THE ROLE OF LOCAL GOVERNMENT IN IMPROVING REGIONAL INNOVATION CAPABILITY: A CRITICAL LITERATURE REVIEW IN THE CONTEXT OF THE ASIAN REGION

Peran Pemerintah Daerah Dalam Meningkatkan Kapabilitas Inovasi Daerah: Tinjauan Literatur Kritis Dalam Konteks Wilayah Asia

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Abstract

This literature review explores the role of local governments in enhancing local innovation capabilities in the context of Asian regions, and specifically identifies the challenges local governments face in this endeavor, as well as solutions to overcome these challenges. Using a systematic literature review approach, this study critiques selected articles that are highly dominated by studies in China in addition to Taiwan and South Korea. Over the past decade, studies on this topic have continued to emerge and be published in high quality publication sources. The results of the critical review of the selected articles show that the main role and challenge of local government in enhancing local innovation capability is highly dependent on the ability to manage various innovation resources. To overcome these challenges, local governments are encouraged to promote cooperation and collaboration with key stakeholders in the regional innovation system, namely universities and industry. This paper contributes to the growing literature on regional innovation policy and motivates the practice of place-based innovation policy in the context of Asian regions. Future research directions are encouraged to focus on a broader range of Asian regions or on specific innovation contexts that reflect the characteristics of Asian regions.
Keywords: Local government; Regional innovation; Capability; Collaboration; Asia region

Abstrak

Literatur ini mengeksplorasi peran pemerintah daerah dalam meningkatkan kemampuan inovasi daerah dalam konteks regional Asia, dan secara khusus mengidentifikasi tantangan yang dihadapi pemerintah daerah dalam upaya ini, serta solusi untuk mengatasi tantangan tersebut. Dengan menggunakan pendekatan tinjauan literatur sistematis, studi ini mengkritisi artikel-artikel terpilih yang sangat didominasi oleh studi di Cina selain Taiwan dan Korea Selatan. Selama satu dekade terakhir, studi tentang topik ini terus berlanjut dan dipublikasikan di sumber-sumber publikasi yang berkualitas. Hasil tinjauan kritis terhadap artikel-artikel terpilih menunjukkan bahwa peran dan tantangan utama pemerintah daerah dalam meningkatkan kapabilitas inovasi daerah sangat bergantung pada kemampuan dalam mengelola berbagai sumber daya inovasi. Untuk mengatasi tantangan tersebut, pemerintah daerah didorong untuk meningkatkan kerja sama dan kolaborasi dengan para pemangku kepentingan utama dalam sistem inovasi daerah, yaitu perguruan tinggi dan industri. Penelitian ini berkontribusi pada literatur yang berkembang mengenai kebijakan inovasi daerah dan memotivasi praktik kebijakan inovasi berbasis tempat dalam konteks regional Asia. Arah penelitian di masa depan didorong untuk fokus pada negara-negara di kawasan Asia yang lebih luas atau pada konteks inovasi spesifik yang mencerminkan karakteristik kawasan Asia.
***Kata kunci**: Pemerintah daerah; Inovasi daerah; Kapabilitas; Kolaborasi; Wilayah Asia*

1. INTRODUCTION

Innovation-driven regional development has become a key focus for countries around the world, including Asia, as a way to enhance global competitiveness and improve quality of life and well-being (Malecki, 2017; Yoon, 2019). The development of technology and innovation in most developing countries in Asia shows significant progress across multiple dimensions at both the country and regional levels (Matthess & Kunkel, 2020; S. Wang et al., 2022). According to the Global Innovation Index (GII), there are at least four countries in Asia that are among the most innovative in the world: South Korea, Singapore, China, and Japan (Dutta et al., 2022; Huarng & Yu, 2022). Proxies for this level of innovation vary and include R&D investment, knowledge production (e.g., scientific publications and patents), and university-industry collaboration.

The conditions and development of innovation and technology in Asia vary widely, especially concerning the regional characteristics, the level of basic technology, and complex socio-economic issues (Litsareva, 2017; G. Liu et al., 2017). The growing literature on innovation and technological development in the context of the Asian region suggests that technological development and innovation in the region significantly affect growth and other socio-economic conditions, such as the quality of human capital and the workforce. On the one hand, these studies ultimately emphasize the importance of the role of government in supporting and optimizing resource management for regional innovation and enhancing regional innovation capabilities through cooperation and collaboration with various stakeholders. On the other hand, only a few studies specifically explore the role of government in enhancing regional innovation capabilities, the challenges and barriers faced in carrying out this role, and the recommended solutions to overcome these challenges.

Despite the fragmented nature of empirical studies on regional innovation in the Asian region, the recommendations from these studies frequently relate to the role of the government and the encouragement of cooperation and collaboration to enhance regional innovation. In the context of regional innovation in China, Y. Zhao & Song (2018) show that the success of innovation in driving economic growth and improving the quality of human resources is inseparable from financial support from the government through R&D investment. In the same regional

context, Gong (2021) find that the management of R&D subsidies and the appropriate allocation of knowledge and technology inputs greatly influence the effectiveness of regional innovation management. However, this is highly dependent on the basic technological level of the region, as well as the public communication process related to innovation-based development. Yoo & Kwak (2016) investigated the factors that can promote open innovation in SMEs in South Korea and classified 16 regions in South Korea based on regional innovation levels. The results showed the role of industrial agglomeration policies, which can facilitate the process of knowledge and technology transfer, as a key driver of open innovation. In summary, the results of this study show that, given the various factors and impacts of regional innovation policies, the success of local governments in achieving their desired innovation goals cannot be separated from the involvement of other stakeholders such as universities and industry. Developing evidence-based regional innovation policies can help to produce policies that are proportionate between theory and practice. However, since each country's case is different from the other, a systematic representation is needed to understand how the government becomes the main actor or takes an intermediary role in the regional innovation system.

Against this background, this paper aims to fill a gap in the literature that has not systematically presented empirical evidence on these issues. The author investigates, specifically in the Asian context, how governments play a role in improving regional innovation, the challenges that arise in this endeavor, and the solutions that can overcome these challenges. Utilizing a systematic literature review protocol, it critically presents study findings from selected articles to address these issues.

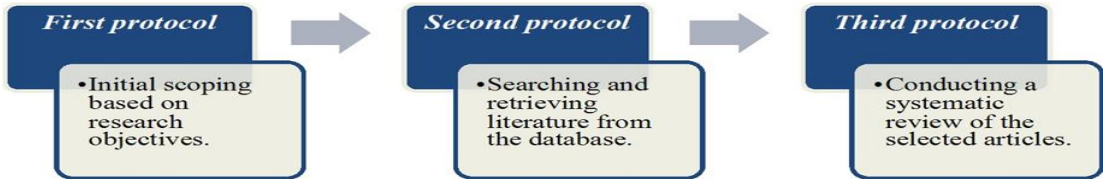
This study is expected to contribute practically to the implementation of regional innovation policies that encourage local governments to enhance innovation collaboration with other stakeholders. Some limitations of the selected articles and the synthesis of this review are expected to provide direction for future research on related topics.

This paper is organized as follows. The next section outlines the systematic literature review method used in this study. The third section is the main part of the literature review, where the selected articles are grouped and described based on their characteristics, then the main findings

of the articles are examined and criticized to produce a synthesis of findings to answer the research problem. The fourth section presents the conclusions, limitations and suggestions for future research.

2. METHODOLOGY

The critical review in this paper follows the systematic literature review protocol of Wibisono (2023) which applies a three-stage process in selecting and reviewing the selected articles. As shown in **Figure 1**, the protocol includes: scoping and initial literature search in the database, searching and selecting the most relevant articles, and critically reviewing the selected articles. In addition, this paper also draws on several methodologies from previous studies that used a systematic literature review approach to conduct a critical literature review in innovation and related studies and synthesized the critical points reviewed from the selected articles (*i.e.,* Hughes et al. (2018); Martínez-Vergara & Valls-Pasola (2021); Shin et al. (2015).



Source: Wibisono (2023).

Figure 1. Research protocol.

In the first protocol, a scoping or literature search was conducted using the PICOC framework (population, intervention, comparison, outcomes, context). This framework is used to guide the identification of articles according to the chosen main topic, that is, regional innovation The population (P) of this study consists of scientific papers on regional innovation published in reputable international journals that have a regional context (C) in Asian countries. The intervention (I) referred to in this framework is the role or participation of local governments in the Regional Innovation System (RIS). The author compares (C) the critical contents explored from the selected papers with each other, especially on the emphasis point of local government capability in RIS. The expected outcome (O) of this review is the identification of important points of current research findings related to the role of local governments in efforts to improve regional innovation capabilities, what are the challenges, and how to overcome these

challenges. The results of this study are expected to reflect current research on this topic as well as future research opportunities.

In the second protocol, article searches were conducted in the Web of Science database. This database was chosen because Web of Science is a highly selective international journal indexer (Martín-Martín et al., 2018; Singh et al., 2021). Journals indexed in Web of Science are journals that have conducted a quality peer review process and apply strict rules in the article publication process to increase their scientific impact. When searching for literature in the database, the author applied the use and combination of several main keywords related to the items in the PICOC framework that must be included in the abstract section of the article, namely (local OR regional) AND government AND "regional innovation" AND capab*. The use of the words "local OR regional" was intended to capture all articles that used two different terms but in the same context, namely local government or regional government. The use of the term "regional innovation" with quotation marks is intended to include only these terms in the article search without separating the terms regional and innovation. The use of an asterisk (*) in capab* is intended to allow terms that have the same meaning but are spelled differently (i.e., capability, capabilities, capable, etc.) to be included in the search process.

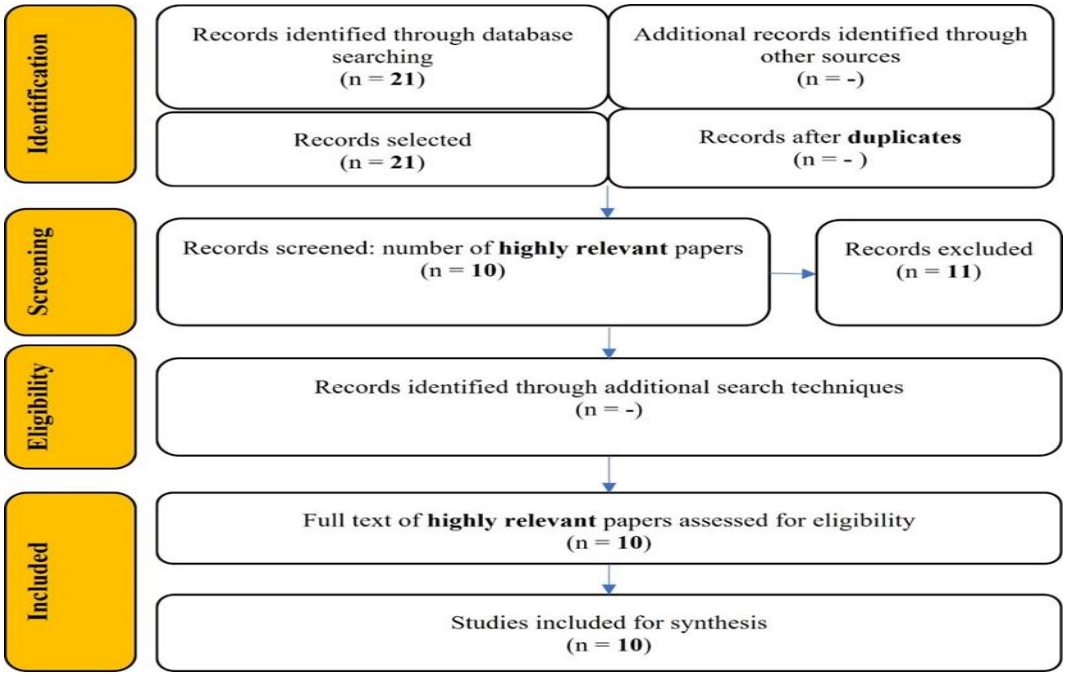
In this second protocol, there were also some restrictions on the exclusion criteria (excluding criteria) and inclusion criteria (including criteria). The first restriction was the year of publication of the articles, namely articles published between 2013 and 2023 and all articles written in English. The type of published document was limited to research articles and review articles, including early access, and excluded articles published as proceedings and book reviews. The authors limited the context of the articles to regions in Asian countries and excluded articles that did not fall within this context.

At this stage, there were 21 articles that met the above criteria and limitations and were potentially relevant to the research objectives. The next step was to pre-screen the articles by carefully reading the content of the abstract, which contained terminology consistent with the PICOC framework. The abstract of an article is a part that can represent the important points of the entire article, so the abstract whose content is in accordance with the article selection criteria and the current

research objectives is considered the most relevant article or can be designated as the final/selected article. Of the 21 articles, there were eleven articles that were not directly related to the research objectives, the PICOC scoping framework, and the desired research context. The articles generally discussed innovation at the micro level of manufacturing firms, examined the characteristics of regional innovation networks without discussing the role of government, the support of government R&D subsidies for regional entrepreneurial growth, the relationship between regional innovation and demographic structure, and the context of regional innovation related to the green finance system. These eleven articles were excluded from the list of potentially relevant articles, leaving only the ten most relevant articles for further analysis at the end of the selection process. The flow of screening articles from initial scoping to selection of the most relevant articles is summarized in the PRISMA flow diagram in Figure 2.

In the third protocol, the ten selected articles were systematically reviewed according to these three steps. The selected articles were described according to specific categories in the first subsection of the critical literature review. In the initial scoping process through the Web of Science database, the author identified several years in the set period (2013-2023) where no articles were published according to the current research design in 2013, 2015, 2017, and 2020, so the graph of research development on this topic from year to year is not shown. From the country/region selection criteria, there were only three Asian countries that published relevant studies, namely China, Korea, and Taiwan. Furthermore, this category is described in the description section of the selected articles.

The next description is the grouping of the articles based on the source and quality of the journal publications represented by the journal ranking category according to Scimago Journal & Country Rank (SJR 2022). The main content of the selected articles is explored by focusing on three general and three specific questions as listed in Table 1. All answers to these questions include critical points of each article, which are elaborated in the second subsection. In the third subsection, the results of this critical review are further discussed and elaborated in light of the growing literature on regional innovation and other relevant literature in both Asian and non-Asian contexts.



Source: authors' elaboration (de Barcelos Silva et al., 2020; Page et al., 2021).

Figure 2. PRISMA flow diagram.

Table 1. List of questions to explore the content of the article

No.	General questions	Specific questions
1	What is the purpose of this study?	What is the role of local government in enhancing regional innovation capability and what factors can influence it?
2	What is the research methodology used?	What are the challenges that local governments face in enhancing regional innovation capability?
3	What are the main contributions or key findings of the study?	How can these challenges be addressed?

Source: authors' elaboration.

3. CRITICAL LITERATURE REVIEW

3.1. Distribution and Characteristics of the Selected Articles

The selected articles, limited to the context of Asian studies, show that only three Asian countries have published studies on the role and capabilities of government in the context of regional innovation. As shown in **Table 2**, China is the country that has published the most studies on this topic (eight articles), followed by Taiwan and Korea with one article each. This suggests that related studies have developed in these three countries, but not in other Asian countries. Furthermore, from the restriction of research years 2013-2022, research on related topics has been consistently conducted and increased in 2019, 2021, and 2022

(**Table 3**). This indicates that the research topics covered in the current study are experiencing positive developments and have the opportunity to be developed in studies in the following years.

Table 4 presents the source of article publication, publisher, number of articles, and quality of journal publication based on the Scimago 2022 journal ranking. Among the 10 selected articles, four articles were published in journals categorized in the first quartile (Q1) of the scientific categories Management of Technology and Innovation, Multidisciplinary, and Social Sciences. Meanwhile, the other six articles were published in journals categorized in the second quartile (Q2) in the subject categories of Finance, Multidisciplinary, Management of Technology and Innovation, and Economics, Econometrics and Finance. From this categorization, it can be assumed that the articles on the topics covered today are topics and scientific fields that are at an advanced stage. These articles are published in journals that belong to the top quartile and have adjacent scientific fields. It should be noted that in the multidisciplinary subject category, economics, management, and social sciences are generally subcategories that are included in this subject category.

Table 2. List of articles by region/country of study.

No.	Countries	Number of Articles	Author(s)
1	China	8	Gao et al. (2014); Gong (2021); Huang et al. (2022); Li (2023); L. Wang et al. (2019); P. Wang et al. (2019); Zhao & Song (2018); Zhuang et al. (2021)
2	Taiwan	1	Dai et al. (2022)
3	Korea	1	Yoo & Kwak (2016)

Source: authors' elaboration.

Table 3. List of articles by year of publication.

No.	Year of Publication	Number of Articles	Author(s)
1	2014	1	Gao et al. (2014)
2	2016	1	Yoo & Kwak (2016)
3	2018	1	Zhao & Song (2018)
4	2019	2	L. Wang et al. (2019); P. Wang et al. (2019)
5	2021	2	Gong (2021); Zhuang et al. (2021)
6	2022	2	Dai et al. (2022); Huang et al. (2022)
7	2023	1	Li (2023)

Source: authors' elaboration

Table 4. Sources of publications.

No.	Source of publication - Publisher	No. of articles	Best quartile (SJR 2022)
1	Journal of Innovation and Knowledge - *Elsevier BV*	1	Q1 - Management of Technology and Innovation
2	Science, Technology and Society - *Sage Publications India Pvt. Ltd*	1	Q1 – Multidisciplinary
3	Scientometrics - *Akademiai Kiado*	1	Q1 - Social Sciences
4	Regional Studies - *Routledge*	1	Q1 - Social Sciences
5	Technological and Economic Development of Economy - *Vilnius Gediminas Technical University*	1	Q2 - Finance
6	Complexity - *Hindawi Limited*	1	Q2 - Multidisciplinary
7	Growth and Change - *Wiley-Blackwell Publishing Ltd*	2	Q2 - Global and Planetary Change
8	Managerial and Decision Economics - *John Wiley and Sons Ltd*	1	Q2 - Management of Technology and Innovation
9	Computational Economics - *Springer Netherlands*	1	Q2 - Economics, Econometrics and Finance

Source: authors' elaboration.

3.2. Critical Review of Selected Articles

The following section presents a critical review of the content of the selected articles. The author divides the ten papers into three groups whose topics are close to each other. The first *five articles (Dai et al., 2022; Gong, 2021; L. Wang et al., 2019; Y. Zhao & Song, 2018; Zhuang et al., 2021)*, are studies whose main content focuses on the role of government in managing key factors or resources in regional innovation, the impact of these factors on various variables related to regional innovation, and other influencing factors. The next *two articles (Gao et al., 2014; Huang et al., 2022)* are studies that focus on the role of government in improving regional innovation capabilities and optimizing innovation resources through stakeholder collaboration or innovation collaboration. The last *three articles (B.Li, 2023; P. Wang et al., 2019; Yoo & Kwak, 2016)* are studies that focus on the role of government and local innovation in relation to other innovation-related studies such as open innovation, entrepreneurship, and industrial cluster policies.

3.2.1. The role of local government in managing regional innovation resources

Dai et al. (2022) developed a measurement index to evaluate regional innovation capabilities in Taiwan by sampling data respondents from six special regions in Taiwan. The

study collected a wide range of public information considered as regional innovation resources, used complex multi-criteria decision analysis methods, and was conducted by a team of experienced experts based on the Consistent Fuzzy Preference Relation (CFPR) and VIKOR frameworks. The main findings of the study led to the creation of a structured innovation evaluation system that serves as the basis for innovation policy in special regions (districts) in Taiwan. The study's recommendations point out the need to adjust the roles of central and local governments in designing the regional innovation system, and the need to pay attention to specific regulations and policies for regional innovation.

The allocation of various regional resources for innovation purposes should focus on R&D and education activities that can be implemented through government-supported innovation collaboration projects involving industry and universities, as developed and stated in many innovation studies (Cunningham & Link, 2015; Tseng et al., 2020). Fundamental factors related to the government's role in allocating these resources include budget support for relevant innovation projects, the availability of knowledge and technology inputs in the region, human capital, regional entrepreneurial capacity, and the ability to create knowledge networks. On the other hand, local governments also face challenges in effectively managing all these resources due to budget limitations, lack of clarity in rules and policies, weak coordination among regional institutions, and limited quality of human resources. In order to overcome these challenges and limitations, Dai et al. (2022) suggested that local governments can improve coordination with other innovation actors, namely universities and industry, develop innovation policies according to regional conditions and needs, invest in improving the quality of innovation human resources (e.g., researchers and engineers), and use external networks to obtain additional resources (Faggian et al., 2019; Grilli & Murtinu, 2018).

In the context of regional innovation development in China, Gong (2021) examines the factors that can affect the allocation of innovation resources, which is closely related to the effectiveness and efficiency of the management of R&D subsidies and knowledge and technology inputs. The study uses regional statistical data, scientific data, and demographic data, and applies the threshold effect model

analysis approach. The results of the study indicate that the positive relationship between government R&D subsidies and the ability to increase regional innovation is highly dependent on the level of achievement of certain technologies and the informatization process in the region.

The level of technological attainment is related to the ability of a region to adopt the technology generally represented by firms and industries for the purpose of increasing the added value of production (Lau & Lo, 2015). A better level of technology can improve the efficiency of production, and at the same time reduce the cost of production and increase profitability. Meanwhile, the level of informatization is related to the speed and accuracy of information delivery that can connect or improve the relationship between regional innovation actors (Qin et al., 2022). The information imbalance between government and market conditions can lead to distortions, such as a lack of synchronization between the planning and implementation of public-private innovation projects, or in other cases, firms using government subsidized funds to produce low-quality patents or patents that are not needed by the market to demonstrate high performance in the quantity of local patents. To overcome such barriers, local governments need to regulate and supervise the use of government subsidies for innovation projects that are most relevant to local conditions and needs by implementing strict selection procedures for project acceptance, open/transparent processes, taking verification, auditing, monitoring and evaluation of projects seriously, and ensuring strict and measurable sanctions against violations and abuses. Local governments can also involve other innovation stakeholders or community groups in these processes, as the majority of government funding comes from public funds. The perspectives and oversight of these stakeholders are critical to ensuring the use of the innovation subsidy funds (Y. Liu et al., 2021; Zhong & Peng, 2022).

The management of innovation resources in the form of knowledge inputs has been studied by L. Wang et al. (2019) in the context of nanotechnology innovation in China. This study examines the impact of knowledge spillovers on the development of nanotechnology innovation. Using 11 years (2000-2010) of invention patent application data from 30 provinces in China and statistical data from various national and regional publication sources, and

applying complex econometric analysis methods, the study concludes that the impact and changes in the process of knowledge spillover and nanotechnology innovation are felt most by peripheral regions compared to more developed regions. This is inseparable from the institutional support of local governments and the consideration of each region's basic technology level.

The progress of nanotechnology innovation in China is strongly influenced by the cooperative support of central and local governments and private R&D funding, and the increasing cooperation between industry, universities and government in regional innovation projects specifically aimed at nanotechnology development. This institutional support is closely related to innovation infrastructure support and financial support (Polzin et al., 2016; Szczygielski et al., 2017). Some of the challenges that often arise in this process are related to human and social capital, namely the availability and quality of human resources. The Chinese government has identified a continuous nanotechnology education and training agenda as one of the important measures to improve the social capital of regional R&D, which in turn can support the desired innovation process. Similarly, innovation collaboration with universities and industry has successfully created significant knowledge spillover effects in the development of nanotechnology in China (L. Wang & Li, 2021).

Consistent with the results of L. Wang et al. (2019), Zhuang et al. (2021) showed that there are significant regional growth differences due to industrialization between the strong eastern region and the fast-growing southern region, which is highly different from the weak western region and the slow-growing northern region. The study examined collaborative innovation in 30 provinces in China using the triple helix model approach of collaboration among the three regional innovation actors of government, universities, and industry, and using five years of invention patent data. According to the results of this study, the evolutionary dynamics of triple helix collaborative innovation in China show the dominance of intra-regional collaboration, but with growing inter-regional collaboration. In innovation-weaker regions, triple helix collaboration seems to be stronger, with the government playing a major role. Meanwhile, in other more advanced regions, where innovation tends to be industry-led, this triple helix

relationship and collaboration is weaker.

In the triple helix innovation model, local governments face challenges in promoting collaboration and participation of all innovation actors, especially in promoting the importance of these relationships, coordinating various interests, and providing adequate financial support, especially in the early stages of collaboration (Danson & Todeva, 2016; Gachie, 2020). Promotion, coordination, and financial support can be done through activities that facilitate knowledge transfer and exchange between stakeholders, such as discussion forums, workshops, and seminars. This aims to equalize perceptions between stakeholders so that the collaborative process that emerges is in line with mutually desired goals and can be sustained. The Chinese government has a lot of challenges in creating innovation and more equitable growth. Without an integrated innovation policy that takes into account the innovation strengths and weaknesses of different regions, more innovative regions will advance while lagging regions will fall further behind (Fu et al., 2016). Innovation policies that encourage lagging regions to tap external knowledge sources and pool more resources across regions have the potential to accelerate the innovation process, compared to adopting innovation policies without involving more advanced regional partners. Coordination and synergy of triple helix elements across regions is key to bringing lagging and advanced regions to collaborate.

In the broader context of China's innovation, Zhao & Song (2018) modeled the regional economy with a knowledge-based growth approach, using statistical databases from various publication sources covering 30 regions in China and estimating regressions in three stages (on R&D investment, human capital, and economic growth). The results of this study show that the productivity of these three key variables is closely related to the region's innovation capability, knowledge base level, and technology absorption capacity, while also influencing the government's willingness to invest in regional innovation.

A recent study by Boeing et al. (2022) shows that the role of local governments in supporting R&D investment in China can indirectly promote economic growth by improving the quality of human resources and increasing the level of regional knowledge and technology, especially at the firm level. Under these

conditions, local governments in China face the challenge of formulating regional innovation policy instruments that can promote the improvement of these factors. Such policy tools include policies to establish innovation centers and technology and innovation parks, policies to improve the productivity and commercialization of regional R&D, and policies on innovative teaching methods at various levels of education (Hou et al., 2019).

3.2.2. Optimizing innovation resource management through collaboration

Gao et al. (2014) examined patenting activities and university-industry-research institute (UIR) collaboration in the ICT sector in China. With a bibliometric analysis approach using the Chinese government's Intellectual Property Office database, the study shows trends in patent output, productivity, and patent institutionalization, as well as regional innovation levels. The results show that there has been a significant increase in patenting and innovation activities in China, with the majority of patents coming from the business/industry sector as opposed to the government or university sector. In terms of UIR collaboration, it still looks weak over the past 20 years. Based on the results of the analysis and the long-term perspective of this research, the ICT sector has a great impact on China's innovation growth.

In China's regional innovation system, local governments play a role in policy and financing functions and promote innovation cooperation among innovation stakeholders (UIR). The government has issued more than 300 regulations to promote innovation cooperation and collaboration over more than three decades. The government also provides support in the form of tax incentives for R&D and technology-related investments. According to several studies, there are several factors that may slow innovation growth in some regions of China, including weak intellectual property protection in the regions, low levels of commercialization of research results, and management and coordination in research collaboration among research institutions (Brander et al., 2017; Sun et al., 2020). The enhancement of the regional innovation system that encourages UIR collaboration, strengthens the institutionalization of R&D institutions, and promotes the commercialization process of research and innovation results is an important step in developing the innovation system in China's ICT sector for long-term goals.

Huang et al. (2022) investigated the impact of entrepreneurship policies on local innovation capabilities by applying fuzzy set qualitative comparative analysis (*fsQCA*) technique using data from 31 provinces in China. The study argues that local governments play an important role in providing an enabling innovation environment for entrepreneurship policy implementation (e.g., through fiscal policy, local innovation management system, technology transfer process, human resource quality, and digital transformation). Government also has an important role to play in fostering collaboration between innovation actors to create a complete regional innovation ecosystem that can support the implementation of these entrepreneurship policies.

Close relationships between innovation actors can form a strong innovation network that can be the basis for long-term innovation and economic development (Varga-Csajkás et al., 2023). Innovation collaboration also aims to create a match between the type of innovation policy and region-specific conditions, which is often a bottleneck for many regions (Sebestyén et al., 2021). Innovation actors in the regions have a better understanding of the problems in their regions, making it easier to implement policies that are in line with regional characteristics. The challenge that may then arise is the issue of coordination and proper communication to bridge the different aspirations of different stakeholders to produce the proper regional innovation policy. The quality of the regional innovation actors involved in the process of formulating regional innovation policy must be ensured. In many cases, the process of identifying and prioritizing regional innovation is a very complex process (Varga et al., 2020). Therefore, a specific policy framework is needed to facilitate it.

3.2.3. The role of local government and regional innovation in other innovation-related studies

Li (2023) explores the concept of social entrepreneurship, emphasizing the importance of social and cultural factors in the context of China's digital economy. The study examines the role of local governments and regional innovation capabilities in mediating the influence of the digital economy on social entrepreneurship. The main findings of this study contribute to the literature that investigates the antecedents of social entrepreneurship in the current digital economy context with government involvement and regional innovation capabilities. According to the results of this study,

local governments play an important role in promoting entrepreneurship and innovation related to digital economic activities (digitalization) through institutional support such as providing infrastructure and access to various innovation and entrepreneurship resources, encouraging the transfer of digital knowledge and technology, acting as mediators in creating collaboration between entrepreneurs and innovation actors, and providing a marketing environment conducive to the growth and development of local innovation and social entrepreneurship.

Governments have an important role to play in strengthening social capital as a key asset for the growth of social entrepreneurship and innovation in the current context of the digital economy (Al-Omoush et al., 2020; Tien et al., 2019). This role can be realized through innovative projects that can open opportunities for the development of new social enterprises, driven by the spirit of digital innovation. Some challenges that may arise in the context of this support include limited government funding and institutional infrastructure to strengthen social capital, weak institutional networks with other innovation actors such as universities, industry, and community groups, and ineffective public communication mechanisms. Forming collaborative partnerships with innovation actors is an appropriate way to build solid innovation institutions and support social entrepreneurship (Phillips et al., 2015).

Yoo & Kwak (2016) further explored the impact of regional innovation on opportunities to implement open innovation concepts at the firm level. Using data from the Korea Innovation Survey (KIS), innovation conditions in 16 South Korean regions were classified into seven innovation groups. Using a hierarchical analysis method, the study concludes that firm size, innovation capabilities of public and private R&D institutions, knowledge network size, and targeted regional R&D funding are factors that can increase this opportunity and depend on the different innovation conditions in each region. The study argues that local governments have a role to play in encouraging small and medium-sized enterprises (SMEs), which are spread across many regions, to increase knowledge and technology exchange activities. One possible effort that can be made in the early stages of adopting the concept of open innovation is to group industry types into clusters to accelerate the desired knowledge and technology transfer process. The implementation of open innovation can also be stimulated by

providing incentives to companies through various innovation collaboration projects between institutions.

In the context of the knowledge economy, the adoption of open innovation at the firm level depends on several factors that can facilitate knowledge sharing or transfer, including collaboration among stakeholders, availability of infrastructure and technology, and regulatory support (Bogers et al., 2018; Leckel et al., 2020; Wibisono, 2021). The availability of knowledge and technology in a region determines the initial stages of the open innovation process. Therefore, companies and local governments face two main challenges: to ensure the improvement of formal and informal education and training of human resources in both sectors as human capital, and to promote the growth of knowledge networks in regions as knowledge capital (Setini et al., 2020). Collaboration between government and industry, reinforced by policy rules, is highly recommended to optimize the impact of knowledge spillovers. The creation of effective knowledge networks both within and between regions can stimulate the growth and development of open innovation practices.

P. Wang et al., (2019) highlight the important role of local governments in enhancing regional innovation through the development of industrial clusters. The main data used are innovation competitiveness indicators from 31 provinces in China. Through the analytical hierarchy process and super-SBM data envelopment analysis approaches, the main findings of this study show the important role of the government in enhancing regional innovation capabilities through the development of specialized industrial clusters. The study also shows that the competitiveness scores of provinces in China are still relatively low, so the government should also strive to improve regional innovation capabilities by improving the competitiveness indicator points. In addition, industrial cluster development aimed at improving regional competitiveness and innovation can be carried out through innovation cooperation and regional innovation competitions.

Industrial cluster development as a form of industrial policy requires a strong role for the government. Industrial cluster policies designed by the government aim to support the growth of specific sectors and use agglomeration effects to increase growth (Audretsch et al., 2019). Clusters formed in a region provide

opportunities for related industries to exchange knowledge and experience and to collaborate in the form of joint R&D or joint use of resources (Della Peruta et al., 2018). Therefore, governments should play a role in promoting these industry clusters and encouraging knowledge exchange among them.

3.3. The Role of Local Government in Fostering Collaboration for Innovation - *Further Discussion*

As in the critical review presented in the previous section, the majority of innovation studies in the Asian context in our current study emphasize the importance of government involvement in effectively allocating various social and economic capitals to enhance regional innovation capabilities. These resource factors include regional knowledge inputs such as human capital (researchers and engineers), R&D funding, entrepreneurship, and knowledge networks. To enhance regional innovation capabilities, especially in the early stages of technology development, the allocation of various resources should be aimed at developing R&D activities through innovation projects supported by relevant stakeholders (Ranga, 2018; S. L. Zhao et al., 2015). However, this is not an effort that can be carried out by the government alone, but also jointly or in collaboration with other innovation actors. In the triple helix innovation model, regional innovation involves the participation of universities or colleges and industries or businesses in addition to local governments (Cai & Liu, 2015; Etzkowitz & Zhou, 2017; Gunasekara, 2006). This innovation model approach is highly developed and various empirical studies in different countries have proven the significant impact of university and industry involvement in supporting the government to strengthen regional innovation (e.g., Asheim et al. (2011); Krishna (2019); Malik et al. (2021)).

The study conducted by Dai et al. (2022) in the case of Taiwan emphasized the need to align the responsibilities of central and local governments in relation to regional innovation policies. This has a significant impact on the decision-making processes of local governments in developing regional innovation policies. Forms of intraregional innovation collaboration have been widely implemented in several Asian countries (Degelsegger-Márquez & Remøe, 2019; Liverani et al., 2023), and interregional innovation collaboration has also shown a positive trend (Fan et al., 2020; Shapiro et al., 2010). In many cases, local government-led and -dominated triple

helix model collaborations occur mainly in innovation-weaker regions (Danson & Todeva, 2016; Kolehmainen et al., 2016). In contrast, in more developed regions, innovation collaborations tend to be led by the industrial sector, even though these triple helix relationships appear weaker (Amaral et al., 2017; Zhuang et al., 2021).

In addition to policy functions, local government-led innovation systems also include financing functions. As in China, for more than three decades, the Chinese government has implemented more than 300 regulations to encourage innovation collaboration through innovation projects in collaboration with industry and universities, significant investment in local R&D resources, and tax incentives for investments that promote the use of cutting-edge technologies (Z. Li et al., 2020; Su et al., 2015). In addition, regional entrepreneurship has also been encouraged to promote innovation. In the case of nanotechnology development in China, the application of these innovations has been rapid due to the promotion of digital economic activities supported by institutional strengthening, entrepreneurship, infrastructure, and access to various regional innovation resources (Liao, 2023; Patrício & Fernandes, 2022). The process of knowledge and technology transfer from collaborative R&D results among many stakeholders in the region, the formation of special clusters according to regional characteristics, which is then accelerated by the promotion of entrepreneurship and the digitization process, has made China one of the countries with the fastest development of nanotechnology in the world (Lei et al., 2023; Zhu et al., 2023).

Strong relationships between government, universities, and industry have the potential to form strong knowledge networks. Knowledge networks are an important foundation for fostering collaboration and forming innovation networks for long-term objectives (Balland et al., 2015; Thomas et al., 2021). Knowledge networks align or create congruence between the capabilities of innovation actors. Strong ties between actors in knowledge networks reflect greater opportunities for collaboration, and the stronger these network ties, the greater the potential for creating regional innovation sustainability (Balland et al., 2016; De Noni et al., 2018). Another factor that can improve innovation collaboration, both in the early stages of collaboration and due to geographic constraints (e.g., peripheral areas, less developed areas, and sparsely

populated areas), is to consider the proximity factor. Wibisono (2023) states that every region has an equal opportunity to enhance innovation collaboration with other more developed regions by considering motivational factors such as common policy goals and various types of geographic and non-geographic proximity (Conaldi et al., 2023; Fitjar et al., 2016). In many developing countries, such as Asia, the creation of regional knowledge networks remains a challenge, especially in regions with early-stage knowledge and technology or less developed regions. In this case, innovation collaboration becomes an urgent solution option. Every region faces the challenge of improving its knowledge levels. However, as each region has different conditions and technological needs, governments can take serious steps to create customized regional innovation policies and promote collaboration motivated by the specific characteristics of the region (Camagni & Capello, 2017; Z. Wang et al., 2022).

4. CONCLUSION

In this study, the author explored the role of local governments in enhancing regional innovation capabilities in the context of Asian regions. Using a critical literature review approach of key findings from selected articles obtained through a systematic literature review procedure, this study critiqued ten selected studies dominated by cases in China in addition to Taiwan and Korea. The development of regional innovation policy literature in relation to the role of local governments over the past decade in the context of the Asian region has been consistent and encouraging. The selected papers were also found to be published in highly reputable journals, indicating that the topic under study is currently well advanced. Although regional innovation studies are highly developed in the context of developed countries such as Europe and the United States (see Crescenzi et al. (2007); Dutta et al. (2020)), attention to knowledge-based regional economic development still needs to be significantly promoted in the context of developing countries in Asia. Similarly, regional research and innovation policies resulting from the commercialization of R&D results are still not given much importance or priority in other parts of the Asian region. Nevertheless, the three country cases discussed in this study have shown how regional innovation plays an important role in the broader economic context.

Based on a critical review of the evidence from the selected literature, the main role and challenge of government in improving regional innovation capabilities is highly dependent on the ability to manage various innovation resources, both within the region and from external sources. In this regard, local governments are encouraged to address this challenge by promoting knowledge (research and innovation) cooperation and collaboration, as well as enhancing their roles and functions in relation to other knowledge policy contexts such as open innovation, entrepreneurship, and industrial agglomeration policy. Furthermore, the results of this literature review point to the importance of cooperation and collaboration between local governments and the other two main innovation actors, namely universities/colleges and business/industry, which in the context of innovation policy studies is referred to as the triple helix innovation model. Human and socio-economic capital to improve regional innovation needs to focus on strengthening knowledge capacity and promoting regional technology scale-up. To solve challenges and problems, local governments cannot only work with their functions and authorities related to the policy or management of public funds, but need to consider the participation, support and regional perspectives of other stakeholders, while ensuring that regional innovation policies truly prioritize the conditions, challenges and necessities of the region.

This critical review is expected to have implications and motivate the practice of regional innovation policy in the context of other Asian regions, both those still in the early stages of innovation-based development and those that are developing or more developed. The author also encourages the initiation of more meaningful research and innovation collaborations that involve more local stakeholders and jointly plan, develop, and implement place-based regional innovation policies. In reviewing the literature on this very specific context, it is recognized that the limited literature in the database makes it slightly challenging to generalize the outcomes of this review to the context of the entire Asian region. The author also argue that the focus of this research has not addressed emerging contexts of innovation studies, such as community engagement in relation to creating sustainable and resilient innovation systems, or more specialized innovation contexts such as

social innovation and environmental (green) innovation. Further research in this direction is expected in the future.

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