch & Schubert, 2008, p. 370). Then to account the finding of Liang and colleagues (2012) that the researchers of Chinese SOEs do not seem to looking into credibility improvement through collaboration with universities, we can presume that the scientists in this firm may not have the comparable perception on their scientific careers relative to the other members of mainstream scientific community.

3.5). Sinopec continuously emphasized in collaborating with local organizations. Petrobras progressed in a similar course. In 1994, the year when Petrobras joined the Fortune 500 list (FORTUNE, n.d. (b)), Scopus record shows the company has a limited number of background institutions of partnering that tripled in the year 2017 (*see* Table 3.6 and Table 3.7). Even though Petrobras then experienced a threefold growth of partnership variation, the weightier portion (around 82.20%) in 2017 was still coming from domestic organizations. Statoil created a rather different pattern. In 1994[37], the institutional affiliations of the collaborators of the Norwegian SOE produced largely come from domestic bodies. However, in 2017, such domestic-affiliation portion plunged to around 55.30%, making almost half of the partnering authors of SOEs had foreign affiliations (*see* Table 3.8 and Table 3.9). Shell has a similar trajectory to Statoil. According to the Scopus database, in 1940, when Shell began to spur the annual productivity of publishing internationally-published scientific articles, 77.42% of the authors had the address of the company's office in the Netherlands. Meanwhile, around 9.68% of the authorship came from an author with a postal address in Shell Development Company, in Emeryville, United States (U.S). By the time, external collaborators coming from the Netherlands and the U.S. took an equal share of 6.45% only. Fast forward, in 2007, around 56.96% of the authors are affiliated to Dutch-related institutions (*see* Table 3.10). In 2017, only approximately 53.61% of the authoring contributors to scientific articles that include the authorship of Shell's researchers had an institutional affiliation from the Netherlands (Table 3.11)[38].

[37] Like Petrobras, Statoil entered the Fortune 500 list in 1994 (FORTUNE, n.d. (d)).
[38] The headquarter office of Shell is the Netherlands although the incorporation of the company was in England and Wales, United Kingdom (Royal Dutch Shell, n.d. (b)). The company has technology centers with major hubs in Houston (U.S.), Amsterdam (the Netherlands); and Bangalore, (India) (Royal Dutch Shell, n.d. (c)).

The finding on the more globalized affiliation of the authors of articles R&D associated with Shell suggests that a strong actor of POE Fortune 500 has a long-held practice of internationalizing their R&D. The internationalization perhaps prompted by their high dependence on foreign markets and international supply chains. In the era of mid-1990, Shell actually spent about 80% of its R&D activities abroad (Gassmann & von Zedtwitz, 1999, p. 234) and owned 15 research establishments all over the world (Gassmann & von Zedtwitz, 1999, p. 240). Then, Statoil emulated the internationalization of Shell. Here we can clearly see an SOE can behave similarly to a POE. Be that as it may, it is difficult to predict the motivation of R&D internationalization of an SOE would be completely analogous to the main purpose of POE in broadening the prospects of generating financial returns (Rosenberg, 1990). Political undercurrents of Norway, not private interests, brought the founding of Statoil, even the first and second chiefs of the firm were political figures (Austvik, 2007). In the first years of the operations of Statoil, the SOE preferred Norwegian companies to become their suppliers[39]. The method influenced the thinking of the SOE that they must act as the enabler components for both industrial development and control of the sector (Austvik, 2007). At the same time, Statoil since the beginning always attempted to make rapid learning by making industrial and technological cooperation with foreign companies that they later use to make competitive decisions (Austvik, 2007). In 2001, by the rule of public opinion and the wish of Statoil itself, the SOE experienced partial privatization to allow the then-matured business entity to grow internationally[40] (Austvik, 2007). At the moment of the writing of this material, Statoil has publicly

[39] As Norway begun to adapt EU rules in the early of 1990's, Statoil ceased to practice this approach (Austvik, 2007).
[40] Today, the Government of Norway owns 67% of ownership share of Statoil (Statoil, 2017).

declared its goal to shift 50% of its entire R&D to be external activities (Statoil, 2018). Parallel with Shell, the current R&D interest of Statoil is to reap knowledge expansion globally. Thus, we can understand that the displacement of the concentration of knowledge creation from domestic to international domains of Statoil happened together with the shifting of the attention of the SOE. From acting as an instrument of public policy – i.e. as industrial enabler – towards a profit-seeking firm that is responsible to mainly to the shareholders. In Figure 3.2 to 3.5, we can see the accumulated portions of affiliations of co-authors of articles that involved contributors from Sinopec, Petrobras, Statoil, and Shell, in the years of 2012-2017.

While Statoil is more similar to Shell, Sinopec is more analogous to Petrobras. Sinopec and Petrobras both emphasized to create collaboration with domestic partners. The contemporary continuance of Sinopec and Petrobras to have a higher portion of authorship of authors coming from domestic institutions gives the reflection that both of the SOEs are still bearing an extensive responsibility to develop human capital than acting on behalf of the enterprise's self-interest. Otherwise, they will behave more like Shell and Statoil. Furthermore, to mention the finding of survey research of Perrons (2014) that the upstream oil and gas industries see neither universities nor government-led research organizations as valued sources of new information and knowledge in their R&D initiatives (Perrons, 2014) adds the doubt that decision of Sinopec and Petrobras to emphasize domestic collaboration as the result of an organic business calculations. On the contrary, it is more believable to say the SOEs take the role as gatekeepers for local institutions to obtain access to the nodes of the network of knowledge creators that uniquely shaped in the business of petroleum industries (Acha & Cusmano, 2005). For the case of Petrobras, scholars have noted that in the 1990s, the Brazilian government

tightly tied Petrobras into the development agenda of Brazil (Dantas & Bell, 2011). Petrobras enjoyed greater freedom from such role expectations after it experienced partial privatization in the early 2000s (Dantas & Bell, 2011). Even so, Petrobras recently unveiled as suffering corruption misconducts[41] denotes the SOE would have to carry high agency and transactions costs that negatively affected the capability of SOE to make adequate transformations. It is more difficult for Petrobras to create the same internationalization agenda as Statoil did in mimicking Shell's R&D behavior. For the regional perspective, corruption reduces the financing of and investing in corporate R&D (Xu & Yano, 2017). Then, if the Brazilian government does encourage Petrobras to perform as "innovation enabler" for its environment, such a mission will never reach maturity as corruption hinders the improvement of other institutions.

Linking knowledge distribution or "innovation" of SOEs to corruption in government practices is a complicated task that scholars still need to study further, specifically on how external actors influence internal operations of the firm (Belloc, 2014, p. 842). A country may not formally administer the task for institutions beyond R&D organizations to distribute knowledge. In such country, the government-masters of the SOEs may have a more feeble foundation to assign the firms as knowledge diffuser or innovation enabler in their policy processes leading to the creation of *laissez-faire* policy where institutions raise strong borders dividing them (Etzkowitz & Leydesdorf, 2000). Indonesia is a good example of that situation. The nation's basic constitution has been serving as the tallest command for economic nationalists to argue the importance

[41] In early January 2018, the New York Times reported U.S. prosecutors have conspired with a group of other companies to overcharge Petrobras for receiving $3 billion bribes and other enticements in return (Bray & Reed, 2018). The scandal begun in 2014 (Bray & Reed, 2018).

of the limitation of foreign ownership, including obviously in the sectors where SOEs subsist (Wicaksono, 2008). While effectively represents the instruction to secure "hard" assets of the firms, the constitution is arbitrary with directives to guard the "softer" aspects of Indonesia's SOEs including for them to assume a public role as innovation enablers. Surely, we can argue that the lower rate of scientific publication of Pertamina Indonesia is because the firm concerns more to applicative than espousing basic science. However, the WIPO database informed that the accumulated patent number of Pertamina today is only a minuscule fraction to Sinopec's and Shell's[42]. Thus, Pertamina operates by almost in entirety or a very high degree of technological supports from other companies. In addition, as the share of patent applications by residents in Indonesia is tiny compared to World's standing[43], it is highly unlikely the operations of Pertamina benefits local technological-supplier companies[44,45] In other words, the constitution that put the yardstick of the direction of Indonesian SOE as an instrument to limit foreign ownership has been chronically ineffective to bring compensation to local suppliers.

What about Sinopec? What is the presumed role of the SOE in knowledge diffuser among other relevant actors? In relation to R&D matters, relying on "hard" indicators such as productivity or market share, recent noteworthy studies appeared to tend to scrutinize the achievements of the Chinese SOEs rather than explaining their

[42] Approximately the portions respectively are 0.54% and 0.12% (WIPO, n.d.).
[43] *See* World Bank Data (2018) (World Bank, n.d.).
[44] Von Tunzelman and Acha (20015) explained there is no strictly "low tech sectors" in our current modern era (von Tunzelmann & Acha, 2005). The "low tech" companies usually focus in application orientation, while the source of utilized technologies will come from separate companies that have their own competencies (von Tunzelmann & Acha, 2005). In spite of this, the "low tech" companies need to have absorptive capacities - i.e. the capability for a firm to recognize new information from elsewhere to then assimilate and apply for commercial ends (Cohen & Levinthal, 1990) – to be able to utilize the supplied technologies (von Tunzelmann & Acha, 2005).
[45]

function in the country's network of innovation. Such a tendency, as referred in the earlier part of this material, signifies the skeptical perception of Western academics on SOEs. For a strong example, see the article of Boeing and colleagues (2015) (Boeing, Mueller, & Sandner, 2016) that seemed concentrate to refine the understanding on Chinese POEs as the contender to the country's SOEs. On contrary, the patent analysis of Kang (2015) on two large Chinese firms – one is a POE and the other an SOE – hinted there is a strategic interrelation or knowledge flow between the two types of the company working in the same sector (Kang, 2015, p. 389). The Chinese SOE and its POE counterpart seem to serve each other (Kang, 2015, p. 389). Additionally, Kang also unveiled that the patent co-application data indicated the SOE, as opposing to the POE, has a major role to become a research partner er for national institutes in China (Kang, 2015). Moreover, through patent citation analysis, Kang (2015) found that the SOE is contributing more to the future R&D of Chinese domestic firms while the POE focuses on international competitions (Kang, 2015). Theoretically, in assessing terms of innovation policy that SOEs carry, we need to elaborate ways to conduct a social audit that the firms deliver that reflect the interest of governments to increase the general industrial technological capabilities[46]. To address the necessity, we can first note that scholars do see that SOEs in China as the presentative of the government in conducting commercial endeavors (Lei, et al., 2012, p. 237) while the state makes the verdicts on the utilization of their patents (Kang, 2015, p. 391). In spite of this, scholars also perceive the managers of Chinese SOEs legally and practically still make their own agency decision (Zhang, Tang, & Lin, 2016; Freeman, 2017; Chan, 1995). Hence, while

[46] *See* Aharoni (2000) (Aharoni, 2000), and Belloc (2014) (Belloc, 2014).

recalling that in industries in petroleum sectors do not pay high the significance of universities nor government-led research organizations as knowledge source (Perrons, 2014), we can infer the wider distribution of institutes that Sinopec researches collaborate as a part of their managers' interpretation on Chinese government's instructions. This instruction seemingly only recently to other Chinese SOEs, China National Petroleum.

We should not be astonished by the conclusive insight that governments may drive SOEs to distribute knowledge hence taking the role of innovation leader. Such a policy pattern actually already became the first episodes of Japanese modernization. In the country's postwar era, petroleum refining and petrochemical production enjoyed the government's support and protection including in the necessity of licensing foreign technology (Sakoh, 1984). But the more apparent example of government's shaping the role of SOEs comes in different economic sectors. Odagiri and Goto (1996) noted in the 1870s to early 1880s, the Japanese government built and owned some key industries that came with a shared objective not to make profit but create openings to learn and acquire technological and managerial capabilities with the hope to inspire POEs (Odagiri & Goto, 1996, p. 21)[47]. These pioneering SOEs were dealing with the challenge to make proper technological adaptations of which early modernized Japanese government learned that POEs act as superior actors to accomplish[48]. We should

[47] Scholars have argued that the affinity towards Japanese model of Chinese modernization by the evolutionary process over the failure of state-oriented employment system which brought the urban societies not a mindset towards to Western ideals that distinguishes individual to enterprises interests, but to an appreciation (that later institutionalized) to personal identity that views "*workplace doubles as a community*" (Chan, 1995). The similar policy structure of China to Japan also came from the legal promotion to prohibit patron-client relationship of government bureaucrats on SOEs that led to the establishment of the State Commission for Reform of the Economic System (*Tigaiwei*), a powerful Chinese organization deliberately designed similar to Japanese MITI (Chan, 1995).
[48] *See* Odagiri and Goto (1996) (Odagiri & Goto, 1996, pp. 137-138, 143).

remember SOEs mainly were not the cause of great innovations. Instead, governments established them as the reaction to technological advancements. In railway technologies[49], for example, far from the government's initiative, it was originally an individual invention that did not perceive it as commercially promising (Spear, 2008). Conversely, even though Japan was highly credited in its speedy mastering in railway technologies, the successful knowledge deployment to the POEs have created engineering chaos of the national system that eventually prompted to the railway nationalization in 1906 (Ike, 1955; Ericson, 1998). Subsequent to the nationalization, the government formed Railway Technical Research Institute (RTRI) that was instrumental to absorb new technologies in post-WWII and also performed joint research with POEs[50] (Soejima, 2003, pp. 5-6). At the point close to the privatization of Japanese railway SOE, the government transformed RTRI as an independent body to serve technical support for the formed new companies (while the re-established firms conduct their own R&D) (Soejima, 2003, p. 7). It is noteworthy to mention that the transformed RTRI takes the task of performing "*basic research with little immediate commercial application*" (Soejima, 2003, p. 7). The statement implies that the institution carries the task of the conventional argument in neoclassical economics that the rationale for the government to administer innovation policy is to addresses the problem of the market's underinvestment in R&D relative to the socially-desirable level. It also means the Japanese government may have anticipated creating a tradeoff

[49] Railways sector, including among Western nations (Galambos, 2000), would often implicate with government ownerships.
[50] The companies aimed to maintain competitiveness and desired to receive orders from the Japanese SOE (Soejima, 2003).

between meeting the political drive to do SOE's privatization and securing the crucial function of innovation leader of the departing SOE.

### 3.5. Conclusion and Suggestions for Future Research

The study here represents SOEs as an entity different from POEs. That although their ownership comes from the state, SOEs' activities are not the same to the government. With such a unique character, we intended to show the extent of the theory of Belloc (2014) in its illuminating SOEs' superiority to POEs in building inter-firm collaborations (Belloc, 2014). The current scientometrics analysis here shows that *although less common*, it is conceivable for governments today to run such policy direction. Governments can direct SOEs to focus on making scientific partnerships with national POEs, research organizations, and universities. However, governments need to anticipate that in the SOEs' progressions, the firms may need to undertake privatizations. The privatization will sacrifice SOEs' social role as "innovation enablers" or the leader in the scientific network (*see* Belloc (2014)).

For future analysis, the apparent topic of scientometricians may perform is to investigate the impact of SOEs privatization of its publications' quality. However, realizing that national politics may prefer to avoid SOEs privatization (Shirley, 1999), the author suggests not only to use quantitative approach but to also apply qualitative methodologies as a more universal strategy to study SOEs. An example research question for such study will be: "Do scientists coming from a different type of institutions see SOEs as having some potentials or exhibit comparative advantages that made them more attractive to become research partners?" Such a question is related to our understanding that governments may have hidden finance mechanisms on SOEs

(Aharoni, 2000, p. 66). Therefore, the scientific communities outside SOEs may not transparently see the intended innovation policy directions that the SOEs convey. Such research may not yield directly promising results. As discovered in this study, the scientometric analysis has quickly shown SOEs may not have an adequate interest in R&D. Regardless, the finding is still useful to raise the issue of the firms' missing role in the national innovation system. We can ask, why governments do not order SOEs they own to have a leading position in the national innovation system? Belloc (2014) has not explained such government's failure as he was focusing in presenting SOEs as a valuable study topic in particular in the companies' contingency of government's policy (Belloc, 2014). That is the next research areas of this study.

# Chapter 4

# Case Study: the Governance of Science, Technology, and Innovation (STI) Policy of Post-Democratization Era Indonesia

## 4.1. Introduction

Government and politicians convey the objective to search for ways to exploit the potentials of science, technology and innovation (STI) for the specific purpose to advance or sustain economic development. However, we can find literature evidence such intention has not been transpiring in the autocratic and democratizing eras of Indonesia. From Amir (2007a) (Amir, 2007b) and Simandjuntak (2014) (Simandjuntak, 2014), we understand that in the nation's experiencing authoritarian control and democratization, the government used STI policy to create the sense of national pride (Amir, 2007b). In the democratizing phase, the missing habit of creating robust policy analysis has created a spacious space for elite actors (including from the industry or state-owned enterprise (SOE), university, and government sectors) to depend on hype creation to attract support towards a "technological policy" idea (Simandjuntak, 2014).

The precision of the analysis of Simandjuntak (2014) deserves more attention as elites' hype-creation habit (Simandjuntak, 2014) have been repeatedly occurring in the post-authoritarian era Indonesia. For instance, in the case of "*Blue Energy*" where President Yudhoyono[51] instructed one of his closest assistants to finance and supervise a

[51] President Susilo Bambang Yudhoyono is Indonesia's sixth president (2004 – 2014) that started his regime six years after Indonesia's commencing democratization in 1998. He was a retired Army general officer.

sensational "scientific" project that later revealed as a hoax: even the "inventor" later imprisoned (Mietzner, 2009, p. 154). In another case, more recently, the Attorney General's Office questioned several SOE elites in the relation to the alleged corruption case of a minister of President Yudhoyono that initiated and supported the development of electric cars (News Desk - The Jakarta Post, 2017). The governance rationalization[52], as a matter of fact, has been occurring also in the post-President Yudhoyono term. Not long ago, the government of President Joko Widodo[53] announced the intention to revive President Yudhoyono's policy to develop electric car domestic industry (Agustinus, 2017). This time, the regime of President Joko Widodo expressed the attention to simulating the low-income society to consume the new product (Agustinus, 2017) and they have finalized a review of tax structure revision for attracting the required investment (Rachman, 2017). Interestingly, such progression has been happening while maintaining the nuance of technological nationalism. We can infer it by evaluating the smaller intensity of scientific publication related with the term of "*battery*" in Indonesia, one of the identified core technology of electric vehicles (Wang & Duan, 2011). Table 4.1 presents the simple calculation of the proportion of internationally-published scientific publications that mentioned the word "*battery*" of authors with contact addresses in Indonesia versus the other writers affiliated elsewhere. The tiny fractions suggest that Indonesian battery producers have more minor capabilities to conduct

[52] The current research concurs with the description of Stirling (2008), that the term of "governance" covers a wider set of subject-actors (Stirling, 2008). Thus, it does not constraint itself to government institutions but more about how a "governance" conjures the involvement of wider participants in the public.

[53] President Joko Widodo is the seventh president of Indonesia. He commenced his tenure in 2014, and by the time of this article's writing, President Joko Widodo is the incumbent president. The unique feature of Widodo's prominence in competitive electoral processes has been said by his not having background in military or owning ample bureaucratic connections, nor substantial personal wealth (Mietzner, 2014).

research and development (R&D) that will be important in the innovation processes of electric cars. On the other side, Indonesian media profusely recorded the narration of the domestic production of the electric car as the creation of a symbol of "national pride" (in the Indonesian language, *kebanggaan bangsa*), including in the context of the government of the current incumbent President Widodo. The key difference of the phenomenon in President Widodo to the condition in the authoritarian Suharto is such nationalistic expression is not the monopoly of national-level elites, but also uttered by a city mayor[54]. This suggests there is a fundamental transformation that made the empirical explanation on the authoritarian technological endeavor in the autocratic personhood of President Suharto[55] will be inadequate to explain the STI government process in today's democratized Indonesia. Democratization in Indonesia has been deepening, along with it, the habit of using the issue of technology as the way to attract public attention by lower levels of government.

### 4.2. The Purpose in Setting the Perspective in the Institutional-Level Standing

In mentioning Suharto, it is worth recalling that he was not the first president in Indonesia[56] that used technology as the tool to create the modernity symbol. Sukarno

[54] *See* Wurinda (2016) (Wurinanda, 2016)
[55] The second president of Indonesia (1968-1998) that ruled in the country for 32 years. The end of his presidential term in 1998 marked the beginning of Indonesian democratization.
[56] It is interesting to learn that the name of "*Indonesia*" was actually the creation of the scientific community in 19th century to describe a culture and a specific region which later outshined by the politics nationalism connotations (Jones, 1973). There is no single ethnic group in Indonesia that comprise no less than 50% of the population of modern Indonesia (Indonesian Statistics Bureau, n.d.). According to government statistical data, there are at least 1331 ethnic groups in Indonesia (Indonesian Statistics Bureau, n.d.). The huge ethnic diversity could help to understand the history why students from the region of Indonesia living in the Netherlands in early 20the century chose the name of Indonesia instead of adopting a name of an ethnic group in making self-identification which later immediately adopted by political activists (Jones, 1973). The history also useful in bringing a clue that scientific ideas has influenced the politics of Indonesia even before the nation was born in 1945, to be precise, before Sukarno era.

did it first[57,58]. Namely through the megaproject constructions of modern architecture buildings and infrastructure in the capital city of Jakarta and some provincial cities that first conceptualized in 1950 or five years after the country's independence (Wiryomartono, 2012; Aryanti, 2007). Then, Suharto emulated the strategy of President Sukarno[59] (Wiryomartono, 2012). For this reason, it is unsurprising to find President Yudhoyono pragmatically repeated such practice by his own launching an architectural project that could be interpreted as a policy to bringing national pride and identity (Wiryomartono, 2012). Furthermore, as previously discussed, President Widodo is seemingly heading into an analogous trajectory. For this reason, we can state that the tradition of the elites' searching momentums through the creation of technological symbols have long been rooted in the history of Indonesia. As issues in technology have been an integral part of the political culture in Indonesia, we can predict such similar materializations will persist for years to come.

It is important to realize that the Indonesian public today have been more educated and the democratic values are intensified[60]. Consequently, the government needs to develop corresponding cognitions and actions to follow the trend of the

[57] Sukarno was the founding father and Indonesia's first president (1945-1967). At the fall of his leadership, Sukarno concentrated power within the president (Bakti, 2004, p. 198). In other words, in the end, he became an autocratic leader.

[58] Sukarno's assigning Sudjono Djuned Pusponegoro as the first minister that administers the field of research in 1962 (Indonesian National Library, n.d.) gives a unambiguous marking the initial definitiveness of Indonesian formal policy enactment in science, technology, and innovation. The dilemma of policy development in Sukarno era (1950's-1960's) among other was coming from the wider socio-economic inquiries that were raised in Bandung's Asian African Conference (Neelakantan, 2015). To put it differently, science was a pivotal element of policy development of the era, with wide relevancies to both domestic economic development and international diplomacy issues (Neelakantan, 2015).

[59] In 1973, Suharto appointed economist Sumitro Djojohadikusumo as his first minister on the field scientific research (Indonesian National Library, n.d.).

[60] According to Scopus (2017), scholars thus far have produced more than 100 articles that linked the term of "*Indonesia*" and the keyword of "*democracy*" that begun to emerge in 1998 (Scopus, 2017). Even though the publication rarely focus in "*innovation*" policy, the relatively extensive number of publications itself present an indication that Indonesia is indeed scholarly perceived as undergoing democratization.

changing of the social environment, particularly to sustain the evolving complexity of the division of labor of the younger generation. We can find the evidence of the changing of social environment through the data of Indonesian Central Statistics Bureau (2010) that stated approximately 97% of the country population aged below 70 years old (Indonesian Central Statistics Bureau, 2010) but only 1% of the population in the productive ages (15-44 years old) are illiterate (Indonesian Central Statistics Bureau, 2016). For this reason, we can predict the entire population of Indonesia has been socialized with the belief that the national identity interconnects well with technology. Equally important, as the population of Indonesia today is getting more educated[61], it is difficult to say that the society today only grasp technology through obscure contexts as Amir (2007) has positioned in explaining how the old autocratic-era leaders manipulated technology in rhetorical strategies to reap political power (Amir, 2007b). On contrary, it will be more convincing, to say that there is a significant fraction of Indonesian society today that have developed more improved cognitive capabilities to evaluate the value of technological development policies for their own well-being. To incorporate the existence of such "rational" population will distort the perspectives of previous scholars in their analyzing Indonesian innovation policy development that heavily focus to the higher rank position of academia, industries, and government elites[62]. To simplify it, to put the elites in a framework of being conflicting to the more rationalized society in the context of a democratizing nation is a flaw in the premise as it will lead to circular reasoning. The thinking framework will always produce

[61] According to Indonesian Central Statistics Bureau (2017), in 2016, approximately 17.91%-23.44% of all younger generation of the appropriate age cohorts are attaining university-level educations while about 59.85%-80.44% are undertaking senior high school level of education (Indonesian Central Statistics Bureau, 2017).
[62] *See* Amir (Amir, 2009), Simandjuntak (Simandjuntak, 2014), and Fatimah (Fatimah, 2015).

conclusions that imply inappropriate bureaucrats' power extension thus fail to clarify the intended effect of democracy in the government-public interrelation[63]. We must remember that the bureaucrats are also the members of the society[64]. Hence, as the wide populations are getting more educated, the bureaucrats are getting more capable to do critical thinking. At the same time, the whole society themselves have no compelling shared experience to develop an innovation policy that genuinely addresses social needs. The unexpected democratization that Indonesia experienced[65], brings a corresponding phase of uncertainties in the policy development of STI as the society suddenly must create resolutions among and for themselves. In term of advancing STI policy in the democratic era, Indonesians endure a time of turbulence. Here, policy analysis using conflict perspective will not be effective. As the paradigm see government institutions and elites as problems that can be transformed as a solution when few social determinants are emphasized or capitalist tendencies (including the industries and SOEs) are unrealistically weakened. However, recent publications have

[63] It has been traditionally accepted among scholars that a government that is discussed as a bureaucracy *cannot* be characterized or theorized as a perfect entity by, for instance, the bureaucrats inability to completely follow a changing in regulation and the leaders' lacking of skill in directing and controlling the administration (Olsen, 2006). For this reason, an analysis that in the end produces conclusions that mainly only adding imperfection features of the government will offer smaller contribution for the wide scientific community in their developing theories about bureaucracy.

[64] Resosudarmo and Kunocoro (2006) argue that the civil society was simply too weak to take a role as a stakeholder in the autocratic government of Suharto (Resosudarmo & Kuncoro, 2006). The statement is reasonable as in 1971, or in the earlier era of Suharto's leadership, the average illiteracy rate (male and female) in the nation is approximately 40% (Jalal & Sardjunani, 2005, p. 05).

[65] To describe such abruptness, it is worthy to attend the note of Wilson (Wilson, 2015): "*In May 1998, Indonesia's President Suharto resigned after over 30 years of unchallenged power. Within a year, the country moved from one of Southeast Asia's most authoritarian to one of its most politically vibrant. Political parties proliferated, elections were held and successive governments embarked on a programme of major governance reform. One of the first and most rapid reforms was the decentralization of authority to local regions*." (Wilson, 2015). Such unique circumstance will bring a signal for scholars in synthesizing generalizations from the analysis coming from Indonesian post democratization contexts. In developing a more universal theory that is derived from the democratization of Indonesia, it should be more plausible to put a framework of analysis within the extent of time more further to the year of 1998.

not discussed how government institutions across public sectors work synergistically in supporting innovation policies. This is the gap this study intends to fill.

The interconnection of cross-governmental areas is a fundamental question in the studies of STI policy. As innovation progressions are fundamentally understood as *not* following a linear model, hence innovation policies demand government from various agents bind their rationalities coherently (Fagerberg, 2005, p. 09; Malerba, 2002). For that reason, an STI analysis needs to cover meso/macro-level of study. In the study, an individual bureaucrat needs to be treated as a part of collective actions that are interacting with different actions that apply different rules[66]. That means the study should gain insight into how the democratic environment of Indonesia has been transforming relative to the autocratic eras for government organizations to be able to resolve conflicts triggered by the heterogeneity of the agents. Unlike in autocratic times, we can assume individual leaders receive greater freedom including in solving conflicts with different institutions. Under such direction of creating a heterogonous arena of innovation, it is very essential for developing the understanding of how the changing cycles of leadership[67] have been transforming the diverse Indonesian government

[66] The thought of the theory of this paper generally shares the conception of Fligstein and McAdam (2011) (Fligstein & McAdam, 2011). As Fligstein and McAdam stated, it is believed here that the state is an assemblage of sector of which character can be identifies by horizontal or vertical connectivity (Fligstein & McAdam, 2011). To put it in other words, this paper argues to use meso/macro-level analysis as it is more suitable standpoint than micro-level (individual actor) study to assess the condition of Indonesian innovation policy post-democratization. As this paper shall explain in later parts, the senior scientists or officials working in an institution can act as resourceful informant to explain the dominant character transformation that has been happening in a sector or a government institution after almost twenty years entering the democratization era.

[67] Hamid (2012) concedes in post-Suharto Indonesia, both executive and legislative tend be a creation of grand coalitions of a larger number of political parties (Hamid, 2012). The victory of the less-known Joko Widodo in the capital city governor election brings a signal that the electorate has not been matured enough (Hamid, 2012). Joko Widodo later repeated in gaining victory by winning the Presidential election of 2014. In the context of this paper, this suggests that the policy innovation in Indonesia is essentially created by different axis of political interests as it is connected to the leadership of varying ministers from differing political parties.

agencies. In line with this argument, the important question to address is "*how diverse is the institutional setting of Indonesian STI policy, and what makes such variety exist*"? Once we have identified the boundaries of such variances, another crucial question to address is, "*how the power mechanisms have been exercising to bind such differences*?" We will answer those questions in the subsequent part of this chapter.

## 4.3 Institutional Diversity in Indonesian STI Policy

Aspinall (2013) has proposed the position of the state (or the authoritarian leader) in Indonesia has been replaced by the institutional and organizational fragmentation (Aspinall, 2013). Therefore, following such a premise, we can draw a generalized assumption that it is the main interest of the relevant agencies to drive their own defined STI policy goals. Therefore, the only way the nation can attain its targets in STI policy is through the mixture of the objectives of the relatable individual organization in the sector. That means, it is rational to predict that the Indonesian STI policy has richer qualitative features as it may be influenced by a wider variety of government organizations. Such prediction appears to be true when we look into the itemization of the revised central government budget. However, before we see the categorization more closely, it is useful to first examine the preparation mechanism of the government budget itself.

The government and the House of Representatives organized the Indonesian national budget annually. The broad conscience on preparing is the state must take certain risks of economic activities, including scientific research, disaster management, and so on (Indonesian Ministry of Finance, 2015). The state expenditure, a major component of the Indonesian national budget, comprised of the expenses of central

government organizations (ministries and national-level non-ministerial organizations) and transfers to the regional governments (Indonesian Ministry of Finance, 2015). There are two ministerial organizations that play central positions in managing the annual and medium-term framework (multi-years planning) of Indonesian national budgetary. They are the Ministry of Finance and the Ministry of National Development Planning or "*BAPPENAS*" (Indonesian Ministry of Finance, 2015). That is to say, the two ministries play a combined important role in estimating and provisioning funds that the national government agencies use every year. Observing such distinctiveness, to be exact by playing the leading role synthesizing the national strategies, here the two ministries are identified as "superior ministries". However, these superior ministries do not monopolize the task of building national development planning and budgeting. We can state that mainly because the law stipulated policy directions mainly come from the vision and mission of the President that government organizations must carry in their respective formal responsibility (Indonesian Ministry of Finance, 2015). Government ministries and non-ministerial national-level organizations propose the activity to be funded by the national expenditures, while the superior ministries appraise and assign the successful proposal (Indonesian Ministry of Finance, 2015). Therefore, the yearly published public report on the state budget can provide information about which ministry and non-ministerial national-level organization that is relevant to the development of Indonesian innovation policy.

From the investigation of such reports, we can see that in 2015 and 2016 – the era of President Joko Widodo – there is a difference of the numbers of national-level entities that receive national funding on R&D purposes. While in the Fiscal Year of

2015, there are 16 national-level government institutions that received R&D funding[68] (Indonesian Ministry of Finance, 2015), by the following term the number or organization increased to 19[69]. To recall that presidential instruction is imperative in the development of government planning and budgeting, from the changing number of the recipient of research funding, we can infer that the thinking of Indonesian STI policy is still developing. Nevertheless, as the research funding has been increasing, we can say the progression has been going in a promising direction despite its duration is too short to make a more firm conclusion (*see* Table 4.2). The World Bank[70], on the other hand, showed that Indonesian expenditure of R&D relative to the gross domestic product (GDP) is far lower than the world's average, namely 0.08% against 2.217% (World Bank, n.d.; World Bank, n.d. (b)). Similarly, a recent national media report shows the low figure has been persisting in President Joko Widodo era (Wurinanda, 2017). As a result, we can predict that it is less likely that the innovation issue in Indonesia has been governed effectively. Aligned with that induction, it is worth mentioning that in the fiscal years of 2015 and 2016, the Indonesian Ministry of Research, Technology and Higher Education (Ristekdikti) received no budget allocation that plainly recorded as "research" (or "*penelitian*" in the Indonesian language). For that reason, it is hard to uphold an argument that Ristekdikti shares a comparable institutional cognition with national-level organizations that administer research budget. Ristekdikti is categorically *not* managing a working unit that conducts research activities although the organization

[68] One ministerial body received two slots of research funding as they operate two research centers.
[69] Identical to the previous year, one ministerial body received two allotments of research funding.
[70] Citing data from United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics (World Bank, n.d.).

*may* distribute research incentives[71]. Therefore, here Ristekdikti cannot be selected as one of the investigated research subjects. On the contrary, Ristekdikti remained a valuable position for conducting the triangulation process in the research phase that shall be explained in the ensuing parts of this study report.

Of whichever the structure of Indonesian STI policy today, we cannot say the configuration has been well advanced. We can say this by looking into a simple description regarding the intensity of internationally published scientific publication of the country relative to other countries of her economic size or G20 countries (*see* Figure 4.1). Among those countries, although the year-to-year proportion of scientific publication publications that involved Indonesian-affiliated institution has been increasing, the output fractions are still very small. We could infer, therefore, the cost of public access towards new knowledge in Indonesia is still relatively high.

## 4.4 Research Question and Hypothesis

The essence of the previous parts of this section is to describe that the democratic environment of Indonesia is very different from her autocratic era[72]. In the democratic environment of Indonesia, the governing power has not been deeply

[71] According to their website, the vision of Ristekdikti is "*to accomplish the high quality of tertiary education and to develop science, technology, and innovation capabilities to support national competitiveness*" (Ristekdikti, 2016). In addition, the ministry's declared mission resides principally in the policy development in the sector of higher education and science, technology, and innovation capability improvement to deliver value addition and innovation products (Ristekdikti, 2016). That is say, Ristekdikti generally do not conduct research and development activities and instead only create policies on the area.

[72] As many evidences lead to our accepting that Indonesian democratic values are maturing, for theoretical development purpose, it is less pragmatic to conjecture that Indonesia may revert to autocratic governance again. Bräuchler (2017), for instance, suggests that in today's standing, it is possible for a minority ethnic group to be successfully represented in Indonesian regional politics (Bräuchler, 2017). Earlier, even when using more dimmed perspective that even though the old elite powers are starved to recapture their privileges, Mietzner (2012) still asserted the public maintained their support for democracy although they are disgruntling over governance ineffectiveness of democratic institutions (Mietzner, 2012). To put it differently, it is more convincing to see democracy more as an endogenous character in Indonesia, a social principle the country widely and *more deeply* adopted.

concentrated in one presidential position. This inference is also applicable to the context of STI policy. The information of the research budget implies that STI sector in 2015 was related to 16 national-level government institutions. In the following year of 2015, the number grew to 19 institutions. Even so, the state's experiencing chronic meager aggregate R&D budget availability gives a strong signal that the governance of STI has the poor capability to influence public sectors. It is hence set a research question of *how those government national-level organizations perceive their limited roles in the governance of STI sectors*?

The reasoning in the research question indicates that the study calls for meso-macro-structural functionalist perspective analysis (or Durkheimian paradigm) to understand how the government national-level organizations developed their institutional cognitions in a way that restricts the bureaucrat conducts in performing their duties[73]. Regarding the conducts of the governance, as discussed above, previous scholars have provided useful directions for interpreting to the behaviors of actors in STI policy (Amir, 2009; Simandjuntak, 2014; Fatimah, 2015). From them, we can develop a hypothesis over the research question. Here, the hypothesis statement is "*the national-level government organizations relevant to the STI policy in Indonesia are failing to make self-adjustment to the changing environment of intensifying democratization as predominantly indicated by their inability to expand institutional rationality/values of collaborating with other bodies*".

Here, to advancing the epistemological definition of "*democracy*" is not the interest of this study. Instead, the study straightforwardly accepts the scholarly verdicts

[73] *See* Durkheim, Lukes, Halls (1982) (Durkheim, Lukes, & Halls, 1982, p. 59).

that suggest that Indonesia now has been undergoing deeper democratization. The underlying conviction in the research is that as a developing country, Indonesia will have a greater challenge to develop an effective policy of STI. Experiencing democratization before having strong STI policy principles made Indonesia cannot adopt adequate models coming from advanced economies to emulate. For example, if we look closer to the history of the United Kingdom and Japan, i.e. Indonesia's fellow members of the G20, the countries historically began to develop "innovation" policies *before* entering democratization era[74]. Therefore, those two countries are incomparable with the existing condition of Indonesia. As there is no country that we can reliably compare with Indonesia, the preferred study target is to explain the causes and consequences of democratization to the governance of Indonesian STI policy. Such a method is aimed to define more specific areas – thus reducing the misperception – of which the Indonesian government can learn from the governance of technologically advanced nations in lieu of their advocating democratic values. It is difficult to make realistic learning from their experience to raise the authorities' standards without

[74] In this context, "democracy" means a governance principle that applies competitive elections, inclusive elections with high integrity, civil liberties, and rule of law (Møller & Skaaning, 2013). If we look in the history, Britain already commenced their technology policy in the 16th century (Lundvall & Borrás, 2005) while only implemented women's suffrage as the fruits of political activism of the 20th century (British Library, n.d.). Technological policy in Britain came almost 400 years earlier than fuller democratization of the country. Likewise, although Japan first began to bolster research scientific policy efforts in the beginning of Meiji Era in 1868 (Harayama, 2001), women received the right to vote and to be voted almost 80 years after that (Koyama, 1961, p. 142). We *cannot* state that howbeit the condition can prevent the progression of the incorporation of the academia by the government in solving public issues. As referring to historical account of the late decades just before and after the Civil War of the United States, it was the democratic environment *specifically* that made the scientists not submissive hence they are freed to lobby the government to be included in dealing with public problems, the academia's cognition begun to evolve in assigning the practical utility of scientific knowledge (*see* Etzkowitz, 1983 (Etzkowitz, 1983)). With that trajectory in mind, it is fundamental to learn how the predisposition of government organizations in developing economies to incorporate universities or scientific communities in handling public issue.

stretching or manipulating the meaning of democracy[75] for translating it to the context of Indonesia. On that account, the research ultimately seeks the way for the *superiority of the general public*[76] over the function of the government over the advancement of STI policies.

### 4.5. Methodology and Analysis

To guarantee that all readers could grasp the empirical valuation of this study, it is important to declare that the whole structuration of the study does not rely on the legal definition of Indonesian institutions. Related to the legal references, the study sees the combined reasoning of the institutions as more powerful in determining how the law should be manifested. Here, the study receives law declarations only as a supporting element to mold the culture of the investigated institutions. As declared in the previous section, the study adopts Durkheimian methodology to inductively study the collective consciousness of the society of the institutions in grasping their own role Indonesian in STI policy. In doing so, the study certainly does not completely disregard Indonesian laws, as the regulations help to contextualize or concretize the governance problem and its research units of the case studies. This means the study is aware of the critics of Durkheim methods specifically on how it has a blind spot regarding the "*asymmetric relation of control or dependency*" (Durkheim, Lukes, & Halls, 1982, p. 23). On the other hand, as the study emphases to learn the inclination for a government institution to

[75] *See* (Collier & Levitsky, 1997) for learning a sound scholarly analysis of how to avoid the dilution of conceptual validity in expanding analysis of democracy.

[76] In a sense, the research conjure that Indonesian governance is evolving to be more inclusive, principally to respect the expansive welfare improvements of the weakest members of the societies while living a depleted natural resources (*see* Gupta, Pouw, & Ros-Tonen, 2015) (Gupta, Pouw, & Ros-Tonen, 2015). In such trend, Indonesian government bureaucrats shall have growing dependence towards scientific (epistemic) societies, bolstering public participation to heighten good governance, and developing more effective-inclusive tools that will need more sophisticated analysis of social science and technology utilizations (*see* Gupta, Pouw, & Ros-Tonen, 2015) (Gupta, Pouw, & Ros-Tonen, 2015).

involve (and to be involved) with other public organizations and the broader societies, the study does not see the law as a reliable variable to measure as the interpretation of the law is subjective. Here, the Durkheimian thinking is how the law is written does not necessarily describe of the government is governed that the ability to organize. The interfaces within society competence are more important to create a more tangible impact than the non-functional sense of national pride (Neumann, 2008, p. 131). As a consequence, the study calls for qualitative research, in particular, to generate insights on how the organizations routinely performed[77].

As described above, the study takes the unit analysis of the meso-macro levels scopes of governance, in particular, in the institutional level of the corpus of STI policy of Indonesia. The study applies a data collection strategy of a semi-structured interview with discussion topics in each topic of the interview points that adopts the proposal of Swyngedouw (2005) (Swyngedouw, 2005)[78]. The design of the questions inquire the

[77] See Silverman (1998) to learn the idea that the selection of qualitative research here is strictly speaking due to the nature of the problem to be addressed that is how bureaucrats of government organizations *perceive* a particular issue hence to develop an expandable theory on the underlying cause of the form of a running governance (Silverman, 1998). The research does not expect to make superficial quantitative estimations of the governance itself, it rather tries to make a more reliable study on structure and process of the real-world setting of a governance system (Golafshani, 2003).

[78] The appealing part of the theorization of Swyngedouw (2005) took the central line of the philosophical contextualization of meta-stable setting, in which external powers of the state (including multilateral and local organizations) and the changing of "technologies of government" bring shifting influences for government to espousing more participatory governance (Swyngedouw, 2005). The dramatic thought he presented is that in the effort of expanding the substance of governance through democracy, other form of norms paradoxically potentially weaken the intention of the democratic governance itself. The appropriateness of such theory with science, technology, and innovation policy is coming with the awareness that technological change of a country may positively influence other nations in such a way that to diminishing trade bar becomes desirable (Eaton & Kortum, 1999). For developing economies, their inherently lagging internal conditions may bring even more strain to the government as the pace level of the technological changing is getting higher means their prevalence to be depended towards foreign powers are always increasing. To rephrase it, their adaptation capabilities to changing environments (for instance, climate change or global terrorism threats) will continually be hinged on technological progresses of advanced economies. The challenge supposedly brings a very distinctive circumstance of science, technology, and innovation policy governance of developing countries to the advanced economies.

*modus operandi* of the organizations to forge a networked association, with the covered aspects of (*see* Swyngedouw, 2005, pp. 1999-2001):

a) Introductory question,

   This point of inquiry serves the main purpose of bringing a signal that the intention of the interview is to reveal the interviewee's level of awareness of the presence of other organizations. The interview is *not* focusing only on their own internal *activities*;

*b) Entitlement and status* (*see* Swyngedouw, 2005, pp. 1999)

   To see how the organizations related to the national spending in R&D see how their entitlement and status are impacting their willingness to incorporate (and be included) with other parties in the setting-up of national agenda. This question is to see the propensity for an organization to collaborate with other bodies;

*c) The structure of representation* (*see* Swyngedouw, 2005, pp. 2000)

   To see how the organizations allow the public to scrutinize their achievement levels, hence permitting the citizens to understand how those bodies are in fact representing the need of the society;

*d) Accountability* (*see* Swyngedouw, 2005, pp. 2000)

   To see how the organizations substantiate the accountability improvements or progression in representing the need of the public relative to the undertaking of the government in the autocratic era that according to scholarly analysis concentrated no more than in the creation of the symbol of national pride;

*f) Legitimacy* (*see* Swyngedouw, 2005, pp. 2001)

To see how the organizations' expanse the extent of their strategies to deal with problematic public issues beyond the comfort of familiar local arrangements (specifically, to dealing with international collaboration);

*g) The scale of Governance* (*see* Swyngedouw, 2005, pp. 2001)

To see their level of optimism in seeing how the political parties (the legislative branch of the government) have provided adequate supports to allow the government to expand beyond the "regular" boundaries;

*h) Orders of Governance* (*see* Swyngedouw, 2005, pp. 2001)

To see whether *the hierarchy levels of an organization* internally share a common perception about today's status of the advancement of STI policy.

It is important to mention as the current study is a part of a bigger study topic in the study of the role of SOEs, therefore, the targeted institutions are not only Indonesian organizations that receive national funding in R&D. The study also includes one national-level organization that did not mention as R&D budget recipient, however, their role is supposedly having a closer affinity to SOEs[79,80]. Prior to the study, each of the targeted organizations (20 institutions in total) along with the superior ministries received a more detailing explanation about the study in a term of the reference (TOR) document. The materials were delivered through postal service. Additionally, to follow the design of the interview, the study added two "superior" organizations targets,

[79] The organization discussed here is National Agency of Drug and Food Control, which work under the Indonesian Ministry of Health (The Indonesian National Agency of Drug and Food, 2001) which became one of the targeted research units.

[80] That assumption is taken from a condition of a state-owned enterprise in another country.

namely Indonesian House of Representatives (Commission VII)[81] and Office of the Presidential Staff, Republic of Indonesia. The thought in the selection of the two additional organizations was because the two bodies have a strong role in the process of the preparation of the national budget[82]. For the purpose of triangulation, the study also includes a figure external to government structure. The person has a long-built international standing in both scientific[83] and professional domains[84]. Both of the targeted superior organizations and the triangulation information source received the same TOR documents that the targeted organizations received. The readers of this study report can download TOR material[85] through https://goo.gl/FjFdQq. Regarding the document, some points worth noting here are as follows:

a) The title

The title mentioned "*post-Habibie*[86]" to accentuate the intention of the study is to learn the differences of Indonesian governance between its autocratic and democratic terms;

b) Anonymity

Anonymity and confidentiality of the informants are ensured with the consideration that the informants are government bureaucrats and the information they share may

[81] One of the working scopes of Commission VII is in research and technology (Secretariat General of Indonesian House of Representatives, 2016).
[82] Admittedly, the Office of the Indonesian Presidential Staff do not have a branch of deputy that is explicitly administering science, technology, and innovation issues (The Office of the Presidential Staff, 2016). The research only speculates that the President also pays detailing attention towards the national coordination of science, technology, and innovation policy of various government ministries and national level-institutions in Indonesia.
[83] As an author of several internationally refereed papers, and owns a doctoral degree from a renowned university in the United States.
[84] The figure is publicly known as the owner a leading pharmaceutical company in Indonesia.
[85] It was written in two languages. First, in Indonesian language and the English version ensued.
[86] Habibie is a very well-known Indonesian Minister of Research and Technology during the Suharto Era. Sulfikar Amir (2013) wrote an extensive analysis on his leadership in the book "*The Technological State in Indonesia*" (Amir, 2013).

contain sensitive issues that are beyond the capacity of the study to interpret. This means the entire or partial record of the discussion and the specific identification of the interviewees will not be re-shared in the nationally or internationally published publications of the study. Furthermore, the targeted informants are those who already hold significant years of experiments in the public sector. The longer experience will enable the informants to have adequate experiences or capacities in distinguishing the environmental shifting between the autocratic and democratic eras of Indonesia[87]. Despite setting such an aim, the study expresses respect to the discretion of the targeted institutions in appointing the informants. All things considered, the study treats each of the interviewees as a representative of their associated organizations. An informant speaks on behalf of his or her organization, not representing personal views.

c) Neutrality

Although Ristekdikti financed this study, the TOR material mentioned a disclaimer statement that ensures the study is not linked to any institutions as its sole purpose is to do an independent analysis.

The major impediment in the interview process was the very limited available duration. The interviews were accomplished only in three weeks[88]. Realizing to having such limited time, the study separates the mode of the interviews into two approaches: direct and written interviews. In the end, three organizations chose to do a written interview. They responded responding via email. Furthermore, the study managed to

[87] Each direct meeting approximately consumed about 1.5 hours of discussion to cover all the assigned points.
[88] If we calculate the time of the conducting correspondence communication with the targeted institutions, then the consumed period was approximately only one month.

conduct seven direct interviews and four additional discussions for triangulation. In total, the interviewed officials are representing ten government R&D units or institutions. Each of the informants was freed to answer according to his or her interpretation. As the sought ideas are the ones that related to the governance of STI policy, the study scrutinizes the expressed ideas that the interviewed shared, to focus only on two relatednesses, namely:

a) The economics of science

An interviewee may attempt to discuss an idea of governance using arguments coming from complex theories in mainstream economics while its linkages with the government's concrete decisions were vague. On the contrary, another informant may completely withhold from mentioning any economics jargon despite the person clearly explained the economics problem of "market failure". In order to ensure the produced interpretation the interviews are relatable with STI policy, the interviewer used the orientation using appropriate more robust economic theories such as the one from Stephan (1996) (Stephan, 1996)[89]. It means the evaluation would identify an unsubstantiated declared theory or opinionated statement in an interview if it failed to direct, for example, the actual demand of industries in innovation. In other words, the study attempted to establish itself based on more theoretically defined constructs in order to diminish subjectivist inclinations in interpreting the content of interviews[90].

[89] Undoubtedly, there are an excessive publications similar to Stephan's. The key strength of her paper here is by the straightforwardness in examining the costs and benefits of science in a style that is operative to highlighting government's potential concerns.

[90] *See* the scholarly suggestion of Silverman (1998) regarding to the importance of apportioning defined theory constructs (Silverman, 1998, p. 13)

b) The dualism in inferring bureaucratic institutions: as individuals and as manifestations of collective consciousness

In relation with the point right above ( "*a. The economics of science*"), the study perceives that the bureaucracy idealism in Indonesia will mainly follow Weberian belief of authority lines, the calculations of specialists, and controlling procedures (Weber, 1968/1921). Notwithstanding, the study does not shun an identified failure in a governments' misunderstanding an "ideal" of STI policy concept. On the contrary, it has the interest to investigate how an "inaccurate rationalization" emerges and how it brings an effect(s) in the actions of the government. In this, it is important to realize that democracy will most likely bring greater freedom for institutions to grow their own nationalities. Accordingly, we can associate an institution as *an individual actor* that owns cognition distinctive or comparable to other institutional actors. In Durkheimian framework, we can infer that each individual governmental actor will be bounded by a contract of dependency to another administrative organization as the law dispenses (Durkheim E. , 1984/1933). The operation of such conjectural "law of interdependence", in this case, is apparent through the cycle of budget allocations, where an actor receives some funding allocation as assigned by "superior actors" that indicatively owns a wider standpoint of the national governance, beyond STI sectors. Nonetheless, despite the "law" is always increasing in complexities, we must count the odds when its effectiveness is weakened by poor consolidations and mandate inaccuracy. In this situation, customs or habits will substitute the function of law. In the bleaker condition, it should be our interest to investigate whether the substituting custom has sufficient effectiveness in manifesting sound orderliness in the relations among the individual

government actors. Assuming the Indonesian STI policy governance still relies on voluntary or customary cooperation of different institutions than deliberate legal enactment, the formerly mentioned “inaccurate rationalization” thus brings an important signal over pathological cases or even hazardous condition of the appropriate coherence connections of the relevant organizations.

Furthermore, the scholarly explanation by Turner (1990) on Durkheimian theorization sees it as applicable to both larger and smaller latitudes (Turner, 1990). That is viewing government institutions as individuals (macro-level as a combination of meso-level), it is possible for the study to also theorize the sectoral policy as a manifestation of the control of a hierarchical organization in deciding more précised rules that control how the bureaucrats work (meso-level). It is very rational to assume that every leader in an organization will attempt to maintain the defined power invested him or her in order to defend a certain belief or principles by communicating his or her directions all the way to the members of the lowest level of the hierarchy. Consequently, the different boundaries of government institutions, imply the existence of *various governmental interpretations on how the STI policy should work*. To point it in a different way, the study posits that in the democratic environment of Indonesia, there is no blanket cross-sectoral government interpretation towards STI policy. In contrast, there are diversified identifiable forms of consciousness of the relevant organizations in viewing the policy. The course of classifying the assorted interpretations of institutional functions creates the succeeding interest of how such differing understandings intertwining one to another. The stronger the binding, the less possibility for an institution to show disobedience against the established bounded collective rationality of STI policy.

Furthermore, aligned with the intention to determine the varied forms of collective consciousness, the study pursued a definitive aim to contact officials coming from R&D units of each of the targeted organizations. The homogeneous unit selection in R&D units is under the argument that they are the organs that have more advanced comprehensions on technological innovation issues relative to other units in a governmental institution.

Regarding the premise of the existence of varied interpretation towards STI policy, as indicated earlier, an expressed "inaccurate rationalization" provides a valuable hint of the strength of the collective consciousness of an organization. The simple logic of it is because an incorrect statement (or incompatible with well-known theories, for instance as those discussed in the previously mentioned the paper of Paula Stephan (Stephan, 1996)) is easier to pinpoint for an investigator who is among the informants that are knowledgeable with the subject of economics of innovation in their managing an R&D units thus potentially able to manipulate the discussion. For instance, to save the public reputation of his or her organization. At the same time, one cannot assert that an interviewee is not familiar with the structure of the theory of STI economics or the comparable empirical concepts despite the interviewee seemingly expressed ideas coherent to the related scholarly theorizations. Correspondingly, a bureaucrat may in point of fact have strong working experience in conducting scientific research work for government institutions, still, he or she has never had the knowledge concerning the managerial determinations in an R&D unit. All in all, whatever the reason, we can say he or she *may* be forced to doing something that is unfounded according to his or her own view. In that account, the tangible position of an "inaccurate

rationalization" can handily provide a trace in denoting a specific social fact[91]. Or, to be more précised, a condition where the constituents of a government organization are exposed to specific forms of conflict that made them distinctive to other bureaucratic institutions (*see* Turner, 1990). As "flawed" ideation of a decision may be remarked as an unsustainable operation, it should be reasonable to see such decision was the production a forcible choice that a bureaucrat member of a government institution must convey. For that reason, it is very important for the current study to develop a mechanism to test the validity of the interview data. As indicated above, the study did plan to conduct a triangulation with a selected notable figure. Although the person was serving an indispensable role in obtaining macro-level re-assessments, the study later unexpectedly found it also needed additional parties in order to run a validation examination on the acquired interview data. The study then approached two officials from Ristekdikti and one official from a national research organization that is not part of the originally targeted bodies to become informants in re-assessing very particular issues emerged in the study process. In this report, they too will remain anonymous, and any produced interview data from the informants also will not be published. To get back to the point of synthesizing social facts, the following flow chart in Figure 4.1 describes the process of how an element of "social fact" is characterized.

To summing up, even the STI policy in Indonesia has been evolving almost as long as the age of the nation's independence, evidence suggests that the cognitive capability of the nation's STI policy is relatively still in fledgling phase while her democratic values are maturing. However, the adolescence brings an advantage for one

[91] Durkheim stated: "*A social fact is any way of acting, whether fixed or not, capable of exerting the individual an external constraint*" (Durkheim, Lukes, & Halls, 1982, p. 59).

to make early identification of how an individual institution forges its own collective conscience in defining their organ function in the governance of STI policy. With such condition, Durkheimian approach by its looseness (*see* Turner, 1990) (Turner, 1990) offers compatibility of multi-scale framework analysis on individual institutions and inter-organizational relations. The interview data provide evidence on elements of social facts that are instrumental to characterizing the assembled collective conscience of the organization in their establishing particular set values and beliefs (as materialized in their *modus operandi*) over their public role in STI sector. Finally, equipped with the synthesized structure of values and beliefs, we can identify the propensity (*or* the lack of) of one institution to collaborate with other entities.

## 4.6 Findings: A Classification of the Government Roles of Democratic-Developing Nations in STI Policy

It is important to be reminded here that despite the study takes the subjective perspective from scientists and officials of the government's R&D units, it does not attempt to comprehend the detail operations of those groups. Clearly, the study is not looking into (for instance) how these units may play the role in funneling public investment in science and technology as discussed by Mazzoleni and Nelson (2007) (Mazzoleni & Nelson, 2007). The study even defers itself to correlate R&D institutions with scientific subjects they establish in[92]. Rather, it uses the knowledge of the senior civil servants working as scientists or bureaucrats in government organizations in order

[92] Pertaining to that orientation, the author has accomplished investigating Indonesian national internationally published publication (1998-2013) (Manurung, Evaluation of Indonesian policy performance on science, technology: Scientometrics analysis on internationally scientific publication by national authors during 1998-2013 (Thesis/Policy Paper), 2014). The research found the exact number of variety of affiliation organizations of government ministerial bodies was 38 (Manurung, 2014, p. 17).

to appraise the diverse subjective roles of bureaucratic intuitions concerning their own respective function in STI policy. We can argue that the knowledge of such subjectivity is useful to estimate the "degree of openness" of STI policy actualization of the country, to evaluate whether a government institute considers public participation is important or not. If they think it is vital, can they substantiate it? For developing countries, to validate such reason can be much harder as they often must endure a condition where statistical data[93] of their respective economic condition do not show a substantial basis of the STI policy enactment. As mentioned earlier, as we are faced with the fact that the fraction of Indonesian national R&D spending to GDP is very close to zero, can we say Indonesian STI policy can be compared with advanced economies? Facing with such greater challenge, the study first found the trace of the *latent* actualization of government STI policy through the distribution of national R&D budget. By that point, we uncover the hidden footprints that the body of Indonesian STI policy in 2016 is related to 19 national organs as working levels and four steering executive and legislative organizations. Then, the challenge transformed to answer why the expansive linkage of government bodies collects scanty public-private funding provision? Is there any common impediment that these organizations suffer? The question is becoming more substantial when we learn that the technological challenge of government in advanced economies may have more complex and subtle constructions in engaging public participation (Stirling, 2008, p. 268). That means, for the sake of ensuring accountability of STI governance of Indonesia as a developing country that is expected capable to becoming economically more advanced, we need to find a way to evaluate on

[93] For example "core" data in business expenditure R&D and patent intensity (*see* Smith, 2005) (Smith, 2005).

the governance in the sector has been expanded. To be more précised, we need to understand how do they see their position in the public, as an accommodator or as a ruler[94]?

Durkheim's theory provides a valuable frame of reference on how to viewing the tug-of-war of the redistribution of powers of the national STI policy functioning in a maturing democracy of Indonesia wherein technology remains to become the public's favored issue. The popularity brings a perpetual signal that every elected executive establishment in the general election cycles must strive to produce a symbol of achievement in technology as Suharto did in the autocratic eras. Nevertheless, the dictatorship has brought the impact of stunted aptitude of the government and elites in driving technological progress. Scholars have found their judgments were not ingrained for attending the problem. Instead, they were more staunched with the intention of supporting the authority hence mirroring the slant of authoritarian rulers that was deprived with deep substantiation on public engagement. In a democratizing environment, the substantively repressing attitude expectedly creates public's opposition or societal trauma by the public's bearing financial loss caused by the policy's slacking in resolution design (Amir, 2010; Simandjuntak, 2014). From the scholarly findings, another question arises, do all government organizations see their position and realities detached to the public? The study took literal construal of Durkheim's social facts in order to create modeling or theory on how the government institutions related to STI policy actualization perceive their role in the public in administering innovation issues. The choice of linking democratization or rapid

[94] We can argue, sometimes government must make "top-bottom" actions, for instance in radioactive waste management (Stirling (2008) citing Wakeford (2003)) (Stirling, 2008, p. 268) (Wakeford, 2001).

transition and Durkheim's theory is not unique to this study. Pridemore, Chamlin, and Cochran (2007) used Durkheim hypothesis in analyzing the impact of the dissolving communist Soviet Union to democratic- free-market economy of Russian society (Pridemore, Chamlin, & Cochran, 2007). More recently, Zhao and Chao (2010) also use Durkheim theory on analyzing the impact of rapid sociopolitical revolution to the society (Zhao & Cao, 2010). The major difference with the current study is *it sees government institutions in the democratizing Indonesia as societies* that each organization is analogous to a societal group that promotes their own sub-culture. As a large economy, the size of the Indonesian government is massive, employing more than 4.45 million civil servants (Indonesian Statistics Bureau, 2014). As there is no totalitarian power that dictates the government lines while ministers changed more frequently than in the autocratic era, there is a bigger chance of differentiation of institutional norms and values (for instance in the definition of organizational targets). The study perceives Durkheimian question in this situation is "*can the government demarcation lead to interdependence*?" or alternatively, "*how the rapid democratization have influenced the socialization or synchronization of diverging institutional goals to realize an effective national STI policy*?" We must realize, no available literature on Indonesia are sufficient to address these questions[95] as none of the reports put a distinction in defining the functions of government institutions. As a result, the output of the current study will be quite different from the previous comparable study findings.

Table 4.3 summarizes the diversity of interpretations of government institutional role in STI policy. Before discussing further, we must be aware that none of

[95] *See* Amir (2009 & 2010) and Simandjuntak (2014)

the respondents come from the strictly "public" organization, such as the ministry that administers religious issues or social affairs. Unfortunately, all responding institutions have closer associations in the manufacturing sectors. Even so, a triangulation informant explained that no organization that has high innovation activities use the focal point of their R&D units. On the other hand, the author has developed a comparison data in the scope of a national scientific publication[96] that could assist in validating the claims that the respondents brought to reconstruct them as "elements of social facts" (see "*Figure 4.2. The process of Identification of Elements of "Social Facts"*). After revalidating those social facts elements, we can see that some institutions have some similar patterns in the way they see their own roles in STI policy. To put it another way, the basic unit of analysis is the interpretation of how each of the unit analysis of government organization operates based on their past actual experience or activities and *not* from personal idealism or aspiration of the bureaucrat staffs[97]. A different perspective brings a different orientation on how to evaluate collaboration hence the distinctions of manner to materializing the democratic belief of within-sector governance they administer. Equally important to mention, *by chance of historical similarities*, some organizations generate similar perspectives to other institutions. We then can propose a categorization of orientations that is useful in predicting the assortment of the subjective role of government agencies in STI policy to be clustered into four different categories: industrial pioneers, market crowding, an internal think-tank, undefined (role confusion). The four points of categorization come with the underlying causes of the difference in the orientation to the market, orientation to collaboration, and working agenda. We shall

[96] That is Manurung (2014)
[97] That means, some information the informants provided have be omitted since they do not pass positively in the validation mechanism.

now go on to describe and discuss the grouping of the interpretations of government institutional role in STI policy in more detail.

*a) Industrial pioneers*

The "industrial pioneers" are the institutions that mainly begun their R&D operations after the fall of authoritarian governance. That means they found the momentum of operations by the dissolving of patronizing power that would have actively blocked the growing autonomy for institutions. The industrial pioneers are highly rational entities. Their construction of arguments will be very comparable to the textbook material, for instance in the overview of the condition of the market and the relation with the public. In fact, the labeling of "*industrial pioneers*" here is due to the shared description over their basic goals to attend the problem of the failure of the existing market (both domestically and internationally) in supplying public good respective to their sector contexts or demand. In realizing the obstacle, they set an intention to drive the domestic industrial capability through the creation of multifaceted complementary arrangement of local companies and national universities.

Surprisingly, their more skillful aptitude does not mean that these institutions hire staffs with high academic degrees. On the contrary, they admitted to enduring a condition where their staffs are not adequately formally trained[98]. The industrial pioneers improved their institutional capabilities in public policy analysis through international relations, by participating themselves in multinational fora or sending their staffs overseas for receiving training. Through such opportunities, they

[98] One organization admitted to have not a single staff that has a Ph.D. degree.

absorbed the knowledge of how the governments of advanced economies related to their own sector determine and address a specific problem. Furthermore, the positive attitude towards other institutions is not limited to overseas organizations. The industrial pioneers also attempt to interact with universities and local companies, for instance, to tap alternative study funding. These institutions actively make self-promotions in exhibitions to disseminating signal over the interest to make scientific collaborations with other researching organizations.

In addition to their espousing deep relations with external parties, the innovation goals of those industrial pioneers also receive significant support from other working units within their own organizations. For their R&D operations are well acknowledged by other working units, they have a greater maneuver room in passing impediments in costs and administrative requirements.

Lastly, the obvious superiority of this type of organizations is they deliberately assign their own laws or regulations as a directional map of which these institutions are trying to attain in mid or long-term through of enacting innovation policies. To put it differently, they circumvent Weberian critics on formal rationality of bureaucracy that the decision making in the system is substantiated in the stated regulation themselves (Leiber, 1994, p. 259). For the industrial pioneers, a provisioning law is not the end-goal, instead, it *helps to find* the goal. The industrial pioneers are adaptive to the influence of external parties (such as industries or universities) hence demonstrating substantive rationality (Leiber, 1994, p. 259). The flexibility through utilizing the law is helpful for industrial pioneers to dealing with a variety of institutional interfaces although remain affixed to the principles of a formal organization.

*b) Market Crowding*

The second category, market crowding, is closely related to the history of technology policy Indonesia in her autocratic era. During Suharto terms, the central government established billions of dollars' worth aircraft industry that straightforwardly challenging the logic of mainstream economics (Amir, 2007). Although the legitimacy of Suharto has been tarnished, the memory of the high technology manufacturing intervention by the government apparently remains very popular among many Indonesians, including within government officials.

The officials of market crowding actors are mainly technocrats (natural science scientists or engineers) hence marking a reassemble to the trait of technocratic policy representation in the authoritarian era (Amir, 2007). By having specialist manpower, we can understand that their analytical competence regarding the economic function of the government's activity is rather inadequate. They do not see, for instance, the character of knowledge as public good hence a government institution ought to assign zero additional cost for the public in accessing knowledge its research organizations produce (*see* Stephan, 1996) (Stephan, 1996). On the other side, some of the existing malleable law makes the pervasive example in the antiqued Suharto era easy for them to imitate. Having a legal standpoint, these actors produce goods or services that are similar to the assortment that existing producers in the market already supply. The act brings a reminder of "crowding out effect" in economics, hence here they receive the corresponding label as "market crowding" institutions. As much as the conceptualization of their public service is absurd from the perspective of economics as realistically speaking, their conducts will discourage the private sectors to invest more in R&D. The fact that the law is

still permitting the practice, we can see the direct indication of the low regulative power in STI policy enactment in Indonesia. Those unusual regulative codes that shape the role of government are biased against the interest of the public (i.e. the private sector) hence may discourage the integration of Indonesian STI policy materialization.

As implied above, the conducts of market crowding actors are proper according to the existing legal stipulations. The rationality in the law brings reassurance for the leader to endorse such performance, as anyhow it has been historically applauded by the public. For the backdrop of the practice is rooted by a politically enticing occurrence, such government failure will not likely receive a deep examination. In Durkheimian stance, however, this condition brings an ambiguity as it may or may not help to increase (in this case) the degree of specialization among the scientific community, particularly in the sector that market crowding resides (*see* Turner, 1990, p. 1099). On the other hand, for winning popular contestation, a political actor can play the positively-correlated between the well-liked outmoded procedure and the current practice without having any attention to expand its actual scientific capability nor to increase the integration of STI policy implementations. It is difficult to project that a market crowding government actor to be willing to prioritize generating collaboration, especially with public sector entities if they are prioritized for finding financial incentive as a part of the rules of the game.

*c) Internal Think-tank*

The type of "internal think-tank" institution is arguably was not found in existence during the autocratic times of Indonesia. In this institution, the R&D unit functions as the intermediary between the domain of knowledge expansion and the interest of

another working unit to make improvements. The character, consequently, assigning a typical function mirroring those organizations that are commonly designated as "think-tanks" (Stone, 2007).

R&D units in internal think-tank organizations actively gather data and conduct analysis outwardly for helping other working units. So they control the selection of research topics that do not represent the interest of the scientific community nor the industry. The deeply fused interest of parent organizations in selectively nominating the research titles makes the perception of "innovation" of an internal think-tank organization almost sounds like ideologically motivated. To rephrase it, aside from within the organization itself, it is difficult to predict a tangible output of the knowledge creation activities they conduct.

An internal think-tank institution will have a very solid definition of their public role. Their compact ideation of self-identity makes this kind of organization analogous to traditional societies. It is from that character, their innovation agenda arise. For this institution, knowledge does not carry a character of the public good but more as an enabler of the organization's internal interest. In this feature, we can reserve in viewing the institution's commitment to endorsing STI policy by the fullest degree namely through collaboration with other parties. Their innovation interest mainly to serve their own organization's goals. Granted, individual scientists can still make personal decisions to nurture their private scientific careers. However, we must remember to assess personal choice is not the interest of this study. By the strict organizational rules, we can be more convinced to predict that it is much easier for the scientists in this type of institution to focus only on internal demands than addressing scientific questions arise elsewhere.

*d) Undefined (role confusion)*

The last name of the institution category, "undefined (role confusion)", directly bringing the perception of a collapsing structure of Indonesian STI policy post democratization. In the surface, this type of institution may look like to having a flourishing R&D activity where its scientists could regularly publish internationally refereed publications. On the other hand, the leaders are not necessarily approving the staffs' vitalities. Similar to the "market crowding" organizations described above, undefined (role confusion) institution leaders tend to become the captive of popular political pressure to entertain the public. Nonetheless, to entertain the public today is virtually impossible for them because the government institution must first disburse a very large initial investment to commence the imagined industrial operation. This is probably what makes the undefined (role confusion) institutions resign to view their STI role in the market. What makes it unfeasible is not the investment itself, but how to substantively relate the financing to R&D activities. This implies the compartmentalization of research. The leaders segregate the R&D section with other working units as it does not bring a very practical or quick output for his or her political intentions.

Furthermore, we can find that among the individual R&D staffs of the undefined (role confusion) institutions, the recollection in the authoritarian eras as *surprisingly gratifying*. At the time, the authoritarian rulers allocate spacious freedom for research with only one identifiable regulation available namely to avoid direct conflict with the president or his cronies. Regardless, scholarly literature brings evidence that suggests such a historic condition is not referring to the affinity of

authoritarian's interest in science and technology. On the contrary, the authoritarian regime was aiming to create some symbol of achievements through the symbiotic efforts of technological policy (*see* Amir, 2007). Still, the "freedom" that the authoritarian regime warranted brought an obstacle for the *current* scientists to exert efforts that could really match today's requisites of sound scientific activities. But the struggle happens, again, as the leaders do not seek to grow the aptitude on how to draw the linkage between the R&D and other working units. We can see the hint that unlike in industrial pioneers organizations, in undefined (role confusion) organizations, they do not have the strong commitment to reformulate the public objectives of the institutions in term of R&D, by, for instance, sending the staffs overseas for absorbing new *governance ideas* from advanced economies countries in exploiting the benefits of science advancement. Having a narrower paradigm, the leaders tend to make politically safe and apparently legal steps to maximize the R&D function for short-term benefits of his or her political tenure. The leaders do it, for example, by altering the function of conducting research activities into public education providing tasks. The direction produces social media-worthy momentums that superficially represent the public's imagination that the educated staffs in the government institutions are ready to serve the less educated members of societies. The decision is perplexing as it seemingly overtakes the basic task of universities[99] of providing education while abandoning the rational expectation of public research organizations to produce new knowledge as a public good. The other possible step that a leader takes in order to rationalize the works of R&D is to push the undefined

[99] Currently there are 4,350 universities in Indonesia (Padjajaran University, 2016). By the abundance, it is not really convincing to learn that government organizations are trying to overtake the role of universities to provide education.

(role confusion) organization to become market crowding entity. As previously described, the step is perfectly legal although it potentially causes damage to discouraging private sectors to make the investment in R&D.

The emerging of undefined (role confusion) entities bring the most profound warning over the structure breakdown of the Indonesian STI policy that is ironically happening in the country undergoing vast democratization. Using the perspective of functionalists, we can understand that undefined (role confusion) is a deviant. It transpires a result of the government societies to make values adjustment on their R&D units to be more compliant with the dominating populist-democratic perceived norms. In the specification of structure-functionalism perception, the modification gains significance by the course of power exercise that explicitly undermining the concern of the scientists. Indonesian values of democracy are conflicting with the desensitizing view on the scientists concerning their ideal functions in the government. The course of diverting the role of scientists in knowledge creation to education provider may not look "violent" per se, but obviously, it is irrational to order highly trained scientists to altogether abandon the hard to acquire skills for doing something that simply looks good politically but institutionally unnecessary. Admittedly, the intention is legal and not all undefined (role confusion) institutions take such dramatic steps of transferring the scientists' task to training providers. Still, that indicates that the leaders of government national-level institutions may undermine the importance of STI policy. The ignorance is very potential for the authorized leaders to force the researchers to abide by leaving the duty of producing knowledge that must be part of the rights of the general public to obtain.

Furthermore, as society expects civil servants to obey their leaders' authorities, the absence of critical observation will make this deviant unchecked.

Here, the interviews unveiled undefined (role confusion) organizations confessed to being unable to make a sustainable collaboration with universities. That is understandable because the institutional environment does not appreciate the world-wide accepted important role of knowledge creation to the advancement of a nation's economy. Consequently, it is bothersome to capture the social fact of organizations with undefined (role confusion) in R&D. Ultimately, in this type of functionally-defective in STI policy organizations, it is fruitless to expect the scientists to become the pioneers of galvanizing the function of scientific research if they are not the leaders themselves. We can conjecture it by borrowing Durkheimian-Merton perception on social structure and anomie[100] (Merton, 1938). If the general society or the law instructs civil servants to be submissive or conform to their leaders, then it is absolutely impossible or very risky for lower-rank civil servants scientists to interrupt the existing operations although in the purpose of increasing the appreciation towards knowledge. Additionally, we must recall that the public (including the political elites) are seemingly still generally receptive to the antiquated authoritarian era approach of producing a symbol of national pride as the best way of manifesting an STI policy in Indonesia. To remain retreat in this habit of

[100] "*Anomie*" is a sociological concept of Émile Durkheim (one of the founders of sociology) that has been widely translated as "*normlessness*" but has been suggested to be understood as "*derangement*" or "*craziness*" (Mestrovic & Caldwell, 2010), that is useful in studying contemporary social condition such as suicide or aggressiveness in which individuals are bound to engage violent thoughts and behavior reflectively or against others, varying from "*altruistic self-sacrifice*" to other shades of "*deliberate versus accidental and unintentional violence*" (Mestrovic & Caldwell, 2010, p. 142). In a sense, therefore, the acts of the leaders of undefined (role confusion) organizations to transform research activities in government institutions to training-providing for the public can be seen as an aggressive situation where the leaders are demoralizing the position of the scientists in his or her maintaining organizational control.

thinking has proven to nestle a deviant practice of (role confusion) institutions to be conveniently existing. It means there is a demand to invent a new culture that invigorates the meaning of "innovation" as a substitute for "pride" that can diffuse through the thinking of institutions of Indonesia. It is logically impossible for a leader of a government organization to pursue such a massive goal of introducing the innovative culture, especially if we desire to maintain stability. One leader will not so easily accept the inducement of the power exercise of other leaders. For this reason, we have arrived at the question, how the "superior" organizations are related with the working-level organizations (i.e. those that has been categorized in Table 4.3.) in term of STI policy actualization?

As described in the introduction section, the two "superior" ministries that we study here are the Ministry of Finance and the Ministry of National Development Planning or "*BAPPENAS*". At the early onset of the democratization, the Ministry of Finance gained the legal opportunities to increase its powers that lead to a decrease of the authority of BAPPENAS (Shiraishi, 2014, p. 278). While BAPPENAS was strong in the Suharto era (Booth, 2005, p. 205), they were historically noted to have the bureaucratic battle against the nation's technocratic bloc (Amir, 2008).

Our data showed that both of the ministries do not avail adequate times on assessing the operationalization of STI policy, particularly in ministerial levels. Every opportunity to make discussion with the two ministries during the cycle of budget preparation only attains administrative issues. The most convincing reason of this due to the perception that the sector is under the administration of Ristekdikti, hence they are seen as the party that should handle detailing analysis of actualization of STI policy across the portfolios of sectoral governments. As described previously in this section,

the complete operations of R&D in each observed organization is categorically integrated with other working units. That means, Ristekdikti essentially does not have enough power to infiltrate the innovation operations of a sector because it is substantially under the jurisdiction of the corresponding sectoral ministries. Regarding the influence of political parties, there is a prevailing doubt that the politicians have adequate concern towards the operation of STI policy realization. This indicates that the legislative bodies should create more substantiation legitimacies of the profound interest of the general public in Indonesian STI policy. As a result, from all of these findings, in Figure 4.3 the author proposes the schematic representation of the actual or latent causal model of the current social organization of the governance of Indonesian STI policy.

## 4.7 Concluding Remarks

Generally speaking, in discussing STI policy, scholars treat governments as a black box. Our awareness or expectation to governments often superficially placing them in an analytical framework that only detects their decisions or policy outputs. We demand governments to do everything "right" [101] without realizing that the individuals of government institutions are socially integrated into the public. Without this awareness of the social features of the government, many theories of economic development can become inadmissible in policy developments. Around the World, not all governments are the same. As countries have different histories, government systems have varying cultural endowments as the general societies are the ones that build them. This study has shown since the dawn of the history of Indonesia, science and technology have helped with the way Indonesians see themselves. Later, the

[101] For a strong illustration of the statement, see the famous writing of Lall (1992) (Lall, 1992) that is full of description on how governments in developing countries have been making right decisions.

authoritarian leaders maintain its function for the manifestation of the symbol of nationalism from which seemingly every Indonesian citizen today has become well socialized with the idea and belief that technology is part of their identity. All of a sudden, the Indonesian society experienced a revolution in their shifting values on the power system, from authoritarian to democracy. As the transition that brings much greater freedom, government institutions began to transform their own belief systems regarding how to exercise their interest in science and technology aspects in each public sector they manage. Eventually, as our analysis showed, as the progressions ensued, there are a variety of latent interpretations of how government institutions play the role in STI policy. What is worrying from the interpretations branching is currently there is no central virtue that guides how government institutions supposedly to play the sound role to help the public improve their innovation capabilities. It is probable this transformation is difficult to be realized by the government organization themselves as it happened gradually, for about twenty years to the writing of this material. That is how the analysis of "social fact" here is important, as it is instrumental in drawing the actual boundaries of the collective conscience of each organization's perception of STI policy. More importantly, it has detected the deprived guidance has brought significant deviation namely by an institution's neglecting the potential in the advancement of knowledge for economic development. From the finding, we can predict that one of the direct technical implications of the obstacle is it will be problematic for Indonesia to maximize the Triple Helix tight configuration of government-industry-academia or the university as suggested by Etzkowitz and Leydesdroff (2000) (Etzkowitz & Leydesdorf, 2000). The development of Indonesia is more prone to become a laissez-faire economy as some of the sectoral governments have a structural defect as robust innovation is

discouraged rather than encouraged (*see* Etzkowitz & Leydesdorf, 2000, p. 111-112). That is to say, the trajectory brings a threat to Indonesian democracy as it forbids the active participation of wider members of society within the development of the nation.

In the permanent interest of the Indonesian public on the technology, we can see the hope of the future's improvement in the nation's STI policy. We can verify such fascination by noticing over the extraordinary agenda of President Joko Widodo to 100 science and technoparks (STPs) that was announced as soon as he was elected (Narita, 2015). Not long from the time of this article's writing, the media noted that the politicians in the legislative branch demanded the government to build a science park in their constituent regions (Retaduari, 2017). For that being the case, we can expect it is very likely the tradition of offering an agenda in STI policy will remain to become a habitual practice in the future's cycles of general elections. For this reason, the president, as the principal of the Indonesian government, needs to ensure that sectoral boundaries do not head into fragmentations hence preventing progressions of STI. In addition, the president must calculate over the prospect of moral-hazard in STI policy in connection by its prospect of expansion in scopes and dimensions. Ultimately, therefore, this logically calls for the Office of the President of the Republic of Indonesia to become the agency that is responsible for a national coordinator that scrutinizes STI programs of the nations.

# Chapter 5

# Case Study: the Imaginaries of the Principals and Agencies in the STI Policy Development on Indonesian State-Owned Enterprises

## 5.1. Introduction

One of the existing definitions of state-owned enterprises (SOEs) is revenue-making institutions that are not part of the government, with independent accounting and have detached legal originality (Shirley, 1983)[102]. The scientific community in economics has long perceived that developing countries have the proclivity to form SOE by rational argument to distribute goods and services on the type of commodities that private profits are unsatisfactory provide (Vernon-Wortzel & Wortzel, 1989). Conceptually, this makes SOEs have a closer association with monopoly activities (*see* Kowalski (2013)) (Kowalski, Büge, Sztajerowska, & Egeland, 2013). With today's supremacy of liberal economy, the real call in comprehending why some nations preserve strong conviction towards SOEs is to define the justification of the respective governments over their selection in promoting the role of SOEs instead of enhancing the role of privately-owned enterprises (POEs). In countries that maintain confidence to SOEs, not only the firms may convey an abstract task on promoting national development agenda[103], but businesswise, traditionally they actually have long been omnipresent, occupying large sectorial varieties (Shirley, 1983). Until recent times, about 10.4% of global trade comes from SOEs in China, United Arab Emirates, Russia,

[102] For cross-national analytical purpose, it is difficult to define a SOE based upon the exact percentage of government ownership (Kowalski, Büge, Sztajerowska, & Egeland, 2013).
[103] For example, in the case of Singapore Airlines before its partial privatization in 1985 (Sikorski, 1990).

Indonesia, Malaysia, Saudi Arabia, India, and Brazil (Kowalski, Büge, Sztajerowska, & Egeland, 2013). We thus cannot escape being inquisitive with the significant role of these firms, at least in the term of their potential role in science, technology, and innovation (STI) policy.

Given the representativeness, it is extraordinary to learn that scholars have not made adequate studies regarding the relationship of SOEs to the STI governance, especially in the context outside communist or post-communist economies[104]. By that situation, the scholars will not be able to advocate suitable strategies for government – particularly in developing economies, to be responsible in enacting plans that involve redistributing justice in enabling the POEs and the academia to have the innovative relationship with the SOEs. Indeed, the simplified portrayal of SOEs as government-controlled firms that mainly play the role as a monopoly or fiscal agent actor is no longer adequate[105], mainly because now the degree of government's position in administering the firms have been found may vary and one even cannot associate it solely with the degree of capital ownership (Bruton, Peng, Alhstrom, Stan, & Xu, 2015; Shirley, 1983).

Aharoni (1981) has theoretically proposed that SOEs while carrying multiple interests of their government-masters can increase their institutional independence and trustworthiness if they are working in high-technology sectors (Aharoni, 1981). The SOEs' capabilities will deter the government to be more intrusive in the companies'

[104] Today, the topic of state-owned enterprises is heavily associated with China or post-Soviet Union economies. According to Scopus data (Scopus, 2018), until 2017, there are 3,029 articles written in English that mentioned "state-owned enterprise". Around 42% of those scientific articles (1,278 items) contain the terms "China", or "Chinese", or "Soviet Union", or "Communist" (Scopus, 2018). The larger ratio illustrates the causative pretext of the economists or public policy analysts often to incorrectly connote SOE with the context of socialists or communists' societies.
[105] *See* Vernon (1981) (Vernon R. , Introduction, 1981).

resolving which goals to attain (Aharoni, 1981, p. 192). Then, more than thirty years after Aharoni (1981), Belloc (2014) proposed SOEs to have leading positions in the network of knowledge creations (Aharoni, 1981; Belloc, 2014). More similar theories to those now have been becoming more urgent as no sector today is completely insular to the impact of high-technology. Now, high-technology sectors regularly diffuse into the "low-tech" sectors (von Tunzelmann & Acha, 2005) leaving no excuse for governments in developing countries to overlook this issue. In the current conditions, it is more sensible to say that if an SOE today has a low technological capability, then the situation should be caused by the social practices (value or norm) of the government that discourage the independence or the leading innovation position of SOEs. But before we return to discussing the statement further, the author will first elaborate on how the scholarly-published materials very rarely raise the problem of STI policy on SOEs.

### 5.2. The American Fallacy

It has been argued that the traditional focus of scholars into the United States (US) economy, the leader of the Western bloc[106], where SOE business extraordinarily occupies a much smaller presence fraction (Galambos, 2000, p. 275), become the barrier of the advancement progress of the theorization of the topic of SOE (Bruton, Peng, Alhstrom, Stan, & Xu, 2015; Cuervo-Cazurra, Inkpen, Musacchio, & Ramaswamy, 2014)[107]. However, The US is not without complete experimentations on the

[106] Until now, national laws in some Western countries still permit the creation of SOEs, indicating the respective political systems as not been completely in contradiction of these nations. These countries are Canada, Finland, Germany, Ireland, Italy, the Netherlands, New Zealand, Norway, Sweden, Switzerland, and the United Kingdom (OECD, 2015).

[107] SOEs are classically described as different to POEs by the former strong association to the state as political entity, including the prevailing ideological concept that makes it generally reasoned in communism (state as *de-facto* owners) or socialism brackets (state as regulators) (Cuervo-Cazurra, Inkpen, Musacchio, & Ramaswamy, 2014). As communism was the major ideological opponent of the Western world during the Cold War, understandably, the scholars from those countries are discouraged to

applicability of SOEs. Historically, in the 19th century, the US public found that state governments are inclined to create corruption, power abuse, and work inefficiently in managing SOEs that triggered local administrations to endure bankruptcies (Galambos, 2000). By around the same time, the government shifted its interest to corporations, namely to disburse subsidies, that waned the practical value of SOE except in postal services (Galambos, 2000). Regardless, the postal SOE is not in exclusion from competition from innovative communication POEs despite the public maintained confidence for the company to receive government subsidies (Galambos, 2000). Nevertheless, the general perception that POEs are far more efficient has made the government provide subsidies to POEs than becoming the owners of SOEs (Galambos, 2000). The reemerging of American SOEs transpired in the 20th century, markedly with the backdrop of the increasing distrust towards the rising of powerful corporations that led the widespread desire of more intrusive administrative state in creating an effective public policy (Galambos, 2000). Then, the new problem of pollution presented a novel experience where POEs could not afford to establish waterworks opened the path for SOEs to engage with the challenge, mainly in municipal-level situations (Galambos, 2000). The involvement of local SOEs then expanded to other sectors, such as transportation, medicine production, and health services, utility suppliers, recreational facilities, and real-estate (Galambos, 2000). The economic turmoil of the Great Depression of the 1930s also brought the federal-level government to create SOEs as private sectors were sagging (Galambos, 2000). The US joined the World War II

advocate the type of firms that were strongly coupled to their enemies. Regardless, in the age where communism has been largely collapsed worldwide, scholars may or should take an alternate view that SOEs are pertinent to national strategies, specifically in undertaking the problem of the inabilities of local POEs (*see* Cuervo-Cazurra, Inkpen, Musacchio, and Ramaswamy (2014) (Cuervo-Cazurra, Inkpen, Musacchio, & Ramaswamy, 2014)).

became another impetus for the federal government to launch Defense Plant Corporation, an SOE to covering the optimal level of military supplies that the POEs unable to attain (Galambos, 2000). The subsequent dominance of the SOE created a problem of injustice as it brought higher entry barriers that only well-connected POEs can pass (Galambos, 2000). By the chance over the emerging nation's leadership that favored the liberal market, the Post-War US government took the decision to release its industrial holdings to POEs (Galambos, 2000). The succeeding long-period of economic growth of post-war US waned the political confidence over SOEs, despite the Federal government still owned two SOEs, Tennessee Valley Authority (TVA, created during the Great Depression) and the postal service (Galambos, 2000). Eventually, the US citizens became disenchanted with the deep government regulation, the welfare system that causes ever more-complex-habitual dependence towards subsidies, and SOE (*see* Galambos (2000) (Galambos, 2000)). The experience of the US, therefore, is not very unique by its leaning towards governments in solving public problems that in other nations SOEs will share to handle. The difference is in the US' smaller proportion, mainly as the reciprocal interaction of SOEs with other issues that affected the declining public approval to SOEs.

By the dominance of American academic contributions, it is rational to predict the soared and receded of public trust to SOEs in the US will not help empirical discussion of how to promote the role of SOEs in the national system of institutions[108]. Adding to the weak civic values and the culture that pays low appreciation towards public services in the country (Galambos, 2000), SOEs' unpopularity in the US will

[108] See the basic definition of "national innovation system" in Nelson (1993) (Nelson, 1993).

discourage for the SOEs there to bring the robust contribution to local the scientific community. Clearly, the US provides a poor national representation to create a theoretical framework of the function of SOEs within a national innovation system, specifically beyond contexts of China or post-communist nations. Hence, SOEs become less favorable to be associated with "democratic" nations. To clarify briefly, here, what the author intends in using the term "democratic" is to represent the governments of countries that do not own the authoritarian capacity invested by its legal mandate to shape the economic outcome[109]. In a practical sense, knowledge and democracy are certainly interwoven. In the US, the US federal government alone spends more than US$100 billion annually on the works of developing information to sustain its democratic governance (Miller, 2015). Quite the reverse, as SOEs has been disassociated with democracy, the epistemic utility of the firms to sustain democracy remains largely an unsolved question. In such a context, this study is aiming to address. But before tackling the endeavor, we should first highlight an instance that will provide evidence that a government indeed can utilize SOEs as an instrument in knowledge creation policies.

Such SOEs-promoting policy is observable in the history of Japan. Namely by the country's creating a policy for SOEs to meet the government demand in various areas, including telecommunication, broadcasting, railways, and airlines in the era where the nation has been seen as "democratic" (Odagiri & Goto, 1996)[110]. In point of

[109] In other words, China cannot take the model as a "democratic" nation. See the cogent article of Naughton (2017) that sharply explains about the economic condition of China (Naughton, 2017).
[110] There is a large of body of literature that discussed about the meaning of democracy. One of the most convincing comes from Schmitter and Karl (1991), that first explained "democracy" as the normative principle that assigns leaders to be responsible to the society, that in modern times the accountability of those leaders reflected by competitive process of intermittent elections to allow the individual and collective citizen-subjects to receive the outlet of interest through the election practices (Schmitter &

fact, the government has begun to create a form of SOEs as early as 1870, notably in their attempting the problem of market failure of local traditional production filature methodologies that were less capable to work as efficiently as the modern Western machinery (Minami R. , 1987). The factories, Tomioka and Kankoryo Filatures[111], were commercial flops (Minami R. , 1987). In spite of that, the SOEs managed to motivate domestic advancements (or economization) of conventional spinning technology and the invention of a Japanese-form of machine silk-mill by local industries (Minami R. , 1987). The important background of this history is the incident happened *before* the Japanese government developed a university or research center(*!*)[112]. In contemporary perspective, the approach of a government only freshly experiencing modernization was a remarkable public policy achievement as it is reminiscing the now common argument of government's conducting technological policy to address the problem of industries doing too little innovation. The incident actually represents what Belloc (2014) described the potential innovation leadership of SOEs (Belloc, 2014). More importantly, the condition when the initiative happened made the incident becomes a convenient model to propose a suggestion how governments of developing countries in dealing with low quality of human resources, they should see SOEs to have the significant position to take leading roles of in STI policy. But perhaps, more importantly, the Japanese experience brought the tangible representation of theoretical economics that sees scientific knowledge as public assets, that its consumption will only make the stock

Karl, 1991). So, supposedly if open election makes the most essential condition to mark a nation as democratic, then Japan entered the phase of democratization in 1946, where the country organized a political election that was contesting 363 political parties, 184 of which returned a single candidate (Reed (1994, p. 20) *citing* Masumi (1985)) (Reed, 1994; Masumi, 1985).

[111] Kankoryo Filature commenced its operation in 1873 (Masumi, 1985).

[112] Tokyo University was established seven years (1877) after the SOE initiative while the Institute of Physical and Chemical Research (RIKEN) was founded in 1917 (Low, 2005, pp. 7, 10).

enlarged (Stephan, 1996). In other words, the instance too can be applied to contexts of advanced nations. Certainly, we should aware that American experience is different from the account that the Japanese public has. Before the modernization, Japanese firms belonged to families of the feudal authorities (Morck & Nakamura, 2005)[113]. Then, in the reforming Meiji period, the government already developed and conducted sell-offs of some sectorial important of SOEs to large POEs in their effort expedite the modernization (Morck & Nakamura, 2005). Until now, it is still possible for the government to institute new SOEs, for example in the inauguration of "Cool Japan Fund Inc." in November 2013 as a government-private partnership (OECD, 2015).

Unlike the US, the privatization trend or dissolving of government ownership of SOEs in contemporary Japan was not initiated by political conflicts over unfair distribution of opportunities, but originated from the 1973 and 1979 oil crises that resulted growth reduction and increased financial deficit for the country while the public refused to accept tax increment (Fukui, 1992, p. 34). At that time, the SOE Japan National Railway (JNR) already experienced a severe financial deficit while the society was experiencing advances in motorization and increased use of air transport (Fukui, 1992, p. 34). Despite the World Bank assessment informed us about the low efficiency

[113] In Japan, the interface between public policy and a technological system has been recorded since the year of 718, categorically in the laws on the usage of water-powered quern or grinding machine to polish rice: a civic habit that was maintained all the way to the Tokugawa period and steadily weakened in Meiji-reformation era by the availability of superior technologies (Minami R. , 1987, pp. 27-29). Before the Meiji era, the ultimatum of Commodore Perry escalated the feudal authority's interest towards technology, that they acquire steam-engine warship from the Netherlands in 1855 that quickly coupled by the creation of locally-made technological system in the same year (Minami R. , 1987, p. 53). In point of fact, the local traditional authorities also partook in the active learning of literature of foreign technologies almost half a century before the arrival of the modernizing Meiji era, expressly by the launching of the production of Japanese that the Satsuma Clan made in 1851 using Dutch literatures (Minami R. , 1987, p. 54). In other words, not only Japan has a long history of incorporating the technological aspiration of the public, but different layers of authorities have had interests in technological mobilizations prior to the country's modernization.

of the SOE[114], it hardly touched about the function or the performance of the firm in the Japanese national innovation system of railways sectors. Again, the gap created additional evidence of the neglect of policy analysts in evaluating the role of SOEs in the national innovation system. The policy analysts' disregarding to inspect such alleged technological function of SOE, yet again, may originated from liberal economists critics over unfair trade practices by the tight coordination of government with industrial actors that often become the root of frequent political scandal in the country (Minami, Kim, Makino, & Seo, 1995). We can see the argument sounds similar to the historical description of the American experience on SOEs. The economists' perception should be the main reason over the impeded study progress of the innovation impact of the Japanese SOEs (or former SOEs). For anyhow, in the context of the railway sector of Japan, as mentioned in Chapter 3, the government deliberately instituted the Railway Technical Research Institute (RTRI) on December 1986 right before the privatization of JNR (Tezuka, 2007). The "coincidence" signals a sort of prevailing rationality among government officials and, probably, of the JNR managers that grew conscious of a specific R&D-related function to the public that SOE will lose once it is undertaking a process of privatization. Another example also from Japanese government's preserving a specific function of Nippon Telegraph and Telephone (NTT) as technology promoters by assigning it to "*conduct research activities related to telecommunications technologies that would form the basis of telecommunications*" (The Government of

[114] According to Fukui (1992), in the Fiscal Year of 1985 alone, JNR did receive "*a special subsidy for the development of technology for a magnetic levitated train, and grants for the special account amounting to $2.6 billion (JPY 348 billion)*" or approximately half of the funding the Government granted by the year (Fukui, 1992, p. 15.).

Japan, 2007) as then the company went privatization in 1985[115]. Unfortunately, to the best that the author understands, there is no previous study that reviews how the changing of ownership of the SOEs has influenced an identifiable role of RTRI or NTT. Or, to be more précised, there has been no convincing research report that may synthesize the government to seemingly disburse new funding or secure public access on the diluted function of the SOEs (by its privatization) in the Japanese national innovation system. Unfortunately, although the idea sounds promising, it is not going to become the topic of this section. Rather than attempting to offer new prescription using Japanese case, the author will discuss a phenomenon that he previously acquainted with[116], namely the varying performance of SOEs of various nations in term of R&D output. Here, as previously explained, *the direction of the study is to explain how governments may not use SOEs as an instrument in their STI policy*.

### 5.3. SOEs and Sociotechnical Imaginations

The part above attempted to give a cogent counter-argument over theoretical conception that perceives SOEs as an obsoleted type of productive institution. In fact, to say the US as the defender of free-enterprise opposes SOEs is an over-generalization. Moreover, through the explanation of how the Japanese government historically benefitted from SOEs' conveying STI policy agenda, we can question how the productive entities fit with scientific endeavors. The author here has left the task for future analysts to develop appropriate theories to explain how Japanese SOEs met such

[115] The study of Sueyoshi (1998) insinuates that the privatization of NTT in 1985 did not necessarily yield substantial improvement that partially contributed by the pricing system of telephone in Japan as determined by political compromise between the company, suggesting the change of ownership does not automatically induce the performance of a firm (Sueyoshi, 1998).
[116] *See* Manurung (2017) (Manurung, 2017).

STI policy tasks. To doing so, the author suggests for the future analysts to pay attention to the detailed history of Japan, the distinctive effort of the government in their early-modernization era to shape the collective imagination of the public, for them to see technology as the manifestation of genuine public interest. Good literature evidence of the astonishing undertaking comes from Nicholas (2011) that unveiled Japan being a newly modernized country conducted five international technological exhibitions that attracted millions of visitors (Nicholas, 2011, pp. 284-285). Furthermore, across the nation, the local governments, later together with private firms, also organized 5534 prize competitions with 2.1 million exhibitors in the span years of 1885 to 1898 (Nicholas, 2011, p. 285). The competitions had an important economic significance in boosting patents outcomes, mainly in less developed regions (Nicholas, 2011, p. 285). By the time when communication system is still in infancy, the government already had a clear protocol description on what they meant as “innovative products”, enabling an swift STI policy repetitions deep to the lower-level of government institutions to distribute incentives for both individuals and communities to communicate new technologies they collectively developed (Nicholas, 2011, p. 285). Using Jasanoff's sociological framework on the relationship between science and the state (Jasanoff, 2006), it is difficult to deny the Japanese government helped to create a society that collectively *desired* to accommodate the progressive evolvement of knowledge by persuading the public to strip their own outmoded traditional practices, identities, norms, conventions, discourses, instruments, and institutions. The SOEs, consequently, was only embedded political agents of the government to deepen the scientific and engineering experience of the industrial territories. In Japan, SOEs were the tools created by the imaginative government to exercise its technological intentions.

Actually, in Indonesian history, we could see a similar situation to Japan where the government used SOE as the instrument to forge its political targets in the technological policy. The major dissimilar aspect is in motivation. In Japan, the modernization of Japan was a necessity in dealing with the risk of the US invasion[117]. In Indonesia, particularly in Suharto era, the government established an SOE as a means to manifest the symbol of esteem and pride, the representation of national imagination of leaving the darker colonial past (Amir, 2007b)[118]. So, in Japan, the imagination came from a hypothetical yet convincing threat. In Indonesia, the imagination rises from the historical tragedy realities. As Amir (2007) described, the policy concept of deploying the strategy is politically persuasive, i.e. to usher the nation's going beyond the mastering of Western technologies, embodying the mission to continue the predecessor's achievement in reaping freedom from the colonial power (Amir, 2007b). On the other hand, Japan domestically did not have an exact point of reference in the past that consigns a hint of trajectory they *should* follow. Either way, both incidents reminiscing what Jasanoff and Kim (2009) defined as "sociotechnical imaginaries"[119], that is the "*collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific scientific and/or technological projects*" (Jasanoff & Kim, 2009). In a sense, the governments of Indonesia and Japan, both intensely believed the technologically-driven SOEs brought the means to attain their

[117] The militaristic diplomacy of Commodore Perry let the Japanese to open the country (Kitahara, 1986).
[118] Sulfikar Amir produced a number of publications related to Habibie and authoritarian/post-authoritarian Indonesia. One of them is the dense book of "*the Technological State in Indonesia: The Co-constitution of High Technology and Authoritarian Politics*" (Amir, The Technological State in Indonesia: the consititution of high technology and authoritarian politics, 2013). Sulfikar Amir is the leading scholar in the topic.
[119] "Sociotechnical" is the term to explain that the society and their institutions develop qualities that reflect the characters of the existing technology (Hughes, 1983). The interaction of the society and their institutions with new ideas bring improvements that sometimes impended by cultural contexts, for then within the yielded resultant line, progressions may occur.

own version of the ideal future. Henceforth, it should be the interest of the STI policy analysts to understand how the state behaves in their utilization of SOEs in maintaining their purposes by supporting scientific progressions through the firms[120]. As the concentration is in Indonesia context, to do so, first we need to briefly review some most relevant articles that are recently published to gather a better understanding of the condition of the evolvement of the country's STI policy in the post-authoritarian or democratization era. From the review, in the next part of this article, the author shall develop the research questions and hypothesis.

### 5.4. Research Questions, hypothesis, and methods

"*Technology*" or "*innovation*" apparently is the word frequently used in scientific articles that put Indonesia as the setting. But the way Muda and colleagues (2017) define the term "*innovation*" clearly describes how Indonesian scholars and policymakers interpret the term i.e. by their mentioning only one reference of national law and then to further explicate their premises on regional innovation system (Muda, Rahmanta, Syahputra, & Marhayanie, 2017). First, the practice illuminates the unfalsifiable reasoning on innovation[121]. But more importantly, it clarifies that by the existence of such law that was ratified in the post-authoritarian era, the State upholds an affinity towards science in a way that puts a thick concealing to answer many "how"

[120] Adapting the conceptualization of Jasanoff and Kim (2009) (Jasanoff & Kim, 2009).
[121] Indeed, "innovations" have two sides of importance in invention and adaptation or improvements. Be that as it may, experts in innovation policy would rather use a negative definition to specify the meaning of "innovation" that is not to follow a linear model, effectively disapproving the understanding that scientists as the major source of idea nor its cycle of improvement can successfully occur in one trajectory (Fagerberg, 2005). Furthermore, for successful catching-up nations, it is hard to reject the idea that technological adaptation is the more desirable undertaking to create innovation connectivity for smaller firms in more rural regions that are lacking to ties with large firms as happened in Japan (Kelly, et al., 1995; Shapira, 1992), implying the governments there have the lesser demand in "scientific" pursuance to create more effective innovation policies. That is to say, the way Indonesian government perpetuate a unfalsifiable definition of innovation policy will create less erratic priorities.

questions in public policy. That although the article did explain the idyllic condition of an innovation system, it detaches itself from the conditions of which the government should release its responsibility on the system. To put it differently, "innovation" in the post-authoritarian era of Indonesia have been perceived largely as government's duty, the interest of the nation, without clarification down on the operation levels or how to prevent negative outcome to transpire. We could accept the prediction of such consequence through anthropological research of Simandjuntak (2014) that explained how the interest gradient in STI policy in Indonesia expanses to become the vision of institution-level elites, including from the SOEs and the academia (Simandjuntak, 2014). The study describes that sociotechnical imaginaries are potentially suitable not only national-level case study but also lower-level institutions, including SOEs. Sociotechnical imaginaries concept is especially useful when we deal with the interaction of a layer of authorities. On the SOE level, a policy agenda is politically distorted by the selection mechanism of the managers that makes them act as "*government administrative*" (Simandjuntak, 2014). Meanwhile, the newly-introduced democracy in Indonesia brought new chances for the public to develop distinctive kind of epistemology to the type that scientific experts offer as it attaches to the interest of the public themselves (Amir, 2009). Therefore, the manipulation of narrations is no longer been the monopoly of the technocratic elites, as previously happened in the autocratic era of Suharto (Amir, 2008). Accordingly, it is reasonable to learn the research report that informed presently there are a variety of paradigms among varying government institutions in Indonesia on their interpreting the task of government in conducting STI policy (Manurung, 2017). Do those propositions lead to our identifying a research gap to clarify *how institutions with diverging conceptualizations and*

*strategies work together to exert a combining influence to attend the desires of the public*? Such a research question is ideal to address here because we can have a concrete object of the "influence" through the institution of SOEs.

A long-standing and important concept in analyzing SOEs is principal-agency theory that accentuates the atypical interest between government (as the principal) and the firm (as the agent), that their relationship is abstract and political (Aharoni, Managerial Discretion, 1981; Ennser-Jedenastik, 2014). For that reason, as institutional thinking and conducts on STI policy are diverging, we can suggest the first hypothesis: *the relationship between government and SOEs are not in one tone, that its typology will erratically follow different orders of interest of the government owners*. On the agency side, through the evaluation of internationally-published publications of Indonesia post-Suharto era (1998-2013), we can learn that SOEs contributed an insignificant portion (3.65%) of the total of national attainment (Manurung, 2014). To again follow principal-agent theory, this suggests that an extra hypothesis that *the managers Indonesian SOEs today are relatively freed from any prioritization assignment from the government to conduct any knowledge creations, therefore they will resort mainly to external resources in conducting any type of innovation initiative*.

To solve the research questions and to test the hypotheses require the incorporation of multiple organizations in one study framework. These organizations interact as the principal and the agency. The Ministry of Research, Technology, and Higher Education, Republic of Indonesia (Ristekdikti) provides the data that accurately meets such prerequisite, which is from their record in organizing a focus group discussion meeting (July 24, 2018) that included various government ministries and SOEs (Directorate Industrial Innovation, Ristekdikti, 2018). The meeting was aimed to

discuss how the nation can develop supply and demand policy for the SOEs to drive innovation. The second topic was to grasp the perceptions of SOEs on innovation. All the digital data related to the program has been stored and publicly accessible through https://goo.gl/uUG3uF. One of the most important materials of the available document is the audio recording of the event. The author transcribed the audio recording and translated to English, then put it in https://tinyurl.com/y94wfwfg. A reviewer may notice, as the audio source has a low quality, both the original transcription and the English translation shows many indistinctive speaking manuscripts. That prevents the analysis to use computer software to make a more convincing qualitative analysis as accomplished for instance by Levidow and Papaioannou (2013) that performed a study in a similar direction to the current research (Levidow & Papaioannou, 2013). In spite of it, aided by other presentation documents that Ristekdikti avails, the constructed text transcription is still sufficient to capture areas of interests and linkages of the participating institutions. A fact that made the FGD meeting to have a resource significance is by its inclusion of: [1] the Ministry of SOE, as the major principal of Indonesian SOEs; [2] the Ministry of Finance; [3] the Ministry of National Development Planning/National Development Planning Agency (BAPPENAS); [4] the Ministry of Research, Technology, and Higher Education (two directorates); [5] the Ministry of Trade; [6] the Ministry of Agriculture; [7] the Ministry of Transportation; and [8] the Ministry of Energy and Mineral Resources; [9] Pertamina; [10] PT INTI; [11] PT INKA; and [12] PT DAHANA. Schematically, the strata of the involved institutions have been described in Figure 5.1.

The main target of the analysis is to obtain the implicit imaginaries of the institutions, not in their statements of policy directions. The study focus in identifying the declarations of norms, the main topic in the debates, representation, and cultural or institutional habit following the theorization of Jasanoff and Kim (2009) (Jasanoff & Kim, 2009, p. 123). The accumulated evidence should describe the permanency of institutional control, earmarked as the priority, to indicate the areas between notions and action (*or* inaction), or internal discussions, and verdicts (Jasanoff & Kim, 2009, pp. 123-124). As a result, the portrayed imagination can be tested in the future if one finds a credible condition that there is a substantial enhancement in the R&D performance of Indonesian SOEs. Example of the future research question is: *How far the imaginaries of the principal ministries and SOEs themselves have changed to co-produce the discovered improvements?* Meanwhile, it is important to raise here the current study result is important to build practical policy prescriptions in the instrumentation of SOEs in STI policy in Indonesia or elsewhere.

## 5.5. Findings: the Imaginaries of Indonesian Government Principals and SOEs Agencies

Following the arrangement of the fore-mentioned FGD, the configuration of analysis will first concentrate on the SOEs, followed by the non-sectorial, then concluded by the sectoral ministries. Admitting that the actual event does not entirely follow such flow, the readers here are suggested to be attentive that the produced notions are often based on the cross-discussions between the participants. Also, it is should a valuable point to state that each participant are formally invited to take the role as the formal representative to their respective organization, that they are allowed only

to express the most important matters that shall be gathered as a public record (Directorate Industrial Innovation, Ristekdikti (b), 2018). The strict stipulation adds the trustworthiness of the data.

### 5.5.1. SOE: Innovation to Seek Profit

Entering the post-authoritarian Suharto era, Indonesian SOEs experienced legal restructurings, including privatization, which was prompted by the government's intention not only to improve SOEs performance and efficiency but also targeted to support the state budget (Fitriningrum, 2015). The momentum brings supplementary motivations to Indonesian SOEs to pay greater attention towards innovation, to be precisely for producing new commodities or to reduce costs especially rent-costs on technology-licensing. All representatives of the presenting SOEs have seemingly agreed the 1998 power transitions made them lose previous monopoly rights or government preferences. tIt triggered the need for survival. Clearly, the media archives allow us to validate the news of new product launchings the companies did. For instance, Pertamina's Musicool (Leandha, 2018), PT INKA's air conditioning system (Deny, 2016), PT LEN's radar (detikFinance, 2013), and PT DAHANA founding a new manufacturing site (Rayanti, 2016). Correspondingly, Indonesia's leading universities (such as Bandung Institute of Technology or ITB and the Sepuluh Nopember Institute of Technology, or ITS) also hold some publicly-available information regarding their having formal ties with the SOEs[122]. The confession of the SOEs, however, cannot

[122] In 2016, ITB has active partnership MOUs with the four presenting SOEs (ITB, 2017). On the other hand, not only the record of owning formal ties (for instance through their Laboratory of Natural Products and Synthesis Chemistry (ITS, n.d.)), ITS also has some recent documentations of a scholarly publications in the form of final thesis for bachelor degree that unambiguously mentioned as connected with the business framework of the SOEs (*see* Fikri (2017) (Fikri, 2017) and (Larasati, 2017)). Therefore,

explain why they do not have profound reputations in R&D. To illustrate the problem, in 2017, Pertamina did not publicly mention their exact R&D spending although mentioned their establishing a unit of "*Research and Technology Center* (*RTC*)" that is directly under the supervision of the company's President Director (Pertamina, 2017, pp. 43, 101). The practice contrasts to Shell[123]. The company informed the public the sum of their yearly R&D budgets in 2015-2017 within their "*Financial Statements and Supplements*" document (Shell, 2017). Therefore, so far, we can make an interim conclusion that the SOEs consider R&D-based innovation as crucial to their own survival as companies. At the same time, as their imaginaries do not seem to be convincingly actualized. That suggests the SOEs' principal (i.e. the government) as the actor that is essentially (perhaps unintendedly) prohibits the firms to have more innovative initiatives. The following parts of the articles will address the assumption further.

### 5.5.2. Sectorial Ministries: Advancing the Reasoning of Habibie?

One of the most interesting evidence we can extract from the FGD data is that an Indonesian government ministry may straightforwardly acknowledge in their having no awareness whatsoever of STI policy. This also clearly informs that the nation has no respectable figure in the leadership of STI policy. To recall the vast literary references that points out the importance of the stronger role of the government in building

although we clearly cannot declare the firms do have some robust ties with universities, it is also hard to deny the SOEs are completely impervious on the beholding of the national higher education institutions.

[123] Together with Pertamina, Royal Dutch Shell is one of the Fortune 500 companies (2017) in the industrial sector of petroleum refining (Fortune, 2017). Sharing the same sector alone would indicate the two companies will have similar knowledge base, technological supply and demand (*see* Malerba (2002) (Malerba, 2002)). It is hence peculiar to observe compare to Shell, Pertamina has chronic lack of interest towards R&D.

industrial capacity (Wade, 2012) of which the governance able to coordinate R&D horizontally (Doner & Schneider, 2016), the revealed absence of strong technological imaginaries entails a hazard over the sustainability of the development of Indonesia. Accordingly, the literature suggests the government institutions are experiencing impeding growth in the aptitude in STI policy by their anchored to the outdated technological ideation as crystallized in Habibie's famous phrase "*berawal dari akhir, berakhir di awal*" ("starting from the end, ending at the start") that makes the ministries inclines to see scope of duties of innovation as very vast: from understanding existing technology, conceiving novel products, and conducting basic research (Amir, 2007b). The inference comes from the ubiquitous utterance of the commercialization of R&D that the ministries expressed in the FGD. Their interests mainly to expand the government or universities' scientific research *into* the industrial domain (not vice versa). The sectorial ministries did *not* communicate their prime role as the entities that are bringing remedies on the problem of market failures. Thus, they do not develop sufficient skill to estimate the adequate R&D investment that the SOEs should allocate. To be sure, all the ministries aware of the economic importance of the SOEs or otherwise they will not utter their institutional interest in the FGD event. The interesting part is the majority see SOEs as the strong actor that will help to patronize the process of technology commercialization of government R&D centers or the universities. Granted, some ministries undoubtedly have scientific concerns[124]. However, it has been already conventional wisdom in Weberian tradition for us to predict that any government body to limit their objectives to follow their elites' partiality[125]. To put it

[124] *See* Manurung (2014) (Manurung, 2014).
[125] From many examples, see for instance Udy, Jr. (1959) (Udy, Jr., 1959).

another way, as long as there is no larger power that stimulates the government organizations to have a uniform technological imaginaries that replace the deep-rooted Habibie's concept, the SOEs will not have a more profound position in Indonesia's national innovation system. As the sectorial government principals of the SOEs will not be functional in assisting the companies in term of R&D contexts. In term of R&D, these government ministries will first prioritize to answer the demands of their institutional mandarins that are not necessarily related to STI policies (see Chapter 4).

### 5.5.3. Non-sectorial ministries: Neoclassical Economics *sans* Realistic STI Policy

Thus far, one fact that has not been mentioned is the participants of the FGD of the sectoral ministries, except for the Ministry of Trade, were all coming from units related to national R&D organizations (Directorate Industrial Innovation, Ristekdikti (b), 2018). Related to this, we should recall the Indonesian history of its autocratic Suharto era has an apparently rather unusual incident of the clash between the technocrats' and the economists' over national development policies (Amir, 2008). As we have just learned that the old imaginaries left substantial remnants in the pattern of thinking of the sectoral ministries, it is commonsensical to expect that the current economists' living in a democratic environment would similarly inherit the same paradigm in their intellect on STI policy, that they will have their own imaginaries biased by neoclassical economics towards the topic. Here, the "economists" participants of the FGD were from the Ministry of Finance and the Ministry of National Development Planning/National Development Planning Agency (BAPPENAS) (Directorate Industrial Innovation, Ristekdikti (b), 2018), in Suharto era both were under the influence of the economist Widjojo Nitisastro, the political rival of Habibie

(Amir, 2008). The mainstream economists were not always sympathetic in viewing STI policy as it renders in materialistic and human capital investments, while the other underscores the significance of learning in making investments efficient and effective (Lall & Teubal, 1998). Also, the mainstream economists will find the unique character of knowledge that tends to increase after consumption (Stephan, 1996) – hence knowledge is *not scarce*. The unique character of knowledge makes it theoretically challenging for economists to understand because such quality fundamentally violates the basic definition of economics as the study of how society manages *scarce* resources (Mankiw, 2018). For economists in developing economies like Indonesia, they will have bigger challenges of the market and institutional failures while governments have more limited competences in planning, execution, and harmonization that make STI policy harder to carry (Cirera & Maloney, 2017). In this FGD, we can learn that the problem of Indonesia is surprisingly more complex, as the non-sectorial ministries (both ministries heavily involved in the cyclical organization of national budgets (Directorate General of Budgetary, Ministry of Finance, RI, 2014)) not only biased by their predominantly background in economics, but they too were influenced by the national experience of deeply trusting the vision of Habibie. First, the FGD revealed an authentic and important evidence that the Ministry of National Development Planning/National Development Planning Agency (BAPPENAS) endorses some particular technological projects (The Minister of National Development Planning/Head of National Development Planning Agency (BAPPENAS), 2018), *without* providing a further clarification of how the funding disbursement meets the market condition that Indonesian SOEs are facing, nor how the schemes are reflecting the existing technical problem of POEs. Secondly, the representative of the Ministry of Finance repeatedly

explained that the current preparation of 300% super deduction tax as the government's plan to provide bring R&D incentives for the companies (SOEs and POEs)[126]. However, there is no evidence be it from the FGD or other resources that indicate the Ministry of Finance is aware that Indonesia's chronic scientific lags have created immense disparities between the capabilities of foreign industries to the present standings that local SOEs and POEs own. The FGD event did raise a question – which the Ministry of Finance clearly failed to respond – if the generous policy will benefit more technology-minded foreign industries working in the country as their level of R&D operation is far bigger than the local industrial attainment. The evidence again suggests that the prevalent imaginaries of Indonesian economists have been persuaded by Habibie's imaginary of technological independence that the country is ideally a system separated to the international competitions. This is a naïve imaginary as the scientific community is *de-facto* operating as a global network. That the problem of developing economies is in their incapability to attract collaboration with other countries to accumulate a larger base of fruitful knowledge (Chinchilla-Rodríguez, et al., 2018). In the vacant of strong empirical ideation, we can understand the dominant imaginaries will not deeply consider the inquiries technological connectivity between Indonesian SOEs with other knowledge creators as we can infer as habitually accepted and politically guarded in Japanese SOEs.

[126] For validation with media account, see for instance Siregar (2018) (Siregar, 2018).

## 5.6. Conclusion: Indonesian STI Policy Imaginaries and its Expressions on their SOEs

The original questions of the current work were entirely immersed in the contextualization of Indonesia as a democratic nation under a significant cognitive influence of the formerly ruling autocratic leadership. The question then assigned a condensing direction to evaluate of how the democratization progressions have left marks in the instrumentation of SOEs in STI policy while setting testing-premises that government inconsistencies will make the firms to have difficulty in developing appropriate "innovation" agenda. The additional hypothesis therefore was, the SOEs will be released to any prioritization tasks in the specific public issue. To answer and test such question/hypothesis is not an easy endeavor, mainly as it must be addressed in a way that put different relevant government agencies – as the principal in STI policy – and the SOEs – as the actuating agency of the STI policy – within a singular framework. Consequently, the author is aware that a skeptical reader will criticize the unusual data source he uses, namely from a record of discussion meeting. Nevertheless, the accessible data is not without significant meaning as it does record the discussion of representatives of government officials together with the SOEs on how they can improve the instrumentation of the companies to materialize public interests in STI policy. The methodology then uses the concept of sociotechnical imaginaries that have been argued as useful in bridging the science and technology to authority institutions (Jasanoff & Kim, 2009). Moreover, it is not logical to use quantitative approaches as it has been shown from a previous study that discovered the scientific productivities of Indonesian SOEs is negligible (Manurung, 2014). To increase the democratic value of the current study, the author rewards future evaluators the transcript of the meeting in

both Indonesian and English languages, additional to his re-availing the public data that he uses that he received from the government.

The study brings an unexpected result that the democratization process of Indonesia, as a matter of fact, brought more practical motivation of the SOEs to conduct innovation efforts for increasing profits by creating new products or reducing costs. That means, the SOEs have developed a new strain of "DNA" over their internal interests to expand scientific edges, preceding to any government instruction. But, again, a critical reader will answer that the admission will not explain how the Indonesian SOEs continually to have small scientific productivities? To answer the critics, the author will refer to the principal-agency theory that has been scholarly well-established in analyzing the relationship of SOEs with the government. That the government agencies are the more powerful party while the SOEs, predictably, as the weaker subjects that carry the government's interest. In other words, one can assume that the faint scientific output of the SOEs actually influenced more by their interacting with the governments' agencies rather than originated from their own choice. The data gives the more convincing evidence that government ministries have maintained the old sociotechnical imaginary from the authoritarian era despite sometimes the institutions' elaborating the vision according to the interest of their respective agencies. The influence also has been interestingly going widespread to government ministries that historically hostile to the old sociotechnical imaginary. Therefore, a prescription to this impediment is straightforward: the president, as the highest authority in the governance of Indonesian STI policy, needs to develop a more strategic way to reinstate a new national sociotechnical imaginary that will help the SOEs to assume an upgraded role to distribute technological capabilities to the nation's POEs. This recommendation is

generalizable to other contexts of nations or future studies regarding SOEs function to the national innovation system. That we must test the following hypothesis: strong national leadership in STI policy of a country will create a more pronounced desirable expression in the country's SOEs in undertaking a substantial responsibility in their national innovation system.

# Chapter 6

## Policy Implications and Conclusions

The chapters of this study have shown that the theoretical development of state-owned enterprises (SOEs) related to science, technology, innovation (STI) policy studies has not been progressed significantly mainly due to the narrowing association of the firms to privately-owned enterprises (POEs) (Belloc, 2014). Although today there is a well-established scholarly prescription for states to leave ownership on SOEs, the developing and advanced economies currently still maintain their SOEs (Belloc, 2014; Kowalski, Büge, Sztajerowska, & Egeland, 2013; Rentsch & Finger, 2015). That means, there is an inevitable requirement for scholars to advance their theorization to describe the relationship between the governments and their SOEs. The theory advancement should cover beyond the efficiency or profitability issues and to empirically confer how the firms involving in bringing social welfare improvements. Related to the SOEs relationship with governments' STI policy, the same pattern of study should apply. As Belloc (2014) theoretically portrays that the constructivist analysis, the broader condition of the states' governments needs to become the part of the unit of analysis to thoroughly explain the cause of such incapacities (Belloc, 2014). Following his own advocacy, Belloc (2014) describes the superior potential of SOEs to POEs is in their having governments' support that will help the firms in sustaining inter-firm collaborations (Belloc, 2014).

The Japanese SOE history has shown the confirmation of the theoretical prediction of Belloc (2014)[127]. Nonetheless, it remains a valuable inquiry to address whether the theory has greater empirical significance to other contexts of nations. Therefore, in the third chapter of this study, the main discussion was to show how SOEs of various countries that have similar revenue sizes expand research and development (R&D) collaborations. The key research variable in the scientometric study was using the instance of co-authorship of the SOEs' internationally published publications. The unique character of the business sector is the industries see universities or government research institutions not as important source of new knowledge (Perrons, 2014). This gives the suitable generalization that as business entities, the behavior of the investigated SOEs in doing research collaboration will need to emulate the conduct of partnership of a leading POE. The findings suggest that all SOEs from Brazil, China, and Norway that were more intensely doing R&D collaboration, have been continually or intermittently concentrating on making domestic partnership hence diverging to the orientation of a leading POE. Additionally, literature evidence suggests the discontinued emphasis on local R&D partnership that one investigated SOE (from Norway) shows has been connected with the progression of the respective country on giving the firm greater managerial freedom. Regardless, the occurrences have supported the theory of Belloc (2014) over the potential leading role of SOEs in building inter-firm partnerships (Belloc, 2014, p. 836). However, the supporting findings to Belloc's theory have left a bigger inquiry, "why some governments do not seem to shape the potential role of SOEs?"

[127] *See* among othersMinami, Kim, Makino, and Seo (1995) (Minami, Kim, Makino, & Seo, 1995), Odagiri and Goto (1996) (Odagiri & Goto, 1996), and Sakakibara (1997) (Sakakibara, 1997).

Still using the reference of Belloc (2014), to investigate government's insufficient support to their SOEs for creating the leading roles in inter-firm partnerships (Belloc, 2014) require macro conditions analysis of the nation. This study chooses Indonesia as the investigated subject considering the data availability that the author can have access to. The previous studies on the latest condition of the nation mainly emphasized the country's experiencing democratization (leaving the authoritarian era). Correspondingly, the study aimed to analyze the latest evolvement of institutional perspectives in STI policies of the contemporary democratized Indonesia. The study mainly uses an interview with scientists and bureaucrats from institutions related to the utilization of national R&D resources. The sought information is to describe how far those government national-level organizations have developed their institutional perception, relative to conditions from the country's authoritarian era, in such a way that restricts the conducts of the officials in performing their own duties. In a more plain expression, the study aims to see how the organizations are routinely performing their institutional interests in STI policy. The interview data represents ten government R&D institutions, with four triangulation discussions. The design of the semi-structured interview questions, correspondingly, cover the *modus operandi* of the organizations' forging networking or democratic associations, that encompasses the issues of budget sharing, relevancies to the public interest, international collaboration, and so on. To maintain accuracy or to reduce the informants' personal bias, the gathered information is filtered by associating the content with more established literary theories and through additional triangulation interviews. The data then can be clustered into four types of variations of institutional perceptions regarding government's direction in STI policy, namely as (a) industrial pioneers; (b) market crowding; (c) internal think-tank;

(d) undefined (role confusion). The points of "*market crowding*" and "*undefined (role confusion)*" particularly echo the closer affinity of the institutions of their reclining the imagination of an ideal STI policy as what the autocratic leader has created. Meanwhile, the "*industrial pioneers*" reflect the perception of STI policy of government institution natively born in post-authoritarian or democratized Indonesia. Lastly, "*internal think-tank*" originates from a type of government institution that has developed a strong institutional culture. This type of thinking is also unique to the democratized era of Indonesia. This finding suggests that the democratization process of Indonesia has produced a government structure that is more prone to become a laissez-faire economy. Some government institutions grow their own distinctive perceptions towards STI policy by their having collective pessimism and the shared interest to embrace an antiquated authoritarian mindset (i.e. market crowding and undefined (role confusion) organization types).

After obtaining the study result above, it is logical to predict in today's democratized Indonesia, the variations of government's perceptions on the function of innovation have contributed to the captured weak scientific performance of an SOE. Using record data of a focus group discussion (FGD) meeting between the representatives of the Indonesian government and their SOEs, the last study section here found an interesting finding that the SOEs have a credible reason to independently work to produce new innovations for the purpose of generating profit. In the democratic era of Indonesia, SOEs are expected to contribute to the state budget (Fitriningrum, 2015). This has led them to launch independent initiatives to generate scientific knowledge for increasing revenues or reducing the operational costs. Nevertheless, such accounts cannot explain why Indonesian SOEs in Indonesia make inadequate effort to invest in

R&D? The FGD record data again illuminate important information that peculiar cognition of government institutions that see SOEs as the potential patron of their interests to do R&D commercialization. Still, we can explain that such anomaly of government thinking is deep-rooted in the authoritarian technological paradigm. This old authoritarian influence propagated vertically to the more strategic government ministries, such as the Ministry of Finance and Ministry of Planning/National Development Planning Agency (BAPPENAS). Here, the implied "old authoritarian paradigm" means the imagination of Indonesia to be a modern and independent country. This is a naïve imaginary will not bring constructive feed of the SOEs' R&D interest as the relating scientific communities operate as a global network. A scientific community in one country depends on other scientific communities in other countries.

The first policy implications of this study's findings are straightforward: governments can indeed optimize the role of SOEs as the inter-firm collaborations as Belloc (2014) theorizes (Belloc, 2014). The validation of such theory is the first theoretical contribution of this study. The second policy implication questions about the coherence of government's policy cognitions specifically in the context of countries that are not successful in improving the STI policy role of their SOEs. As the case studies here is from the subject of the democratized nation of Indonesia, such inference perhaps is more attuned to other developing countries that are intensifying their democratic principles. Future analysts may hypothesize that STI policy incoherency of various government institutions is the root cause of the governance ignorance about the potential role of SOEs in their national innovation system. Such a diagnostic mechanism is the second scientific contribution of this study along with its supplementing the theory of Belloc (2014) (Belloc, 2014). Namely, governments being undisciplined or

malevolent in nature are not the only corresponding cause of SOEs weakness in manifesting leading roles in national innovation systems. That governments' being unaware or carrying incoherent STI policy cognitions can contribute to SOEs to demonstrate weak function in the knowledge creators network. That is, the study of the broader coherence of STI policy governance is important for revealing the cause of an identified weak role of SOEs in national innovation systems.

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*Figure 3.1. Top four of all-possible investigated years of English-written articles publication accumulators*.
Source: author's calculation using Scopus data.

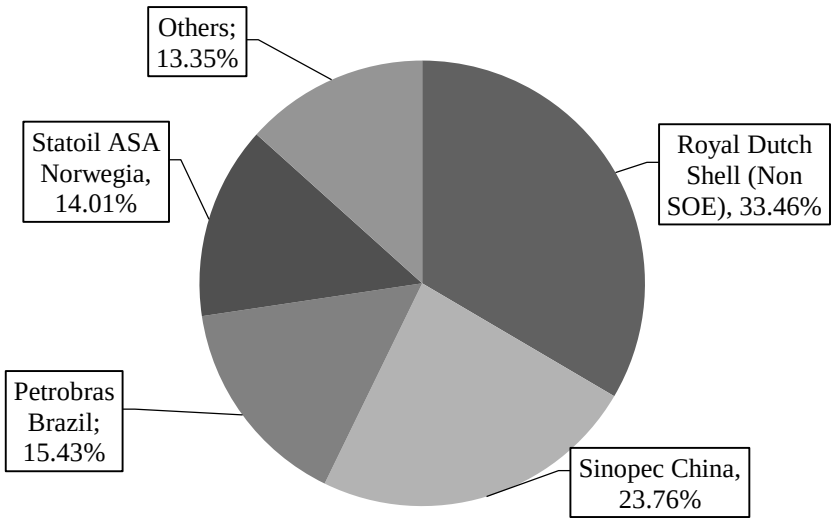


Figure 3.2. The proportion of affiliations of co-authors of article publications of Sinopec China (2012-2017).
Source: author's calculation using Scopus data.

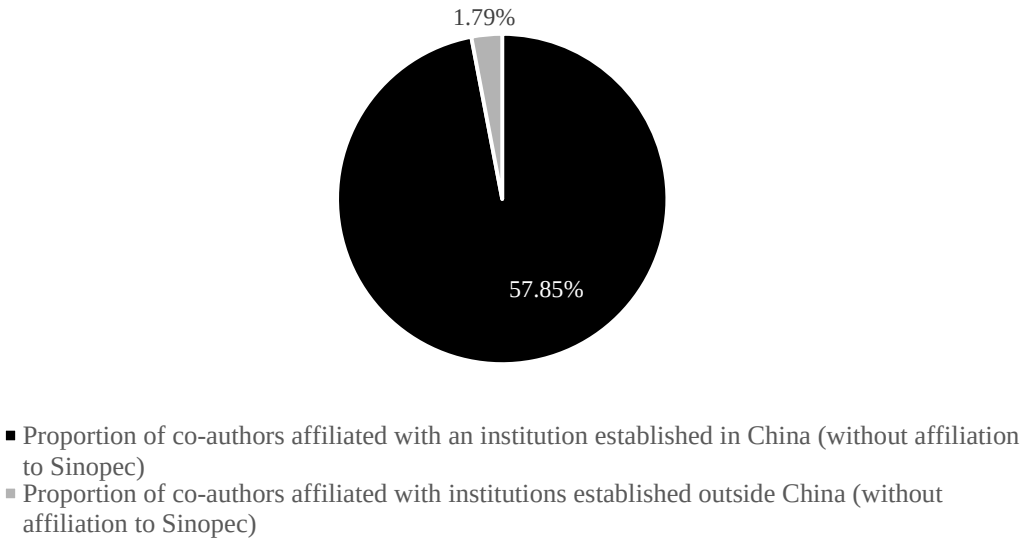

*Figure 3.3 Calculated proportion of affiliations of co-authors of article publications of Petrobras Brazil (2012-2017).*
Source: author's calculation using Scopus data.

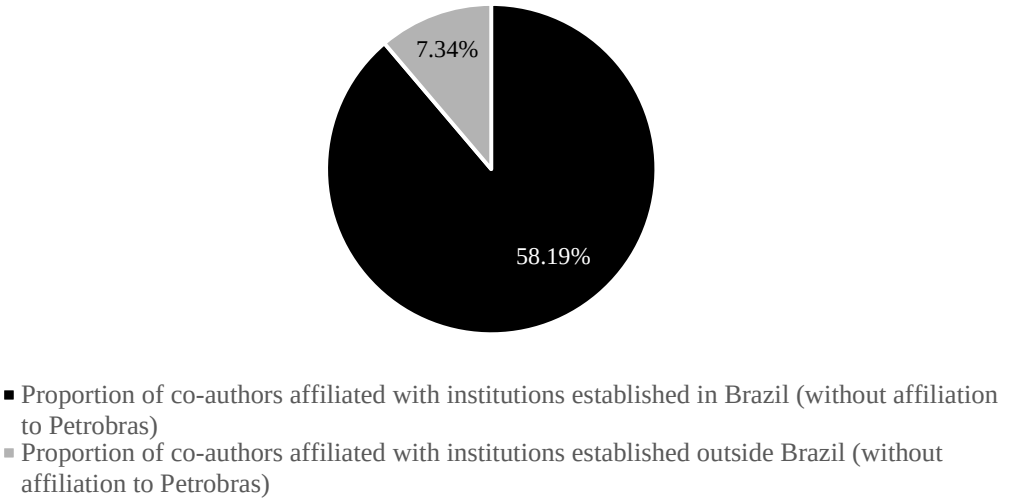


*Figure 3.4 Proportion of affiliations of co-authors of article publications of Statoil Norway (2012-2017).*
Source: author's calculation using Scopus data.

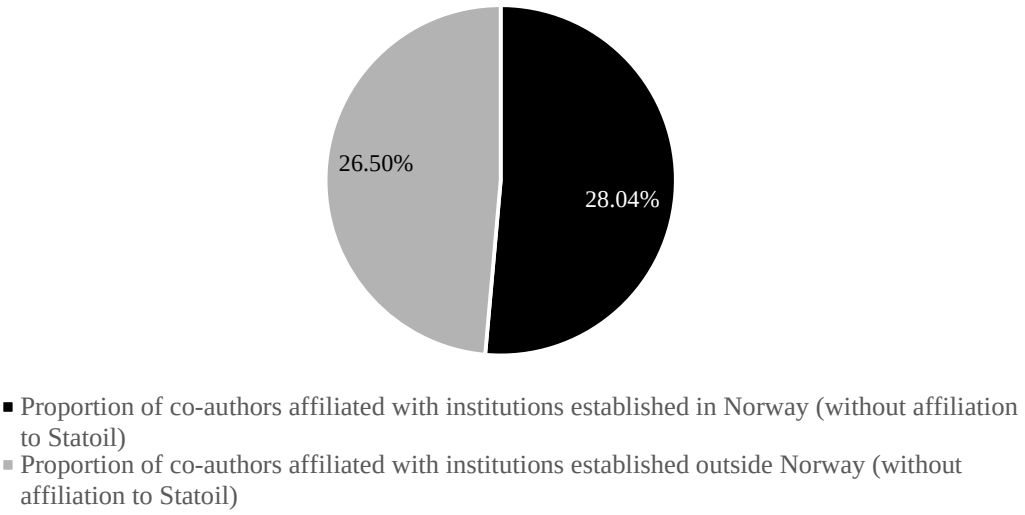

*Figure 3.5 Proportion of affiliations of co-authors of article publications of Royal Dutch Shell (2012-2017).*
Source: author's calculation using Scopus data.

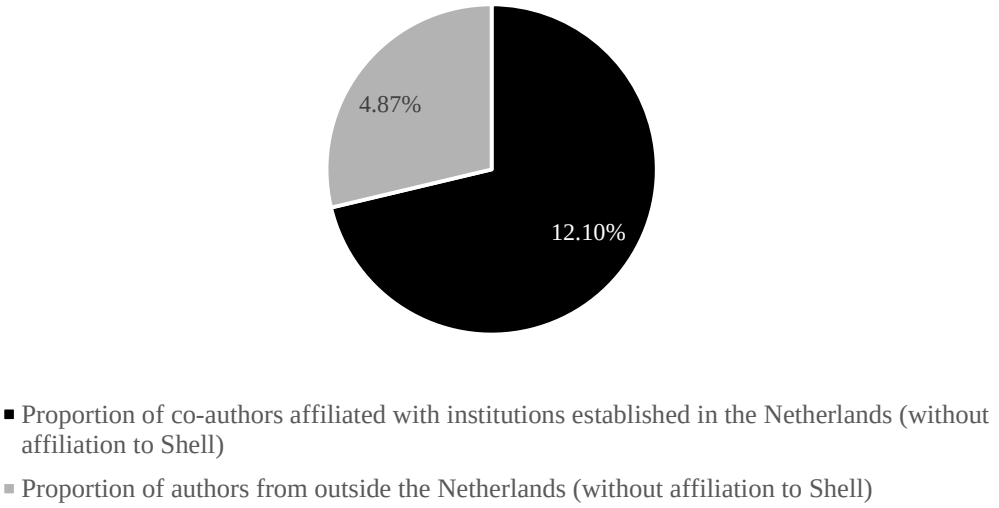

*Figure 4.1. Changing of Productivity Proportion of Internationally Scientific Publication among G20 Nations (articles written in English (Scopus data, 1998 - 2016).*

*Note:*
*From the graphic, we can infer that among G20 economies, Indonesia has the highest cost for the public to access new knowledge. For this reason, we can argue that the current system of Indonesian STI policy still needs many improvements before it can attain similar levels that other G20 countries have achieved.*

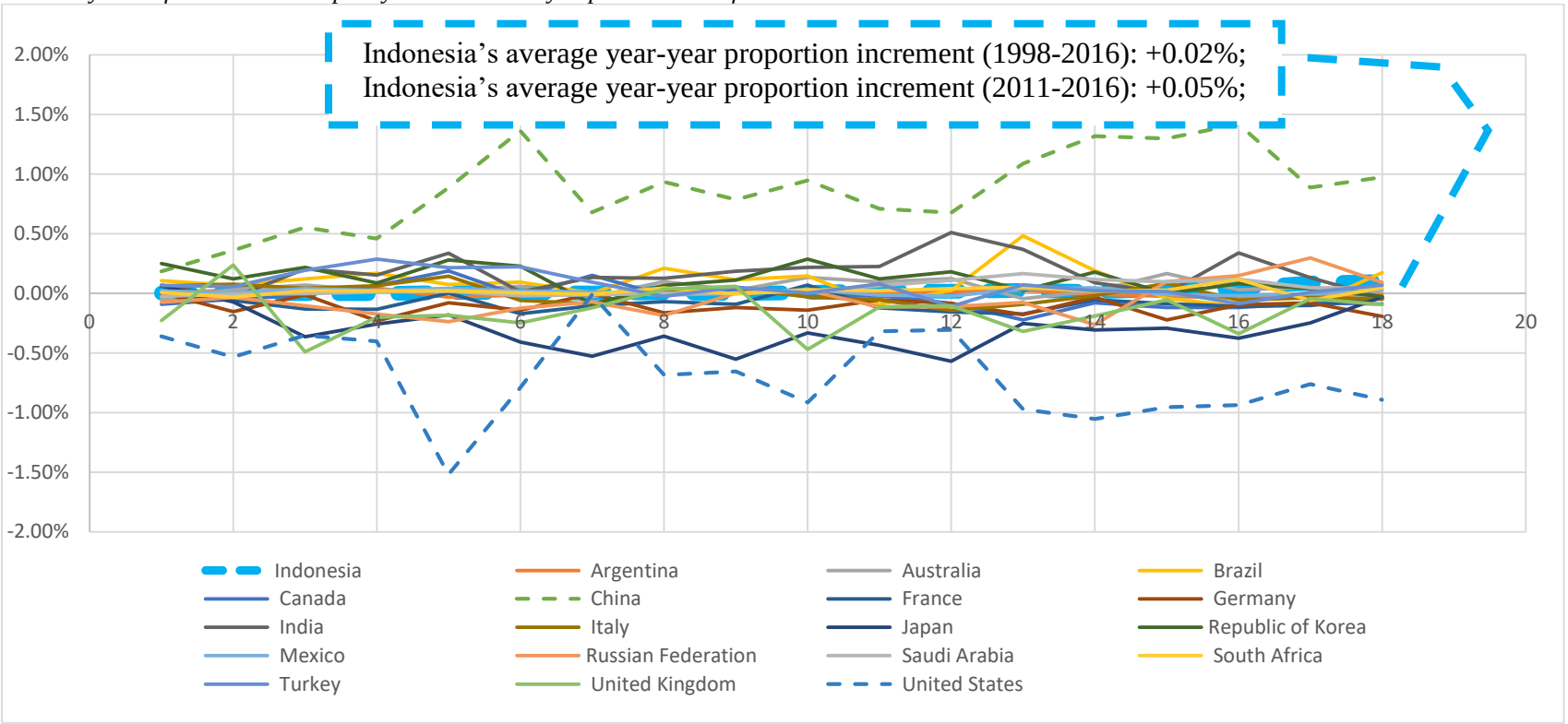

*Figure 4.2. Process of Identification of Elements of "Social Facts"*

This flow chart explains of the research identify how an element of a "social fact" is characterized from the interview data

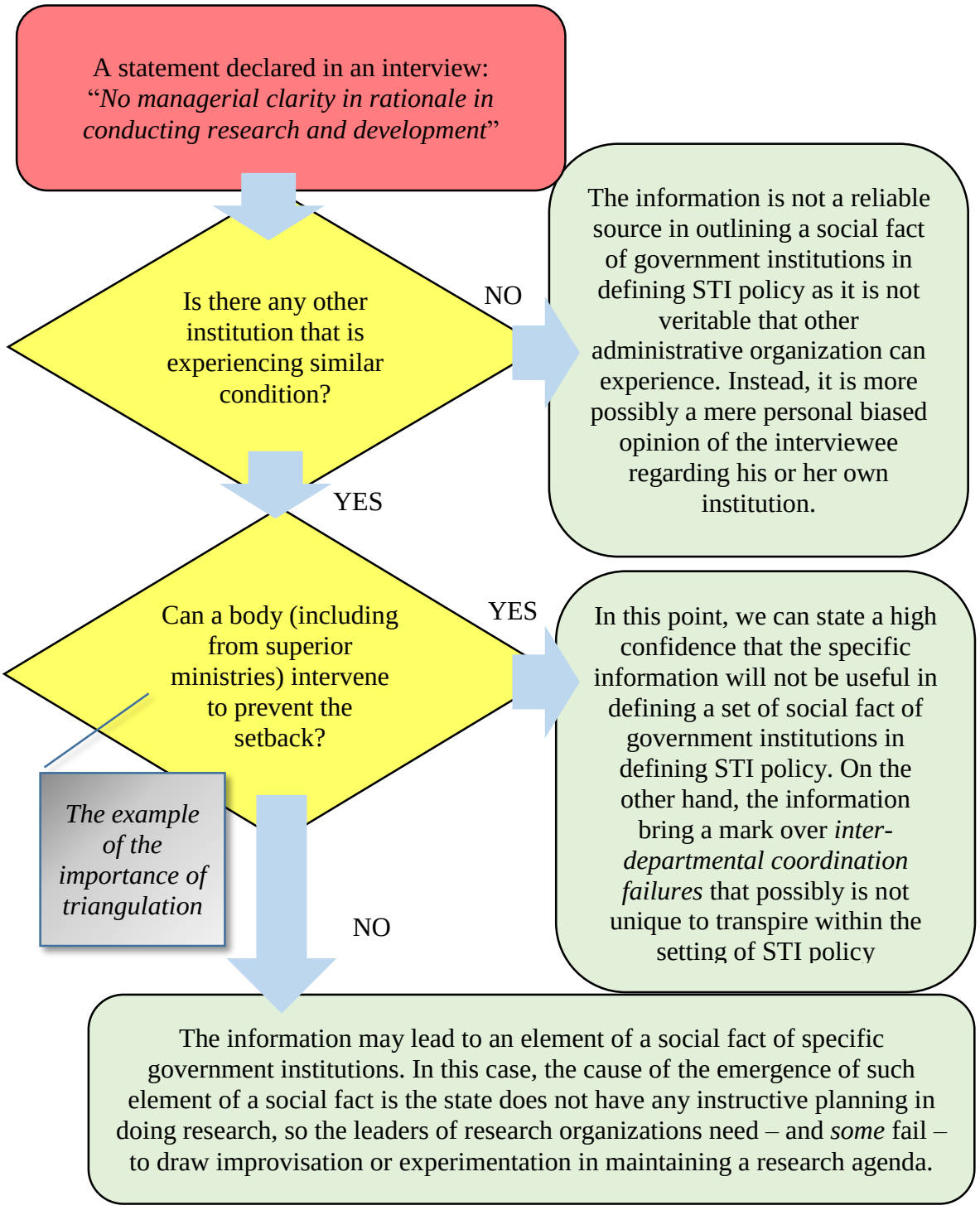

*Figure 4.3. Proposed model of the actual or latent causal model of the current social organization of the governance of Indonesian STI policy*

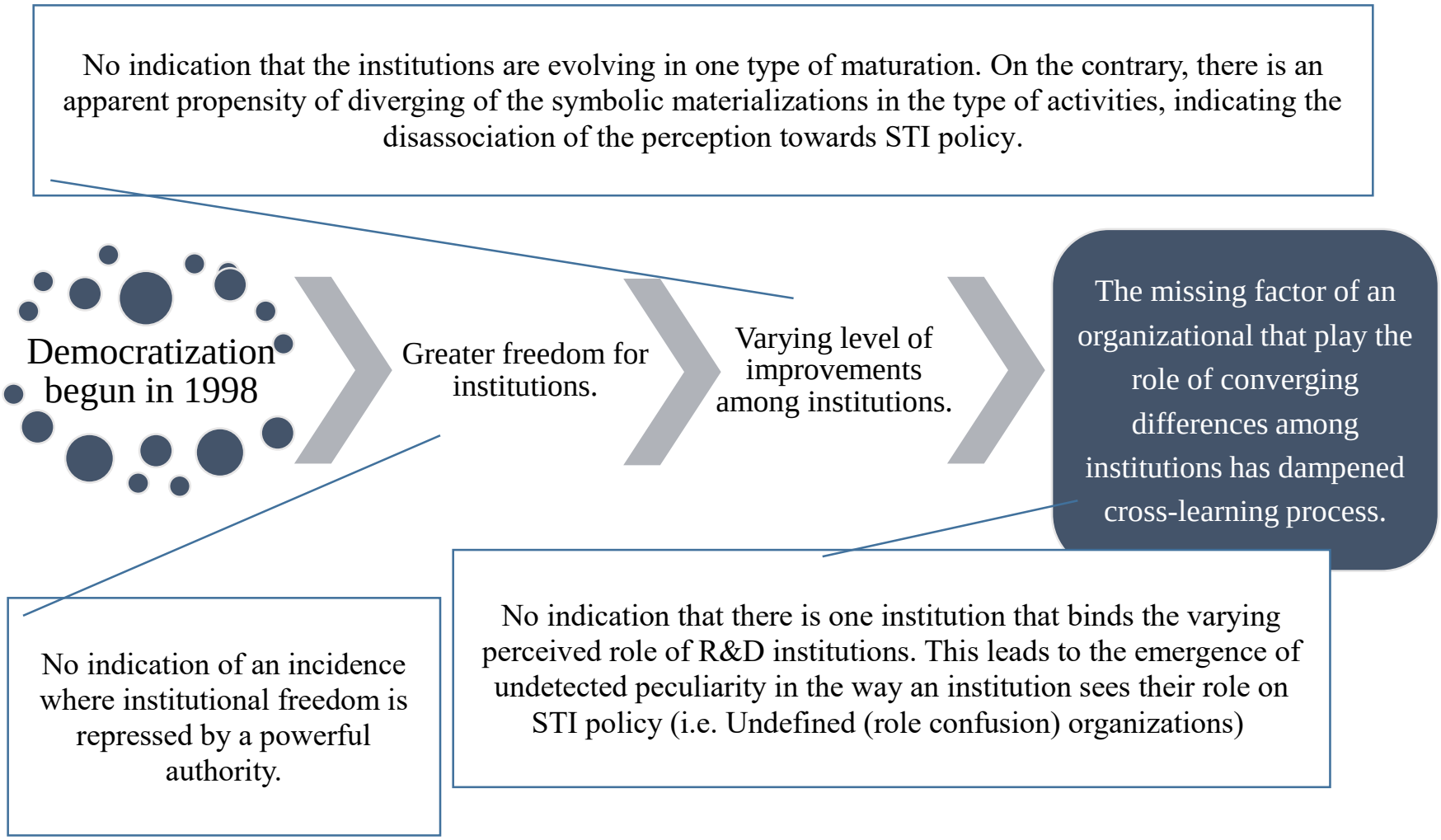

*Figure 5.1. The flow or relationship between the principal and the SOEs of the participating organizations in the FGD event of Ristekdikti (July 24, 2018).*

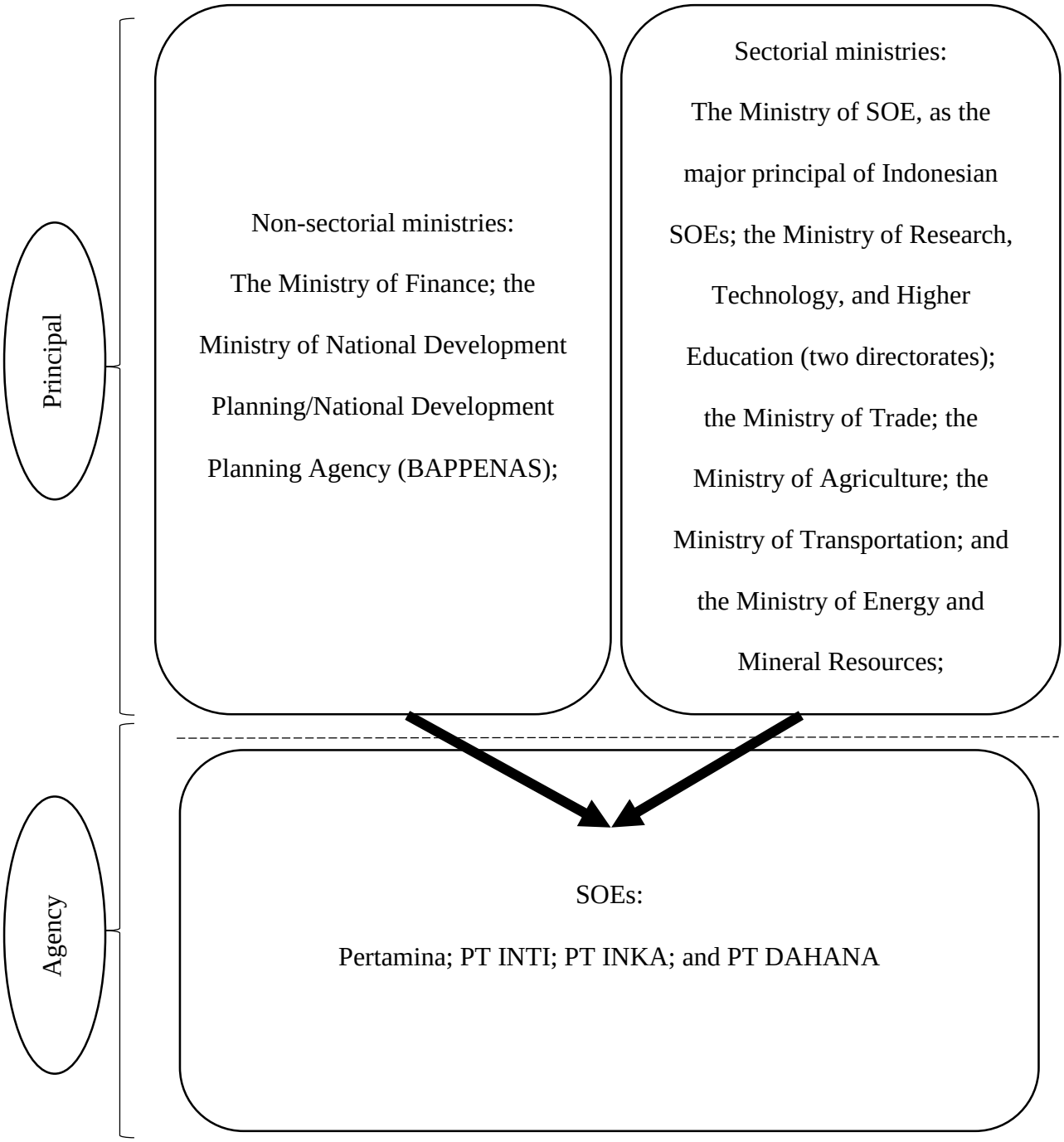

Table 3.1

*Simple Count of Articles Published in English*

| No. | Firm | No. of articles | Percentage |
|---|---|---|---|
| 1 | Royal Dutch Shell (POE), Scopus Institution Code (SIC): 60030496 | 4678 | 33.46% |
| 2 | Sinopec China – SIC: 60021623 | 3322 | 23.76% |
| 3 | Petrobras Brazil – SIC: 60006171 | 2157 | 15.43% |
| 4 | Statoil ASA Norway- SIC: 60083053 | 1959 | 14.01% |
| 5 | China National Petroleum China – SIC: 60004598 | 722 | 5.16% |
| 6 | Petronas Malaysia – SIC: 60007119 | 435 | 3.11% |
| 7 | Indian Oil India – SIC: 60030411 | 379 | 2.71% |
| 8 | PTT Thailand – SIC: 60015778 | 183 | 1.31% |
| 9 | Bharat Petroleum India – SIC: 60000310 | 77 | 0.55% |
| 10 | Pertamina Indonesia – SIC: 60070443 | 39 | 0.28% |
| 11 | Hindustan Petroleum India – SIC 60009693 | 31 | 0.22% |
| | Total | 13982 | 100% |

*Note:* The author compiled the data for this study using the Scopus database.

Table 3.2

*Rank in the Growth Rate Of Publication Intensity Of All Counted Years*

| No. | Firm | Growth rate |
|---|---|---|
| 1 | China National Petroleum China** | 17.91% |
| 2 | Royal Dutch Shell (Non-SOE) * | 13.33% |
| 3 | Petronas Malaysia** | 12.69% |
| 4 | Petrobras Brazil* | 10.30% |
| 5 | Statoil ASA Norway* | 10.20% |
| 6 | Sinopec China* | 9.06% |
| 7 | PTT Thailand** | 4.16% |
| 8 | Bharat Petroleum India** | 0.20% |
| 9 | Indian Oil India** | -0.06% |
| 10 | Pertamina Indonesia** | -2.07% |
| 11 | Hindustan Petroleum India** | -11.44% |

*Note:*

1) * Top four of all-years article accumulators (see Figure 3.1);
2) ** Minority of all-years article accumulators (see Table 3.1);
3) The author compiled the data for this study using the Scopus database.

Table 3.3

*Rank in the Growth Rate Of Publication Intensity Of 2007-2017*

| No. | Firm | Growth rate |
|---|---|---|
| 1 | Statoil ASA Norway* | 31.55% |
| 2 | Bharat Petroleum India** | 30.35% |
| 3 | Pertamina Indonesia** | 29.09% |
| 4 | PTT Thailand** | 23.83% |
| 5 | Petronas Malaysia** | 20.67% |
| 6 | Sinopec China* | 20.28% |
| 7 | China National Petroleum China* | 17.76% |
| 8 | Indian Oil India* | 14.96% |
| 9 | Petrobras Brazil* | 8.17% |
| 10 | Royal Dutch Shell (Non-SOE)* | 3.59% |
| 11 | Hindustan Petroleum India** | -35.91% |

*Note:*

4) * Top four of all-years article accumulators (see Figure 1);
5) ** Minority of all-years article accumulators (*see* Table 1);
6) The author compiled the data for this study using the Scopus database.

Table 3.4

*A portion of the Accumulated institutional affiliation variation of the authors English-written articles that involved with writers from Sinopec (2000)*

| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|
| Internal (including subsidiary companies) | Domestic universities or research organizations within domestic universities | National think thanks | Other Chinese SOEs | Regional think thank | Foreign universities or research organizations within foreign universities | Foreign research organization (including privately-owned research organizations/consultants) |
| 69.32% | 14.77% | 2.27% | 1.14% | 1.14% | 2.27% | 1.14% |

*Note:*

7) Number of authorship: 88 (domestic-affiliated: 88.64%; foreign-affiliated: 3.41%);
8) The author compiled the data for this study using the Scopus database.

Table 3.5

*A portion of the Accumulated institutional affiliation variation of the authors English-written articles that involved with writers from Sinopec (2017)*

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Internal (including subsidiary companies) | Domestic universities or research organizations within domestic universities | National think thanks | Organizations affiliated with the Chinese government ministries | R&D Organization of national-level government | Other Chinese SOEs | Regional think thank | R&D organization of regional-level governments | POEs (including subsidiary companies of other SOEs) | Foreign universities or research organizations within foreign universities | Foreign research organization | Foreign POEs (including privately-owned research organization and consultant) |
| 37.77% | 34.33% | 5.00% | 5.00% | 2.73% | 2.92% | 1.36% | 0.45% | 5.00% | 4.74% | 0.39% | 0.32% |

*Note:*

9) Number of authorship: 1541 (domestic-affiliated: 94.55%; foreign-affiliated: 5.45%);
10) The author compiled the data for this study using the Scopus database.

Table 3.6

*A portion of the Accumulated institutional affiliation variation of the authors English-written articles that involved with writers from Petrobras (1994)*

| (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|
| Internal (including subsidiary companies) | Domestic universities or research organizations within domestic universities | R&D organization of national-level government | Foreign universities or research organizations within foreign universities | Foreign Research organization | Foreign POEs (including privately-owned research organization and consultant) |
| 38.10% | 30.95% | 7.14% | 9.52% | 2.38% | 11.90% |

*Note:*

11) Number of authorship: 42 (domestic-affiliated: 76.19%; foreign-affiliated: 23.81% );
12) The author compiled the data for this study using the Scopus database.

Table 3.7

*A portion of the Accumulated institutional affiliation variation of the authors English-written articles that involved with writers from Petrobras (2017)*

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Internal (including subsidiary companies) | Domestic universities or research organizations within domestic universities | Domestic research consortium | Domestic military institutions | Central Bank of Brazil | R&D organization of national-level government | Other Brazilian SOEs | R&D organization of regional-level governments | Domestic POEs (including consul-ting privately-owned firms and subsidiary companies of other SOEs) | Foreign research organization | Foreign universities or research organizations within foreign universities | Foreign government institutions | Foreign research consortium | Foreign POEs (including privately-owned research organization and consultant) |
| 32.39% | 45.08% | 0.19% | 0.19% | 0.19% | 2.46% | 0.57% | 0.19% | 0.76% | 3.60% | 12.88% | 0.57% | 0.38% | 0.57% |

*Note:*

13) Number of authorship: 528 (domestic-affiliated: 82.20%; foreign-affiliated: 17.80%);

14) The author compiled the data for this study using the Scopus database.

Table 3.8

*A portion of the Accumulated institutional affiliation variation of the authors English-written articles that involved with writers from Statoil ASA (1994)*

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|
| Internal (including subsidiary companies) | Domestic universities or research organizations within domestic universities | Organizations affiliated with Norwegian government ministries | Domestic POEs (including privately-owned consulting firms and subsidiary companies of other SOEs) | Foreign universities or research organizations within foreign universities | Foreign research organization | Foreign POEs | Unidentified by Scopus |
| 60.53% | 15.79% | 2.63% | 5.26% | 5.26% | 5.26% | 2.63% | 2.63% |

*Note:*

15) Number of authorship: 38 (domestic-affiliated: 84.21%; foreign-affiliated: 13.16%);
16) The author compiled the data for this study using the Scopus database.

Table 3.9

*A portion of the Accumulated institutional affiliation variation of the authors English-written articles that involved with writers from Statoil ASA (2017)*

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| Internal (including subsidiary companies) | Domestic universities or research organizations within domestic universities | Domestic research collaboration entity | Organizations affiliated with Norway government ministries | Domestic Professional Community Association | Domestic POEs (including privately-owned consulting firms and subsidiary companies of other SOEs) | Foreign universities or research organizations within foreign universities | Collaborative research organization with foreign entities | Foreign research organization | Foreign government institutions | Foreign POEs (including privately-owned research organization and consultant) |
| 30.46% | 17.55% | 0.66% | 0.33% | 0.99% | 5.30% | 25.83% | 0.66% | 5.63% | 0.33% | 12.25% |

*Note:*

17) Number of authorship: 302 (domestic-affiliated: 55.30%; foreign-affiliated: 44.70%);
18) The author compiled the data for this study using the Scopus database.

Table 3.10

*A portion of the Accumulated institutional affiliation variation of the authors English-written articles that involved with writers from Shell (2007)*

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Internal (including the operational office of Shell outside the Nether-lands and research centers of Shell) | Dutch universities or research organizations within Dutch universities | Dutch research centers | Dutch POEs (including Child Companies of Shell/Joint Ventures with Other Companies) | Dutch universities | Non-Dutch research centers | Non-Dutch universities or research organizations within non-Dutch universities | Non-Dutch POEs (including privately-owned consulting firms, R&D center of non-Dutch POEs, and subsidiary companies of non-Dutch SOEs) | Non-Dutch Government institutions | Non-Dutch SOEs | Multinational industrial associations | International Organization | Unidentifiable |
| 44.98% | 6.80% | 0.97% | 0.65% | 3.56% | 8.09% | 19.09% | 12.30% | 2.27% | 0.32% | 0.32% | 0.32% | 0.32% |

*Note:*

19) Number of authorship: 309 (Dutch-affiliated, including Shell: 56.96%; Non-Dutch-affiliated: 42.72%);

20) The author compiled the data for this study using the Scopus database.

Table 3.11

*A portion of the Accumulated institutional affiliation variation of the authors English-written articles that involved with writers from Shell (2017)*

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| Internal (including the operational office of Shell outside the Nether-lands and research centers of Shell) | Dutch universities or research organizations within Dutch universities | Dutch research centers | Dutch POEs (including Child Companies of Shell/Joint Ventures with Other Companies) | Non-Dutch research centers | Non-Dutch universities or research organizations within non-Dutch universities | Non-Dutch POEs (including privately-owned consulting firms, R&D center of non-Dutch POEs, and subsidiary companies of non-Dutch SOEs) | Non-Dutch Government institutions | Non-Dutch SOEs | Non-Dutch NGOs | Multinational Industry Association |
| 40.00% | 9.72% | 2.22% | 1.67% | 6.39% | 29.17% | 8.06% | 1.39% | 0.28% | 0.28% | 0.83% |

*Note:*

21) Number of authorship: 360 (Dutch-affiliated, including Shell: 53.61%; Non-Dutch-affiliated: 46.39% );

22) The author compiled the data for this study using the Scopus database.

Table 4.1

*Proportion of the intensity of scientific publication written in English that mentioned about "battery" (the world vs. Indonesia), Scopus data (2013-2016)*

| | Year | | | | |
|---|---|---|---|---|---|
| | 2012 | 2013 | 2014 | 2015 | 2016 |
| Total number of publication (worldwide). | 16,457 | 19,358 | 22,999 | 24,847 | 26,629 |
| Portion of publications that involved authors affiliated with an institution having an address in Indonesia. | 0.19% | 0.24% | 0.25% | 0.22% | 0.45% |

*Note* : the data was retrieved using Scopus database. The search categorization was made by utilizing the word "*battery* " within "titles, keywords and abstract", "*English* " as the language. In the spanning year of 2013-2016, the country that host most authors' affiliation by average occupies 20.6% of number of proportion.

Table 4.2.

*Indonesian central government spending in research (not to be confused with government budget in research)*

| | Year | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | The Era of President Joko Widodo | |
| | | | | | | | | | 2015 | 2016 |
| Spending of research funding (in Indonesian billion Rupiah) | 1,543.4 | 1,431.7 | 1,241.7 | 1,580.5 | 2,797 | 2,300.5 | 2,553.9 | 2,618.3 | 9,889.5 | 21,590.2 |
| Total central government expenditure (in Indonesian billion Rupiah) | 504,623.4 | 693,356 | 628,812.4 | 697,406.4 | 883,721.9 | 1,069,535 | 1,154,381 | 1,249,943 | 1,994,888 | 1,734,500 |
| Proportion of research spending to total central government expenditure | 0.31% | 0.21% | 0.20% | 0.23% | 0.32% | 0.22% | 0.22% | 0.21% | 1.6% | 3.34% |

*Note*:

1. The data is taken from the Ministry of Finance (2013, 2014, 2015, 2016) (Indonesian Ministry of Finance, 2013; Indonesian Ministry of Finance, 2014; Indonesian Ministry of Finance, 2015; Indonesian Ministry of Finance, 2016);
2. The calculated items are the ones that literally mentioned "*penelitian*" (or "*research*" in English) on the ground that it represents state's account over the budget appropriation of the declared national activities across sectors concerning to scientific research;
3. Not all recipient organization declared the funding allocation as simply "*research and development*", some state the nomenclature with additional terms or phrases, such as "*mitigation and services*" and "*education-training*". The variances imply there are heterogeneous perceptions towards "research" activities among Indonesian national-level government institutions.

Table 4.3.

*Variety of Interpretations of Government Institutional Role in STI Policy*

| Elements of social fact | Category of Collective Consciousness Regarding Their Institutional Role in STI Policy | | | |
|---|---|---|---|---|
| | Industrial Pioneers | Market Crowding | Internal Think-tank | Undefined (role confusion) |
| Orientation to the market (i.e. the public) | Argue that the existing market does not supply essential goods that the public need (respective to their sector), thus they must address market failure | Argue that government research can or should be able to bring superior goods and services that already exist in the market, hence they actively become an additional market actor | Their subjective paradigm on "innovation" the market needs depend mainly on the definition of the patron institution | They are designed to see their specific government role in the market. It is *possible*, their main role to be transformed from doing R&D to providing educational training |
| Orientation to collaboration | Collaboration is important, namely to create more substantial support from external parties' supports (e.g. funding, collaboration with universities) and internal divisions (other working units) | Collaboration is part of work, be it with internal and external parties. | To collaborate internally with other working units is the main task – a collaboration with the external party is for the purpose of fulfilling partnership with other internal units | Collaboration is unmanageable namely because the hired younger staffs have very low qualifications and/or owning less interest in scientific research |
| Working agenda (source of the main pointer to the mid-long terms directions) | The law/regulation is deliberately developed as main direction or guide of the criterion of institutional success (substantive rationality) | The leader's order (formal rationality) | The routine of the institution (a combination of formal rationality-substantive rationality) | The leader's order (formal rationality) |

| Elements of social fact | Category of Collective Consciousness Regarding Their Institutional Role in STI Policy | | | |
|---|---|---|---|---|
| | Industrial Pioneers | Market Crowding | Internal Think-tank | Undefined (role confusion) |
| Special condition | (Re) established after 1998 (the year when Indonesian democratization commenced) | Established before 1998 | The organization owns a very strong definition regarding its reflective public role | Established before 1998, and *actually* enjoyed greater academic freedom during Suharto era |