

# Challenges in Developing Indonesia's National Innovation System for Strengthening the Bureaucratic Reform Agenda in the VUCA Era: A Literature Review

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## INTRODUCTION

Strengthening the public sector reform agenda has been a major concern of governments worldwide, including Indonesia, in recent decades (Dwiyanto, 2022; Pradana et al., 2022). Due to rapid changes in the political environment, Social and economic activities have encouraged public sector organizations to reform themselves in order to be able to provide quality public services to the community. Bureaucratic reform aims to improve good governance, reduce the occurrence of bureaucratic pathology, and strengthen coordination between various stakeholders to support a country's development (M. de Vries & Nemeč, 2013; Yusriadi, 2018b).

Bureaucratic reform focuses on improving internal processes, organizational restructuring, or developing new policies (Sinambela, 2017; Yusriadi, 2018a). However, in order to accelerate the process of bureaucratic transformation, public organizations need to be supported by innovations in the form of conceptual, administrative, and new products or services (Pradana et al., 2022; Pratama, 2017). Developing a national innovation system at the macro level is urgent to foster a spirit and culture of innovation in strengthening the public bureaucracy reform agenda. With adequate SIN, innovation performance that has a sustainable impact at the organizational level will be easier to

achieve (Gaus et al., 2017; Narutomo, 2014).

In this context, the national innovation system (SIN) is a crucial element that is useful in accelerating the process of public bureaucratic reform, especially in the midst of the VUCA era (Volatility, Uncertainty, Complexity, and Ambiguity), which is characterized by rapid and unexpected changes (Hijal-Moghrabi et al., 2020). Strengthening the national innovation system can encourage cultural diffusion to produce innovations in the bureaucracy to accelerate change and transformation, increase the efficiency and quality of public services, and encourage bureaucratic transparency and accountability. Therefore, the government of a country needs to strengthen SIN as an integral part of efforts to reform the public bureaucracy (Lakitan, 2011; Narutomo, 2014).

Despite the importance of SIN for the bureaucratic reform agenda, the challenges in developing a national innovation system are increasingly complex, especially for Indonesia (Lakitan, 2011; Triyono & Prihadyanti, 2017). Meanwhile, at the same time, there has yet to be much research that specifically addresses the challenges for the development of SIN to strengthen the bureaucratic reform policy agenda. Thus, the challenges faced must be deeply understood to succeed in developing a national innovation system. Therefore,

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this study aims to fill this knowledge gap and dig deeper into the challenges in developing Indonesia's SIN system to strengthen the bureaucratic reform agenda in the VUCA era by answering the following research questions:

1. What is the national innovation system (SIN) concept for bureaucratic reform and public sector innovation?
2. What is the role of SIN in strengthening the bureaucratic reform agenda?
3. What are the challenges in developing SIN in Indonesia?

This study uses a literature review method to answer these research questions to understand the challenges in developing Indonesia's SIN for strengthening the bureaucratic reform agenda. In using the literature review method, this study will study scientific articles, books, research reports, and related policies that are relevant to identify the main challenges in developing Indonesia's SIN in the VUCA era, as well as the essential role of the bureaucratic reform agenda in overcoming these challenges. Besides that, through a literature review, this study will analyze, combine, and synthesize various conceptual ideas and significant findings related to the research questions to provide policy recommendations that can strengthen the national innovation system.

This research contributes to two things. First, this study provides a better understanding of SIN's critical role in helping achieve public bureaucratic reform goals. Second, this article contributes to a deeper understanding of the challenges in developing a national innovation system and guides future research and policy.

This article is then structured as methods, results and discussion, and conclusions.

## RESULT AND DISCUSS

This study uses a systematic literature review method on 27 scientific articles on national innovation systems and public sector reforms from the world's top public administration journals, books and government reports. A systematic literature review is an appropriate method for understanding the development of the body of knowledge of a research topic; in which previous experts have used this method in studying various research topics such as the topics of public sector innovation, human trafficking and tourism (e.g., Nusair et al., 2019; Okech et al., 2018; Pradana et al., 2022). Thus, a systematic literature review is an appropriate method for studying themes about the challenges of developing SIN for strengthening the bureaucratic reform agenda (Moher et al., 2009). Furthermore, the source of the article data in this study was obtained from the Web of Science (WoS) database, especially those related to articles from the world's top public administration scientific journals and the Google Scholar database for articles, books or government reports related to SIN. This study uses the keyword "national innovation system" because this keyword allows this study to find specific articles written in English or Indonesian.

Furthermore, the article selection strategy was carried out in three stages. First, this study seeks and selects articles based on the type of article, the category of public administration and English or Indonesian, which has the highest citations and is relevant to the research theme in this article. Based on the selection process, this study obtained 27 articles that met the requirements following the inclusion and exclusion criteria. Selected articles that met the requirements were then analyzed qualitatively. In the final stage, the analysis results are then presented as the

results of a literature study to answer research questions.

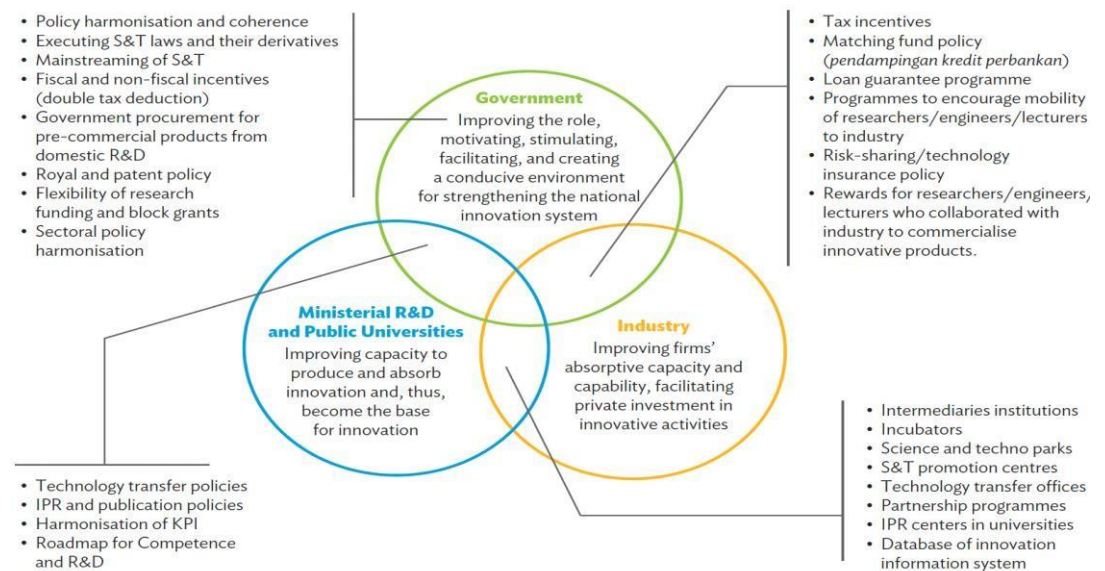
## THE CONCEPT OF THE NATIONAL INNOVATION SYSTEM (SIN) AND BUREAUCRATIC REFORM

This section aims to answer the first research question by presenting the concept of a national innovation system (SIN) and bureaucratic reform, including

productivity, job creation, and increased competitiveness of a country through building new technologies, improving organizations, and discovering new markets (Schumpeter, 2021).

Concerning this, the idea of SIN emerged as a strategic approach used by countries to establish an environment conducive to innovation and technological development so that it serves to

**Figure 1. Indonesian National Innovation System Design**



IPR = intellectual property rights, KPI = key performance indicator, R&D = research and development, S&T = science and technology.

Source: Amuri, et al (2018)

its definition and critical components.

### ***The Concept of the National Innovation System (SIN) and Bureaucratic Reform***

This section will present the concept of SIN, which includes definitions and vital components that play a role in the development of SIN. The results of the literature study found that experts have long recognized that innovation plays an essential role in driving economic growth and the competitiveness of a country, one of which is through the role of SIN as an instrument in accelerating the public bureaucracy reform agenda. It is because innovation enables the creation of new products, processes, and business models, which lead to increased

strengthen the economic competitiveness of a country through the creation, adoption and continuous dissemination of innovations (Fernandes et al., 2022; Sharif, 2006). This concept encompasses various institutions, policies, and mechanisms that affect a country's ability to create, adopt, and implement innovations within its economic and social sectors (Lee & Lee, 2020). SIN involves interaction between various stakeholders, including the government, private sector, academic institutions, research institutions, and the general public (Peters, 2006).

Furthermore, SIN has five essential elements (see Figure 4). The first element

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is policy innovation. The government plays a role in formulating innovation policies that include regulations, incentives, and strategic measures to encourage innovative activity in the economic sector. This innovation policy includes investment in research and development (R&D), education and training, intellectual property rights protection, and international innovation cooperation (Liu, 2021). The second element is the Research and Development Research Institute. Research institutions, such as national research institutes and universities, are important in generating new knowledge and technologies through research and development activities. They also serve as centres of expertise and collaboration in fostering technology transfer and commercialization of inventions (Volkodavova et al., 2019).

The third element is the private sector. Companies and private industry are key to adopting and implementing innovation in business practices. They invest in R & D, create new products and services, and implement new technologies to improve competitiveness. Initiatives from the private sector are often driven by government incentives and cooperation with research institutions (Eastwood et al., 2017; Leyden, 2016). The fourth element is funds and resources. The National Innovation system requires adequate resources, both financial and human, to support innovative activities. The government can allocate funds and budgets for R&D, provide fiscal incentives for innovative investments, and involve the private sector and financial institutions in supporting innovation development (Nasierowski & Arcelus, 1999). The Fifth Element is networking and collaboration. Collaboration between various stakeholders in the National Innovation System is becoming essential to accelerate technology transfer, knowledge sharing, and expand innovative

networks. Cooperation between governments, universities, research institutions, and the private sector can create powerful cohesion and facilitate the exchange of ideas and best practices (Petraite et al., 2022).

### ***The Concept of Bureaucratic Reform***

This section will present the concept of bureaucratic reform, including the definition and various changes in bureaucratic reform. The results of literature studies on the literature found that bureaucratic reform is a concept that emerged in response to the need to improve the efficiency, accountability, and quality of services provided by the public bureaucracy. Bureaucratic reform covers various aspects, including organizational structure, work processes, decision-making systems, governance, regulation, and work culture within the bureaucracy. The main objective of bureaucratic reform is to create a bureaucracy that is more responsive, transparent, efficient, innovative, and able to provide quality services to the community (Dwiyanto, 2022; Sedarmayanti, 2009). Furthermore, some important concepts in bureaucratic reform. First, the reduction of bureaucracy. Bureaucratic pruning aims to reduce excess staff, excessive regulations, and overly complicated work processes in the bureaucracy. It is done by reducing layers of bureaucracy, eliminating unimportant tasks, and optimizing existing resources. Trimming bureaucracy aims to create a more concise, efficient, and responsive bureaucracy (Agustamar, 2014; Yusuf, 2018).

Second, increase efficiency (efficiency improvement). Efficiency improvement in bureaucratic reform focuses on reducing waste of resources, faster and more efficient work processes, and the use of technology and innovation to increase productivity. It includes better use of

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information tools and systems, automation of work processes, reduced unnecessary bureaucracy, and development of employee skills and capabilities (Lampropoulou, 2021; M. Rogers, 2017). The third is accountability enhancement. Increasing accountability in bureaucratic reform involves building a system that can better measure, track, and account for bureaucratic performance. It includes setting targets and performance indicators, providing clear incentives and sanctions, and using effective supervision and audit mechanisms (Adeti & Christiani, 2022; Wicaksono, 2015; Yusriadi, 2018a).

Fourth, increase public participation. Bureaucratic reform also includes efforts to increase public participation in decision-making processes. It involves allowing people to provide input, feedback, and oversight of public policies and services. By involving the public, bureaucratic reform can better meet the needs and expectations of society (Curto & Dias, 2014; van der Voet, 2016). The Fifth is transparency enhancement. Increased transparency in bureaucratic reform involves disclosing wider and more accessible information to the public. Thus, the public can understand and monitor the decision-making process and the use of the budget and involve themselves in the supervision of the bureaucracy. Transparency also prevents corruption and power abuse (Dwiyanto, 2022; Turner et al., 2022; Wu et al., 2020).

Bureaucratic reform aims to achieve a more adaptive, responsive and innovative bureaucracy through these concepts. These interrelated concepts support each other to create a better working environment and public services. Bureaucratic reform is not only about structural change but also about changing attitudes, culture, and work practices within the bureaucracy to achieve better

performance and more effective service to the community.

### ***Public sector innovation concept***

This section will present the concept of public sector innovation, including the definition, topology and benefits of innovation for the public bureaucracy reform agenda. The literature review results in this study found that public sector innovation itself is a concept that describes the use of new ideas, practices, and technologies to create positive changes in public service delivery and governance. Public sector innovation aims to improve the efficiency, effectiveness, and responsiveness of the bureaucracy and provide added value to the community. In other words, innovation plays a role in strengthening the transformation of public bureaucracy towards better quality (H. De Vries et al., 2016; Pradana et al., 2023; E. M. Rogers, 2010).

Furthermore, the literature study results show that public sector innovation has four typologies. First, policy innovation is developing new policies or modifying existing policies to address complex public problems and solve societal challenges. Second, process innovation is changes in the work process and methods of implementing public service activities to increase efficiency, eliminate administrative barriers, and accelerate decision-making. Third, technological innovation is the use of new or newly developed information and communication technologies to improve the quality of public services, accelerate the exchange of information, and improve accessibility for the community. The Fourth is organizational innovation, which includes changes in organizational structure, work culture, and relationships between work units in the bureaucracy to improve collaboration, communication,

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and coordination (Buchheim et al., 2020; H. De Vries et al., 2016).

Furthermore, public sector innovation alone provides several significant benefits. First, improve the quality of public services by providing more effective and efficient solutions for the community. Second, strengthen bureaucratic physics by helping to optimize work processes and reduce excessive bureaucracy, thereby increasing efficiency and cost savings. Third, increase public participation in decision-making and policy implementation, strengthening democracy and accountability. Fourth, improving the capability of bureaucracy in the face of growing challenges (Cummings, 2015; Julier, 2020; Pradana et al., 2022).

#### **IMPORTANT ROLE OF NATIONAL INNOVATION SYSTEM FOR BUREAUCRATIC REFORM AGENDA**

This section aims to answer the second research question by presenting the role of the national innovation system (SIN) in strengthening the bureaucratic reform agenda. The literature study revealed five important rationales explaining the important role of the national innovation system in the bureaucratic reform agenda in the VUCA era.

First, the national innovation system allows the creation and development of new knowledge. Research and development (R&D) form the foundation of the innovation process, and a strong national innovation system provides the necessary support to generate new knowledge through investments in research and research infrastructure. Through research institutions, universities, and innovation centres, the state can advance science and technology and produce discoveries that can be applied in the economic sector. The innovations resulting from this new

knowledge provide a competitive advantage for the country and promote long-term economic growth (Aguirre-Bastos & Weber, 2018).

Second, the National Innovation System facilitates technology transfer and collaboration between the public and private sectors. Close collaboration between government, universities, research institutions, and industry can create a strong innovation ecosystem. Governments can act as catalysts in facilitating technology transfer and incentivizing the private sector to invest in innovation. Through this cooperation, knowledge and technology can be adopted quickly and applied in various sectors of the economy, increasing competitiveness and efficiency (Attia, 2015).

The national innovation system also plays a role in developing high-quality and creative human resources. Relevant and quality education and training form the foundation for a country's innovative capabilities. Governments can invest in higher education, research, and the development of the expertise needed to drive innovation. In addition, a good national innovation system encourages entrepreneurship and the creation of new jobs, creating a supportive environment for individuals to develop new ideas and implement them in successful businesses (Filippetti & Archibugi, 2011).

Furthermore, the national innovation system contributes to a country's economic diversification. In the face of global challenges, countries cannot rely on a single economic sector or rely too heavily on specific natural resources. Economic diversification is important to create diversity and resilience in the economy. An effective national innovation system can encourage the development of new high-potential sectors, create new opportunities, and reduce risks when existing sectors experience pressure or change. Economic diversification from

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National Innovation Systems provides long-term economic stability and reduces dependence on external factors (Arman et al., 2022).

Finally, the national innovation system plays an important role in building a country's reputation and image at the international level. Countries known for innovation and technological excellence will gain traction for foreign investment and international collaboration. A reputation as a centre of innovation can improve a country's bargaining position in international trade and open up new opportunities for Economic Cooperation. An effective national innovation system enables the country to leverage its competitive advantage and strengthen its position on the global stage (Abramov & Sokolov, 2017).

The successful implementation of the national innovation system is supported by the successful implementation of Public innovation in the regions. One example is Difagana (Disaster Preparedness disability) D.I. Yogyakarta, an inclusive laboratory related to disaster management resulting from mitigation studies on vulnerable groups, especially disabilities in disaster emergency conditions. Difagana won the top 45 commendable public service innovations in 2022 from the General Group and the Top 5 Outstanding Achievement of Public Service Innovation from the special group. Based on the direction of the Minister of Social Affairs, Difagana was officially formed nationally in each province. Through Difagana, people with disabilities also get a role and become priority subjects in disaster management.

Another example of innovative public service is the Lontong Balap Program (integrated Online service One Gate system with the Department of Population and Civil Registration and the District Court) of the Surabaya city government. Lontong Balap won the Top 30 Award of

the East Java Public Service Innovation Competition (Kovablik) 2022. The need for a population administration application (Adminduk) that requires the determination of the District Court, such as changing names and death certificates for residents who do not have other population documents, is submitted to the village, and the application documents are sent to the District Court and Disdukcapil in digital form. The trial can be scheduled for the District Court if the requirements are stated in full. The purpose of the Lontong Balap program innovation, in addition to making it easier for residents, also reduces contact with parties not interested in the process, such as brokers.

While at the ministry level, one of the innovations from the Directorate General of Treasury (DGT), namely Digipay, managed to become the winner of the Top 45 public service innovations from the Ministry of Administrative Reform-Bureaucratic Reform (Kemen-PANRB) in 2022. Digipay provides the convenience of transacting government spending more safely, practically, and efficiently. Digipay aims to provide wider market space and access for MSMEs to develop through the digital world, which is the government's effort to reduce the impact of the pandemic on the economy through the National Economic Recovery, program while supporting the Bangsa Produk Indonesia Program.

Overall, the national innovation system plays an important role in improving a country's competitiveness and economic resilience, one of which is as an instrument that encourages accelerating the transformation of public organizations. The National Innovation System provides a strong foundation for sustained bureaucratic reform efforts through new knowledge creation, technology transfer, and Human Resource Development. To achieve this, collaboration between the government,

private sector, universities, and research institutions is key to building a strong innovation ecosystem.

## CHALLENGES OF DEVELOPING INDONESIA'S NATIONAL INNOVATION SYSTEM

Schumpeter (1947) explained that innovation plays an important role in improving the employment achievement of a country. Thus, for many countries, including Indonesia, having the ability to innovate is crucial, especially to improve the internal administrative processes of public organizations in the context of bureaucratic reform. Various experts see innovation as an "inspirational" approach to accelerate the transformation of public bureaucracies that are sustainable, competitive, and solid.

In Indonesia itself, bureaucratic reform efforts have been carried out for a long time. However, until now, the Indonesian government realizes that efforts to improve the performance of the

bureaucracy through the reform agenda have yet to be successful. One of them is because of the need for more policy innovations produced, so that Indonesia's innovation performance is still lagging behind its regional counterparts. Therefore, since the mid-2000s, the Indonesian government began emphasizing innovation in formulating economic policies. Various development planning documents explicitly and indirectly mention efforts to increase innovation and targets towards a more competitive, technology-based, and knowledge-based economy.

However, several indicators in the Global Innovation Index (GII) indicate that Indonesia has a lower innovation performance, hence the impact on the limited availability of innovation for the Indonesian economy compared to most neighbouring countries. GII is a ranking of innovation capabilities and results of the world economy. The GII measures innovation based on criteria including institutions, human resources, research,

**Figure 2. Indicator Global Innovation Index**





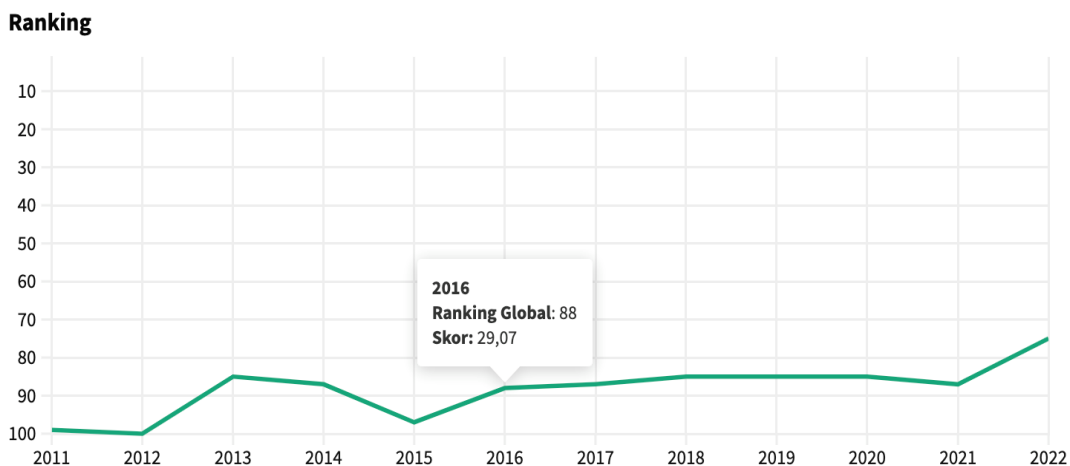
infrastructure, credit, investment, linkage; creation, absorption and diffusion of knowledge; and creative output (Figure 2).

In GII 2022, Indonesia was ranked 75th out of 132 countries and 13th out of 17 countries in Southeast Asia (Figure 6). The lack of optimal improvement in Indonesian innovation shows that Indonesia still needs to improve its innovation performance through the Indonesian National Innovation System (SIN) (WIPO, 2022). Which one will be considered as follows:

Furthermore, the World Bank (2019) pointed out that in 2019, Indonesia allocated about 0.08% of its GDP for R&D funding, well below the average of Southeast Asian countries, which reached 0.48% of GDP. While developed countries, on average, allocate about 2-3% of their GDP. This lack of funding could limit Indonesia's ability to conduct in-depth research, develop new technologies, and drive innovation.

One country that pays extra attention to the field of R&D investment for public service innovation is Singapore.

**Figure 3. Indonesia Ranking (2020-2022)**



Source: World Intellectual Property Organization (WIPO), 2022

The First is low R&D investment. Low R&D investment limits Indonesia's ability to generate new knowledge, innovative technologies, and inventions that can drive economic growth (Lakitan, 2011). In connection with the low R&D investment in Indonesia, based on the Global Innovation Index 2022 report, Indonesia produces less innovation output compared to its innovation investment level (Figure 3).

According to the Global Innovation Index (GII) in 2022, Singapore is ranked 8 out of 20 countries in the world as the most innovative country and the most investment attention in the field of R&D. One example is the implementation of Singapore's main e-government portal called E-Citizen One Stop, A One-Stop Integrated Service as a representation of Integrated Public Services that provides 1600 online public services to the public. From its initial launch in 1999 to 2020,

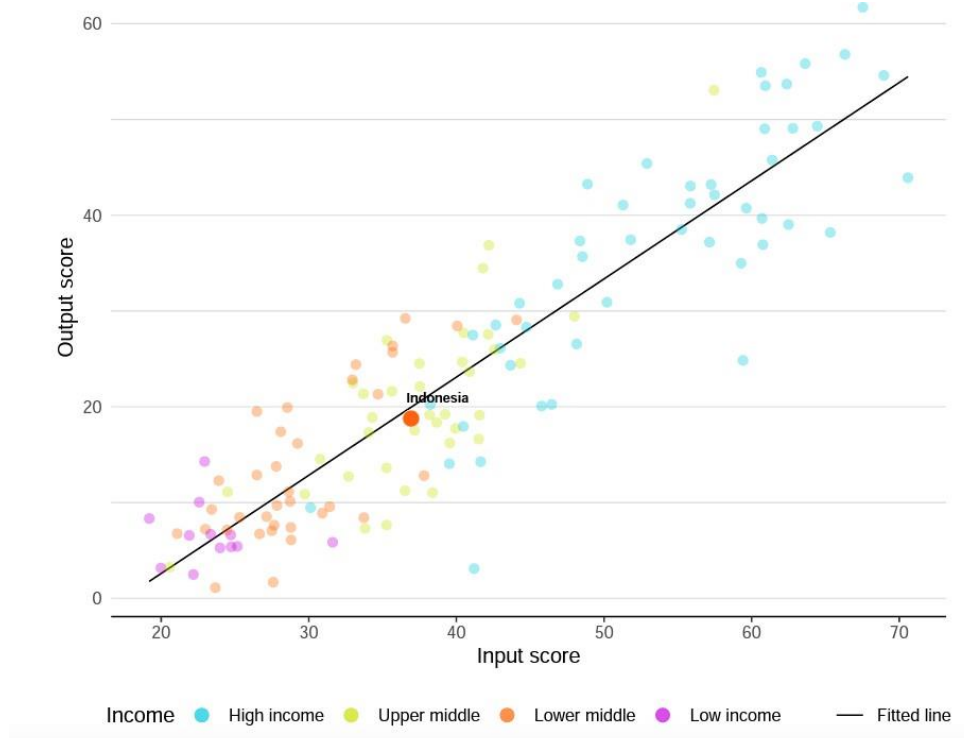
the Singapore government has invested \$ 1.6 billion in developing, innovating and maintaining the E-Citizen portal. The Ministry of Finance is the exclusive authority appointed to provide and approve the funding of e-government projects, including infrastructure and public services (Rahman et al., 2020).

Besides Singapore, Japan is also one of the countries whose government pays full attention to R&D investment for public service innovation. Since 1994, based on the e-Government Development roadmap, The Japanese government has built coherent data connectivity between 2000 private companies and the public sector fronted by 279 local governments at various levels in Japan (Government of Japan, 2016). The Integration of a National Identification Number, or " Mai Nanbaa" (in Japanese), is useful for Japanese residents to gain access to public services provided by local and central governments (Okamoto T, 2019). Even Japan's E-Tax system can significantly increase state revenue, simplify bureaucracy, and increase public confidence in the National Tax Agency (Yunas, 2018). Since 1994 on an ongoing basis until the early 2010s,

the Japanese government has budgeted expenditures of 1,655.5 billion yen for measures that contribute to the advancement of information and bureaucratic reform in the digital direction (Rahman et al., 2020).

Second, the need for collaboration and technology transfer between the public, private, and academic sectors. Innovation Systems theory emphasizes the importance of networking and synergistic relationships between various stakeholders in SIN to create an environment that supports innovation (Adamides, 2023). Close collaboration between research institutes, universities, and the private sector is the foundation of a successful SIN, as it can facilitate the flow of knowledge, technology transfer, and commercialization of innovation (Perez, 2009). However, in Indonesia, this cooperation still needs to be improved. The 2020 Global Innovation Collaboration Index states that Indonesia ranks 91 out of 131 countries in collaboration between universities and industry. Data from the Ministry of Research and

**Figure 4. Innovation input to output performance**



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Technology/National Research and Innovation Agency (Kemenristek/BRIN) shows that only about 13.2% of companies in Indonesia collaborate with universities in research and development activities.

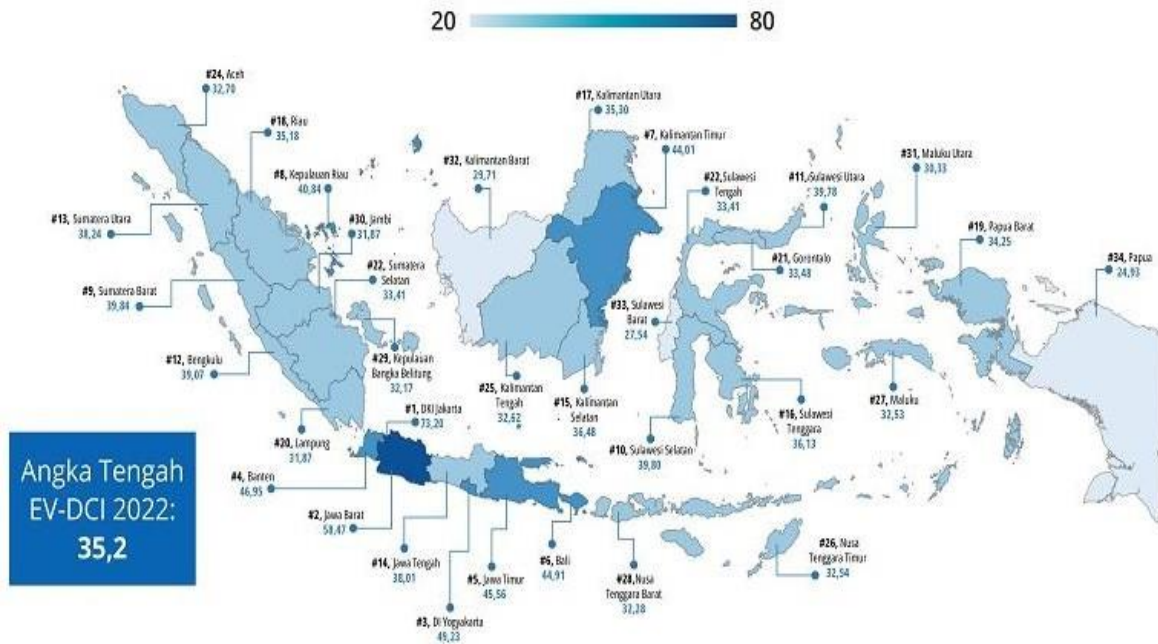
In managing E-Citizen One Stop, the Singapore Government encourages collaborative efforts with various stakeholders across agencies. IT managers and directors from all institutions meet every three months to share knowledge and policies for Best Practice Updates and technology updates in their workplaces. With this collaboration, the Singapore government can unite citizens with a single point of contact and seamlessly integrate front-end applications and back-end systems (Ke, W., & Wei, 2004) similarly, with the Japanese government, the IT Strategy Board is a solution to the common interests of the Ministry of Post and communications with the Ministry of International Trade and Industry to shape innovation policies in the field of ICT-based public services, consisting of various experts from the private sector chaired by Sony Nobuyuki Idea, the founder of Sony Corporation who was a more accommodating and representative of the Japanese government (Rahman et al., 2020).

Third, the digital divide between regions. Diffusion Theory Of Innovation Rogers (E. M. Rogers, 2010), explains that society will easily spread and accept innovation if supported by communication channels, which is digital connectivity. In the digital divide, groups of people with limited access to digital technology will experience obstacles in adopting and

utilising innovation, thus hindering the development of the national innovation system (Apriliyanti et al., 2021). According to data from BPS (2020) 2020, only about 64.8% of Indonesia's population had internet access. In addition, the East Ventures - Digital Competitiveness Index (EV-DCI) 2022 report also shows that Indonesia's median digital development gap is 35.2, with the best digital development figures in the Java and Bali regions. While other regions, especially eastern Indonesia, are the most disadvantaged (Katadata, 2022). Many people still need adequate internet access to access information, resources, and innovation opportunities. It hindered community participation in the innovation ecosystem and reduced the potential for developing new technologies and products (see Figure 5).

In the Japanese government's e-government roadmap, the development of a cable-based fibre optic network infrastructure in Japan, with speeds of up to 10 Gbps and LTE-Advanced (4G) infrastructure with 500 Mbps wirelessly that can be used to access, send and receive high-resolution video and more between users throughout Japan (Rahman et al., 2020) by levelling internet access both LAN (Local Area Network) and WAN (World Area Network) networks to various parts of Japan, will speed up and simplify the management process of digitization of application procedures, One-Stop administrative services, enhance the development of comprehensive electronic document management, to connect local governments and public enterprises.

**Figure 5. The Spread of Indonesia's Digital Competitiveness In 2022**



Source: Report East Ventures - *Digital Competitiveness Index (EV-DCI), 2022*

Fourth, protecting Intellectual Property Rights (IPR) needs to be stronger. Legal uncertainty and inadequate enforcement of IPR violations can hinder innovators' motivation and discourage investment in R&D. The Theory of Innovation Economics emphasizes the importance of IPR protection in encouraging innovative activities and protecting the benefits of innovation. Effective intellectual property rights (IPR) protection is important in the National Innovation System (SIN). Success in protecting IPR can encourage the process of innovation and commercialization of research results, motivate innovators, and improve the flow of technology. Furthermore, based on the 2019 Global Competitiveness Index, Indonesia ranks 64th out of 141 countries regarding intellectual property rights protection. A WIPO report in 2020 noted that Indonesia still faces challenges in terms of improving the quality and efficiency of its intellectual property protection system.

Japan is ranked number one in Asia on the International Intellectual Property Index by the U.S. Chamber of Commerce's Global Innovation Policy Center (GIPC). According to the Global Innovation Index in 2020, Japan and Singapore are the countries with the most innovative category. The higher the state's legal protection for innovation from intellectual property, the more it fosters a climate of competitiveness and innovation for its citizens. The form of implementation of legal protection in Japan is the participation of manufacturers to form a committee to combat copyright infringement at home and abroad on innovative products produced. One of this committee's tasks is to contact the perpetrators of copyright infringement and solve it through legal channels (Nugraha, 2019).

The Fifth is the need for more awareness of innovation and entrepreneurship. Awareness of innovation and entrepreneurship is a cultural factor that supports SIN.

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Entrepreneurship theory emphasizes the importance of a strong innovation culture and entrepreneurial skills in facilitating innovation. Awareness of innovation and entrepreneurship is an important social factor in developing the National Innovation System (SIN). In an environment that encourages innovation, individuals and society tend to adopt attitudes that support the creation and adoption of innovation ((Shane, 2003). The National Innovation Survey 2019 shows that only about 10.5% of Indonesians have a pro-innovation attitude, and 14.4% have a pro-entrepreneurship attitude. The Global Entrepreneurship Monitor (GEM) 2020 Report ranks Indonesia 87th out of 100 countries in the Entrepreneurship Index.

One of the pillars in calculating the Global Entrepreneurship Index (GEI) is the Human Capital Score, which is citizens' ability, capacity, competitiveness, and innovation in growing and creating an entrepreneurial climate. The United States and Japan became the top 10 countries in the GEI in 2022, indicating that the more developed a country is, the higher the number of citizens aware of doing business or entrepreneurship

## CONCLUSION

In strengthening the face of increasingly complex global challenges in the VUCA era, the Indonesian government should focus on developing the national innovation system (SIN) as one of the instruments in helping to accelerate the bureaucratic reform agenda in Indonesia. Recommendations for improvements that need to be made by the Government of Indonesia in order to strengthen SIN and encourage innovation in various economic sectors include increased investment in R&D, collaboration and technology transfer, strong IPR protection, reducing the digital divide between regions,

education and Human Resources Development, encouraging entrepreneurship, and evaluation and monitoring of SIN policies. With good implementation, a strong SIN will be the foundation to improve the competitiveness and resilience of the Indonesian economy in the increasingly intense VUCA era.

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