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Research Paper

Business Model Innovation in Research and Development: State of the Art and Based on Public Needs

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ABSTRACT

Every institution has business models, but some are not properly realized to benefit and meet the public needs. The aim of the study was to improve the government's existing business models in space technology to meet the public needs. Related studies regarding the issues were reviewed, and personal observation was conducted at the government space institution in Indonesia. The study found that to attain the public needs, the development of the business model in space technology should consider four aspects, research and development expenditures, wellbeing, sustainable cities and communities, and adoption of emerging technologies. Incorporating the four aspects into the existing business model is expected to bring the research and development closer to what the public wants.

Keywords: business model innovation, public needs, research and development, space technology institution

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1. Introduction

Innovation in business models, especially related to technology, has been widely discussed in previous studies, such as by Chesbrough (2007a), Gambardella and McGahan (2010) and Spieth et al. (2014). Business models have become a very important tool for financial institutions to "commercialize new ideas and technologies" (Chesbrough, 2010). Every institution has a business model, but not all are well materialized into "profitable" activities. This also happens to national institutions, especially in research and development in Indonesia. Government's interests are interpreted when all efforts made by the agency are in line with public needs while the public interest is steadily increasing. Activities carried out at these institutions often do not address the public needs because the businesses are not carried out according to the community's needs. This was reported in the study by Dutta & Lanvin (2020), who explained that Indonesia, especially on the people pillar, second sub pillar: businesses, R&D expenditure by businesses, is in the 81st position out of 134 countries in the world. This also affect impact pillar, especially on the sub pillar number 3, SDG contribution about SDG 3: Good Health and Wellbeing, which is still stranded in the 101st (in 2020, and 99th of 130 in 2021) of the world ranking and SDG 11 Sustainable Cities and Communities which is also still in the 45th (in 2020, and 52nd of 130 in 2021) of the world ranking.

Furthermore, it is also mentioned that Indonesia's value for adopting emerging technologies is still at the level of 4.04 or ranked 41st globally. The highlight of the application of technology and its impact on SDG achievement has also been reviewed by Pratistha (2018). The study suggested that the readiness of institutions in Indonesia to run their business must be improved in the way of explaining the business, running the business, and developing the business. These three elements were also mentioned in a study made by Spieth et al. (2014). They found that the need to increase connectivity should be directed to the fragmented communities in the innovation business model.

Table 1. The Network Readiness Index in Detail

Indicator	Rank and Score		
	2019 (Rank /121)	2020 (Rank /134)	2021 (Rank /130)
A. Technology pillar			
1st sub-pillar: Access			
Mobile tariffs	64 and 63,58	64 and 63,58	58 and 63.09
Handset prices	72 and 42.05	72 and 42.05	96 and 37.87
Households with internet access	68 and 63.96	70 and 66.13	61 and 78.27
SMS sent by population 15-69	-	-	11 and 87.86
Population covered by at least a 3G mobile network	-	-	74 and 99.38
4G mobile network coverage	61 and 92,70	62 and 92.70	-
Fixed-broadband subscriptions	71 and 48.04	73 and 48.04	-
International Internet bandwidth	75 and 66.84	76 and 66.91	1 and 100.00
Internet access in schools	-	-	-
2nd sub-pillar: Content			
Digital participation and content creation	-	-	
GitHub commits	-	88 and 1.68	87 and 1.52
Wikipedia edits	-	91 and 27.98	96 and 30.51
Internet domain registrations	-	-	-
Intellectual property receipts	75 and 0,16	-	-
AI scientific publications	-	-	18 and 66.91
Mobile apps development	81 and 49.79	85 and 54.47	85 and 67.98
3rd sub-pillar: Future Technologies			
Availability of the latest technologies	65 and 52,56	-	-
Adoption of emerging technologies	-	41 and 59.47	41 and 59.47
Government procurement of advanced technology products	12 and 69,87	-	-
Investment in emerging technology	28 and 59,63	28 and 62.78	28 and 62.78
ICT PCT patent applications	79 and 0,16	81 and 0.06	-

Indicator	Rank and Score		
	2019 (Rank /121)	2020 (Rank /134)	2021 (Rank /130)
Computer software spending	30 and 27,27	32 and 29.17	27 and 31.83
Robot density	47 and 1,56	47 and 1.56	49 and 1.33
B. People pillar			
1st sub-pillar: Individuals			
Internet users	96 and 33,37	100 and 38.28	-
Active mobile-broadband subscriptions	50 and 33,30	50 and 33.85	5 and 91.73
Use of virtual social networks	58 and 55,30	55 and 58.76	76 and 61.33
Tertiary enrollment	73 and 26,14	74 and 26.14	77 and 24.99
Adult literacy rate	43 and 93,31	43 and 94.44	41 and 94.44
ICT skills	53 and 20,07	49 and 60.88	41 and 49.98
2nd sub-pillar: Businesses			
Firms with website	108 and 2,47	115 and 12.77	111 and 12.73
GERD financed by business enterprise	-	-	80 and 9.81
Annual investment in telecommunication services	-	-	13 and 88.2
GERD performed by business enterprise	-	-	82 and 0.24
Internet Shopping	68 and 12,64	-	-
Ease of doing business	66 and 69,60	68 and 69.60	-
Professionals	115 and 1,14	99 and 13.78	101 and 13.84
Technicians and associate professionals	77 and 25,70	106 and 12.63	108 and 11.66
The extent of staff training	28 and 64,35	-	-
Business use of digital tools	-	35 and 75.86	-
R&D expenditure by businesses	77 and 0,54	81 and 0.42	-
3rd sub-pillar: Governments			
Government online services	90 and 52,30	71 and 67.28	70 and 67.28
Publication and use of open data	38 and 38,35	38 and 38.35	38 and 38.18
ICT use and government efficiency	28 and 63,27	-	-
Government promotion of investment in emerging technologies	-	24 and 60.62	24 and 60.59
R&D expenditure by governments and higher education	75 and 17,79	72 and 21.25	72 and 21.25
C. Governance pillar			
1st sub-pillar: Trust			
Rule of Law	79 and 46,15	-	-
Software piracy rate	93 and 8,11	-	-
Online trust and safety	3 and 93,00	-	-
Secure Internet servers	61 and 61,06	60 and 59.28	58 and 60.15
Cybersecurity	43 and 83,00	43 and 83.21	31 and 94.79
Online access to the financial account	-	94 and 14.96	91 and 14.96
Internet shopping	-	69 and 12.64	67 and 12.64
2nd sub-pillar: Regulation			
Regulatory quality	75 and 49,84	76 and 49.84	75 and 38.58
ICT regulatory environment	90 and 71,24	95 and 71.24	121 and 56.47
Legal framework's adaptability to emerging technologies	27 and 69,60	36 and 55.08	36 and 55.08
E-commerce legislation	1 and 100,00	1 and 100.00	1 and 100.00
Social safety net protection	41 and 56,11	-	-
Privacy protection by law content	-	65 and 34.22	91 and 56.29
3rd sub-pillar: Inclusion			
E-Participation	86 and 56,69	56 and 74.07	56 and 74.07
The socioeconomic gap in the use of digital payments	97 and 41,34	105 and 41.34	101 and 28.66
Availability of local online content	45 and 62,23	45 and 70.21	45 and 70.21
The gender gap in internet use	75 and 46,91	78 and 46.95	80 and 48.52
The rural gap in use of digital payments	57 and 69,30	60 and 69.30	58 and 69.30
D. Impact pillar			

Indicator	Rank and Score		
	2019 (Rank /121)	2020 (Rank /134)	2021 (Rank /130)
1st sub-pillar: Economy			
High tech and Medium-high-tech industry	40 and 44.72	40 and 44.72	41 and 39.92
High-tech exports	56 and 15.19	60 and 15.19	46 and 38.17
PCT patent applications	86 and 0,01	86 and 0.01	94 and 5.71
The growth rate of GDP per person engaged	-	-	34 and 66.73
ICT services exports	-	-	93 and 14.48
Labour productivity per employee	76 and 15,60	85 and 15.38	-
Prevalence of gig economy	-	16 and 73.20	16 and 73.20
2nd sub-pillar: Quality of Life			
Happiness	75 and 47,55	83 and 52.15	82 and 46.24
Freedom to make life choices	36 and 81,23	49 and 83.45	47 and 83.27
Income inequality	66 and 65,53	72 and 61.86	66 and 64.58
Healthy life expectancy at birth	93 and 46,89	97 and 50.97	92 and 62.27
3rd sub-pillar: SDG Contribution			
Access to basic services	95 and 75,25	-	-
Pollution	42 and 88,89	-	-
Road safety	48 and 70,31	-	-
Reading proficiency in schools	42 and 66,42	-	-
Maths proficiency in schools	62 and 15,93	-	-
Use of clean fuels and technology	87 and 66,67	-	-
Good Health and Well-Being	-	101 and 47.54	99 and 47.54
Quality Education	-	72 and 20.12	70 and 19.51
Gender Equality	-	93 and 64.22	-
Affordable and Clean Energy	-	33 and 86.20	35 and 83.71
Females employed with advanced degrees	-	-	86 and 20.58
Sustainable Cities and Communities	-	45 and 75.94	52 and 85.16

Source: Network Readiness Index

Table 1 above reports the network preparation index for the cost of research and development in business, happiness, sustainable city and community. The application of Emerging technology is also important notes in previous studies. For example, Egger et al. (2012) stressed that research and development expenditures have been significant to ASEAN countries' economic growth and happiness. However, the failure of a research and development project is a common and scary issue in innovation processes and causes significant damage to companies (Cheng and Chen, 2011). Secondly, it is very important for countries where most research and development activities are still dominated by the country (more than 90%), such as Indonesia, to create a system to resolve and protect the industry that wants to allocate some of its money for research and development activities. Another aspect recognized in previous studies is also linked to sustainable cities and communities. The community also plays an important role. This is enhanced by a study conducted by Pratistha (2019), explaining that consumers are part of the community as intermediary manufacturers. They have the opportunity to determine the optimal market. Community aspects become very important here. Later, the association with sustainable cities was also the main topic of Stratigea et al.'s (2019) research, The study associated urban and happy environments. They also explain that reasonable indicators must be compiled to support decision-making planners and plans. Cities and sustainable communities are obviously a public demand (Höjer and Wangel, 2015; Cloutier et al., 2014). Another aspect of public needs is that emerging technologies are still deficient, especially in small and medium enterprises (Beekhuyzen et al., 2005). The public has limited access to technology (Mejias et al., 1997), which often occurs in emerging economic countries, such as Indonesia (Ejiaku, 2014), so the model should be changed (Newman et al., 2012) and begins from the Gil-Garcia et al. (2014) model.

The concept presented in this study refers to a business model that leads to public needs so that Research and Development expenditures, wellbeing, sustainable cities and communities, and adoption of emerging technologies can improve the business model implemented by institutions engaged in research and development (Agostini et al., 2020; Latronico and Pellegrini, 2019). Indeed, this cannot be separated

from existing resources that must be optimized and increased. The sharpening of the business model related to the four elements that manifest the public needs becomes state of the art in this study. No studies explain the application of these four elements simultaneously to produce the formulation of the forming elements in the business model.

Previous literature reviews on business models have attempted to categorize business model innovation research in different ways. Morris et al. (2005) defined three general categories related to economic, operational and strategic. Furthermore, Zott et al. (2011) focused their study area on e-business and the use of information technology, strategic issues, and innovation and technology management. Perkmann and Spicer (2010) found that transactional structures, value extracting devices and mechanisms for organizational structuring are the dominant business model conceptions. Demil and Lecocq (2010) explained the difference between static and transformational approaches to the business model concept. George and Bock (2011) also took the initiative to cluster them into six broad themes: organizational design, resource-based view, narrative and sensemaking, innovation, opportunity, and transactive structures. Furthermore, Schneider and Spieth (2013) categorize existing literature on business model innovation into three streams of research: (1) prerequisites of conducting business model innovation, (2) elements and processes of business model innovation, and (3) effects achieved through business innovation models. Spieth et al. (2014) also clustered roles into three things, (1) explaining the business, (2) running the business and (3) developing the business.

Table 1: Roles and Respective Categories of Business Model Definitions

Role	Associated terms	Authors (examples)
R&D expenditure by businesses	Applied Research	Coccia (2008)
	Financial Risks	Hill (1969)
	Grants and Procurement	Coccia (2011)
	Strategic Orientation	Engel et al. (2016)
	Business Innovation and Inventions	Huňady and Pisár (2021)
	Specialization	Guellec and van Pottelsberghe de la Potterie (2003)
Wellbeing	Achievement	Bass (1999); La Guardia, et al. (2000)
	Self-actualization	Bass (1999)
	The organization	Bass (1999), Dodge et al. (2012)
	Self-interest	Bass (1999); La Guardia et al. (2000)
	Individual preference	Ferrer-i-carbonell (2005)
	Survival	Bass (1999)
Sustainable cities and communities	Synergies	Bai et al. (2016)
	Inclusivity	Bai et al. (2016)
	Social-ecological–technological systems	McPhearson et al. (2016)
Adoption of emerging technologies	Limited resources	Amos (1982)
	Innovative and knowledgeable about IT	Beekhuyzen et al. (2005)
	Quality of access to suppliers of technology-related services	Scupola (2003)
	Government intervention	Scupola (2003)
	Pressure from buyers	Scupola (2003)
	Suppliers and competitors	Scupola (2003)
	Manager characteristics	Harker and Van Akkeren's (2002)
	Return on Investment (ROI)	Harker and Van Akkeren's (2002)
	Firm characteristics	Harker and Van Akkeren's (2002)

Research and development expenditures subjected to such volatility are more challenging to manage and control. The mismanagement of R&D projects can lead to situations in which R&D projects continue to absorb resources without ever delivering the intended benefits (Cheng and Chen, 2011). R&D Expenditure's actors here are public and private (Coccia, 2008; Rakhel et al., 2021). One study also explains that one dollar of direct government funding to business generates a $0.70 marginal increase in business-funded R&D – $1.70 in total R&D (Guellec and van Pottelsberghe de la Potterie, 2003). The impact is even felt in industries related to chemicals, electronic components and communications equipment, electrical equipment and office machines in emerging countries (David et al., 2000; Falk, 2004; Szarowská, 2017). Thus, it is obvious that R&D has an impact in all aspects and is highly oriented to public needs because it also contains elements of wellbeing (Campbell and Guttel, 2005). Also, there are consequences for business innovation and inventions (Huňady and Pisár, 2021).

Campbell and Guttel (2005) and Bass (1999) explained the wellbeing aspect. They found that the wellbeing is closely related to achievement, self-actualization, the organization, self-interest, and survival. One of them is influenced by R&D activity. Greater security in people's general attachment has been

associated with greater wellbeing (La Guardia et al., 2000). They also argued that wellbeing is synonymous with meeting needs. Another study also found that wellbeing depends on the individual's income and the income of the reference group. The reference group can include all members of a society or only a subgroup (Ferrer-i-Carbonell, 2005).

The smart city concept has been largely conceived as a new ICT-enabled approach for sustainable urban development and is constantly gaining popularity among various cities around the globe (Komninos et al., 2016). The sustainable development of cities (and communities) is increasingly recognized as crucial to meeting collectively agreed sustainability goals at local, regional and global scales and, more broadly, secure human wellbeing worldwide (Bai et al., 2016). Synergies and inclusivity are needed. Furthermore, a systems approach is economically sustainable as it is inclusive of different types and a wider range of economic values attached to goods and services provided by urban system functions. A systems approach begins with a sound understanding of the genesis of current systems, social structure, economic, ecological, political, and dynamics within and beyond the city (Bai et al., 2016; McPhearson et al., 2016). Solutions derived from the systems approach are not fixed in time or space but need to be flexible to account for new challenges and opportunities (Leichenko, 2011).

Some new challenges and opportunities that affect sustainability are closely related to technology and the implementation of innovation. Thus, the application of technology and innovation must be in line and ensure the sustainable development city (McPhearson et al., 2016). Furthermore, their study also emphasizes the influence of technology and innovation on sustainable communities. Communities become a very crucial factor. Power (2004) found that the sustainable community plan tackles main issues like the need for higher quality homes set in safe and attractive neighbourhood environments. Government's R&D activities have the potential to cause air and noise pollution. For this reason, it is necessary to make remote areas the central locations for R&D activities, especially the sensitive technology testing. The government should make communities central to its overall growth and development strategy. Power (2004) also found that there are four essential measures of building blocks for sustainable communities. 1) Planning, design, density and layout will influence the shape of a community, the level of services and the way people interact with each other and their environment; 2) minimizing energy use and environmental impact contributes to sustainability, helps combat global warming and encourages 'long-term stewardship of' communities; 3) a viable local economy and services provide the rationale and underpinning for community development and survival; 4) community organization and neighbourhood management are essential to social networks and urban viability, ensuring well maintained, safe conditions which are the prerequisite of stable, long-term, participative and cohesive communities.

Technology adoption is affected by several factors, often being influenced by at least one (and often many) of the factors presented by MacGregor et al. (1998). The factors include limited resources (Amos, 1982), innovation and knowledge about IT (Beekhuyzen et al., 2005), quality of access to suppliers of technology-related services, government intervention, pressure from buyers, suppliers and competitors (Scupola, 2003), and manager characteristics, Return on Investment (ROI), Firm characteristics (Harker and Van Akkeren, 2002). Steers et al. (2008) found that local culture will be another challenge in technology adoption. They also explained that technology is both powerful and prospective, and nations that shy away from widespread technology adoption often curtail their national competitiveness and their standard of living.

Other components can be considered to make the company profile complete in the business model. These other components are complementary to the previous literature review. The theory presented by Spieth et al. (2014) is part of the big picture of the business model, especially regarding the value proposition. However, other components that should be included in the business model besides the value proposition are key partners, key resources, cost structures, revenue streams, channelling, customers, main activities, and products. The business model becomes more oriented towards innovation and sustainability by sharpening the value proposition (Spieth et al., 2014).

2. Methodology

This study aims to construct theory by forming the necessary elements to build a business model based on public needs. The outcome of this study can answer the need to improve the business model commonly used in research and development institutions in Indonesia, especially in space technology

institutions. The unit of analysis in this study includes the space technology institution, while the unit of observation is the management. This study uses a literature review to build a theoretical framework based on a business model on the issue of innovation. The primary literature in this study comes from the gaps in the results obtained from Spieth et al. (2014) study, especially on how to run a business. The study found that the need for a stakeholder perspective and exploratory innovation or exploitative innovation in a business model canvas also explains organizational design and values.

Furthermore, after the literature review, the author also conducted secondary data mining to present benchmarking for applying business model innovation carried out by four similar institutions abroad. To validate the results, the author also made observations. Observation is an activity of observing the company's activities related to the problem being researched, especially concerning the studied variables, by conducting direct observations to obtain more accurate information. Creswell (2014) explains that observation is very good for identifying the unit of analysis used as the object of research. The closeness of a researcher with his unit of analysis can be an advantage in subjectively justifying the images captured through his five senses. In this study, observations were made on a small part of the use of Indonesian space research and development products. This study was carried out in stages in the form of an overlay process between secondary data and theory that can complement each other to provide complete information to the research object.

3. Results and Discussions

The current business model innovation focuses on research and development, creating the regulation, giving products and services, and customer relationships (Aeronautics and Space Research Organization [LAPAN], 2020). These four aspects have so far provided evidence of an impact on national development (but only for fellow government agencies and have not had a direct impact on end-users, in this case, the community), such as agriculture, forestry, finance, marine, energy, transportation, defence sectors, security, social, industrial, education, public works, and tourism. The role of space technology in the agricultural sector can be seen from a technological solution in the form of LAPAN Surveillance Unmanned (LSU) Drone Precision Farming which helps overcome the nation's problems, especially related to seed distribution and spraying of plant pests. The presence of LSU Drone Precision Farming is also able to answer issues related to the decline in labour interest in the agricultural sector so that the limited workforce can be replaced with technology and crop yields from agriculture remain optimal. Furthermore, the information provided from the processing of remote sensing data and space and atmospheric science data can help the planting and harvesting periods so that precision and the cycle of work processes to fertilizer distribution becomes better. In the forestry sector, Indonesia currently has a key technology in the form of very high-resolution image data[1]. It can assist the decision-making process regarding the quality of forest plants. Space technology can provide information support related to finance, such as calculating potential state tax revenues, which has been ongoing since 2013. Space technology has also contributed to the energy sector (through remote sensing information) to increase the electrification ratio and distribute electricity to villages that are yet to get electricity, such as in Eastern Indonesia. Furthermore, space technology also plays a role in transportation, such as research related to decision-making systems on aviation and navigation safety and innovative products such as N-219 and N-219A to ensure connectivity between remote islands with runways. The manned aircraft technology is also expected to fulfil passenger seat capacity and accommodate the increase in domestic and foreign tourist traffic.

Space technology also contributes to defence and security sectors such as decision-making systems for radio communications, remote sensing satellite imagery, rocket technology for special uses, LAPAN-A2, A3, and A4 satellite-based monitoring. These technologies support the national defence system from land, sea, and air crimes. Space technology also assists the social sector, where remote sensing data and drones have provided solutions to help map poverty areas, environmental conditions for poor families, and the potential that can be developed. In the industrial sector, designing and building space technology has also stimulated the growth of related industries such as manned and unmanned aircraft components, rocket raw materials, and remote sensing data and information processing industries. Its design process also stimulates the growing interest and potential of the education sector

[1] Procurement of national remote sensing image data through one door policy through LAPAN can increase cost efficiency up to 12 Trillion Rupiah/Year (Center for aeronautics and space policy studies (Puskkpa, LAPAN) (2017)

through work schemes based on work breakdown structures to technical cooperation in the Academy, Business, and Government (ABG). Another sector that also feels the impact of space technology is public works, where the implementation and performance of almost all national strategic infrastructure projects can be monitored through remote sensing satellite imagery, both high and very high resolution. Furthermore, another development sector (but not the last) is tourism, the spirit of space tourism based on local economy and culture continues to be explored and is now entering into several more concrete projects, one of which is the construction of a national observatory in East Nusa Tenggara, which is expected to grow the interest of domestic and foreign tourists to travel based on space information (for example, dark skies at night). In addition, national space technology also plays a role in efforts to reduce the impact of losses due to natural disasters through a disaster early warning system. At least, this is what continues to be a concern for stakeholders nationally.

LAPAN (which is integrated into the National Research and Innovation Agency (BRIN)) as one of the institutions involved is currently focused on efforts to produce low orbit communication satellites that will be operational in the full constellation by 2024. Significantly, the contribution of this technology will accelerate the dissemination of information in the event of a disaster from 5 minutes to 3 minutes, and the economic value of this project can save foreign exchange costs for satellite communications of no less than 121 million USD per year. Space technologies also help mitigate and deal with disaster impacts through remote sensing data to monitor hotspots during forest and land fires and the health of lake, coastal and marine resources. Data and information that is no less important is the monitoring of space objects through space science data and information, which also plays a role in efforts to mitigate disasters from outer space such as the solar storm that occurred in 2012. Table 2 below describes the comparison of business model innovation in similar institutions.

Table 2. The Comparison of the Application of Business Model Innovation in Similar Institutions

No.	Institution	Application of Business Model Innovation
1.	Indian Space Research Organization (ISRO)	ISRO applies innovation to the business model by including it in the value proposition that allows them to satisfy a specific need for a specific user. Furthermore, they also place strategic partnerships into value creation and share value with stakeholders in the column of value appropriation. Uniquely, they also put public awareness into value discovery (Angeli and Jaiswal, 2016).
2.	The National Aeronautics and Space Administration (NASA)	The key strategies included establishing strategic relationships to leverage the resources of others and developing a forward-looking and flexible (and more collaborative) business model that would transform the Human Health and Performance Directorate (HH&P) into a learning organization more adaptable to change (Davis, et al., 2015).
3.	The GE Aircraft	The GE Aircraft engines unit crafted an innovative value proposition when they shifted from selling airline jet engines to selling flight hours. This shifted the risk of downtime from the airline customer to GE, and enabled GE to establish a very profitable service operation.
4.	Space Economy Startups in Emerging Industries	They defined several business model building blocks for private investments and new economic growth policies.

Note: processed by the author from various sources

Referring to the explanation presented about the current business model innovation and empirical evidence, space technology implementation needs to consider business models that are much more comprehensive and accommodative to the public needs. The discussion below is also a continuation of the study conducted by Spieth et al. (2014), especially on how to run a business. Their study explained the need for a stakeholder perspective and exploratory innovation or exploitative innovation in a business model canvas that also explains the design and value of the organization. For this reason, this study aims to complement and explore the innovation so that the business model can be more applicable and provide added value to the larger public. This is certainly a big goal for the object of this study, the government research institute.

3.1. R&D expenditure by businesses

The author's long experience of being involved in every business pattern in government research institutions encourages the need to develop current business models. The author realizes that businesses' aspects of R&D expenditure are fundamental when running a business. Since every activity still uses state resources, it is necessary to encourage business actors to ensure everything is in line. These business actors play a

crucial role considering that they are the closest to the market, and development often ideas can come from them. Many heads of work units also conveyed this in various focus group discussion sessions. For example, the 2020-2024 National Research Priority failed because of its inability to identify the end-user's needs. As a result, businesses are reluctant to involve their resources to support R&D.

George and Bock (2011) explained that the use of R&D expenditures by businesses could even encourage the creation of entrepreneurship research. Simply put, entrepreneurship can encourage activities that are more based on public needs. This is also reinforced by studies conducted by Alizadeh et al. (2018) and Falk (2006), explaining that research and development (R&D) in the business sector has a critical role in a knowledge-based economy because it results in commercialization and wealth creation with a high probability. The use of this aspect in the run the business element also allows the application of an open business model. Open business models enable an organization to be more effective in creating as well as capturing value. They help create value by leveraging many more ideas because of their inclusion of a variety of external concepts (Chesbrough, 2007b) and developing more outward-looking strategic approaches to research and development to source at least some knowledge of potential value from the broader environment in which they operate (Mina et al., 2014). Referring to empirical studies and experiences, the author believes that R&D expenditure by businesses is a crucial element in exploring the entrepreneurial potential for research actors. The pattern of activities to be carried out can be more oriented to public needs.

3.2. Wellbeing

The exploration of this wellbeing within the framework of a business model has been studied in previous studies. Stubbs and Cocklin (2008) explain the importance of this element to support the business model's sustainability. Their thinking is based on structural changes to the socioeconomic system (such as redesigning transportation and taxation systems) and cultural systems (such as attitudes toward consumption and economic growth). In another study, Harter et al. (2003) also explained that the application of wellbeing also impacted business outcomes. In the context of government research institutions in Indonesia, outcomes here can mean that all services provided are beneficial for the affected community, which is the public. Thus, the understanding of wellbeing meaning in the context of running the business must be reaffirmed as an element of the public that must be understood so that research activities are in line with matters related to improving the public's wellbeing. To ensure this, research institutions must understand market conditions related to business cycle volatility (Wolfers, 2003).

Synergy in the use of resources between government R&D and businesses ultimately has implications for wellbeing. An interesting issue is the ability to maintain the consistency of actors in the ecosystem. The implication concludes in end-user engagement with the resulting product. LSU, which is very good at solving the problem of labour shortages in the agricultural sector, should be consistently used, for example, in smart farming, which can be extended to all agricultural lands in Indonesia. However, this technology is less massively utilized, so end-users or communities do not directly feel the meaning of wellbeing for the abundance of agricultural products. Consistency is an obstacle that must be resolved immediately.

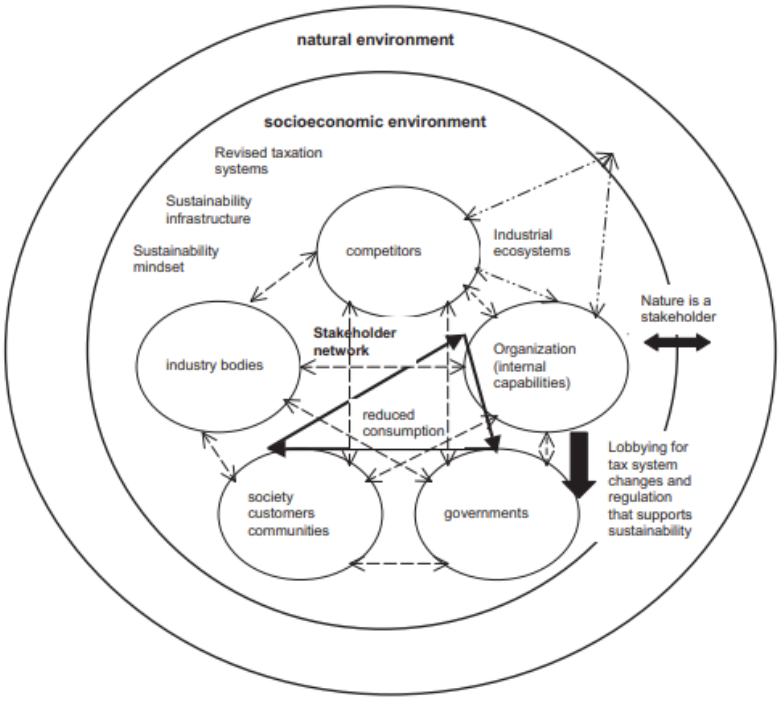

Figure 2. An Illustration of a Systems-Based Sustainability Business Model, adopted from Stubbs & Cocklin (2008).

Organizations can make significant progress towards achieving sustainability through their own internal capabilities. Changes to the socioeconomic system, both structural (such as taxation systems) and cultural (such as wellbeing), are required to facilitate firm-level and system-level sustainability. An organization adopting an SBM develops internal structural and cultural capabilities to achieve firm-level sustainability and collaborates with key stakeholders. At the systems level, an SBM is characterized by ubiquitous sustainable infrastructure such as sustainable renewable energy facilities and ecological tax reform systems. This requires changes in legislation and regulation, a "sustainability mindset" in society, and collaborative partnerships among stakeholders (such as organizations, competitors, industry bodies, governments, communities, NGOs, the media, and financial markets) to promote and develop sustainable infrastructure at a local and global level. Planning and implementing a system-based SBM requires the involvement of all stakeholders. A stakeholder network based on stakeholder collaboration aimed at improving the environment and society and traditional value creation is appropriate to support the development and implementation of the overall system vision, mission, strategy, planning and tactics. The structure can be a system that facilitates the achievement of sustainability. In industrial ecosystems (for instance, the space technology industry in Indonesia), companies closely coordinate the management of raw materials, energy, water, and waste management. The interdependent material and energy flow of the components is analyzed to reduce the environmental impact of the entire system. Consistent with the stakeholder network approach, Figure 2 does not place the organization at the centre of the network where multiple stakeholder relationships must work. There are no central nodes in the network, and the organization is just one of the participants in the network. Within SBM, many entities interact to achieve system sustainability. SBM operates and interacts within the broader socioeconomic system and natural environment. Figure 2 shows only the selected stakeholders and additional stakeholders, and their interactions need to be added to this model, such as non-governmental organizations (NGOs), media, upstream and downstream stakeholders in the supply chain, financial markets, and investors.

3.3. Sustainable cities and communities

Cities and communities today show a growing concern about sustainability issues, and they are increasingly trying to find means to preserve natural and economic resources (Ahvenniemi et al., 2017). A few companies and government bodies around the world have begun to explore the creation of "ecocities"—a term that overlaps and is sometimes used interchangeably with "smart cities" or "sustainable cities" (Alusi et al., 2011). In their study, Ordonez-Ponce et al. (2021) explain that sustainable cities and communities are also part of the organization's partnering efforts with their communities. Thus, the identification of community needs can be explored better and with precision. Aluchna and Rok (2018) called it a collaborative economy. It is not uncommon for collaboration to be considered a measure of success (Clarke, 2017) and can be used for schemes for its implementation in government R&D agencies. Performance measurement systems suggest that smart cities' initial target, defined as attaining sustainability of a city with the help of modern technologies, is not sufficiently addressed in some of the smart city frameworks (Ahvenniemi et al., 2017). While environmental sustainability is an essential target of smart cities (European Commission, 2012; United Nation Task Team, 2015), environmental indicators are clearly underrepresented in the smart city frameworks. Referring to the information obtained by the author from the research and development implementing unit at LAPAN, it is clear that R&D requires a review of this aspect in the run of the business so that the use of technology can positively impact cities and communities as part of the ecosystem.

In the indicative planning document for the development of the State Capital, smart cities and communities are part of the development targets that must be carried out. The use of space technology is very crucial in supporting this target, starting from disaster mitigation, which can reduce losses, the digital lifestyle supported by satellites, sustainable development supported by spatial-based development planning using remote sensing technology based on very high-resolution satellite imagery data, and smart patrol to improve city security through LSU Drone technology.

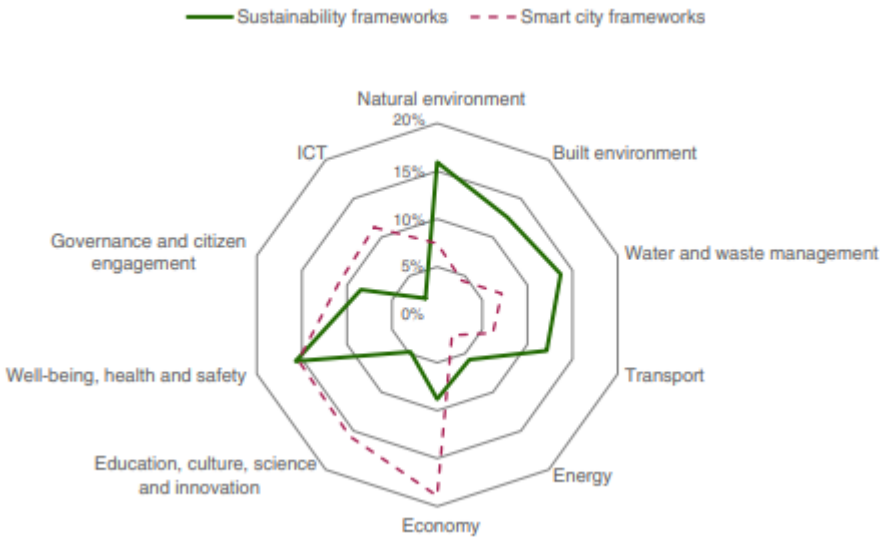

Figure 3. Indicators of Smart City and Urban Sustainability Frameworks under Ten Sector Categories, adopted from Ahvenniemi, H., Huovila, A., Pinto-Seppä, I., & Airaksinen, M. (2017).

3.4. Adoption of emerging technologies.

The adoption of emerging technologies causes the overall changes in the business model (Sharma and Khanna, 2020; Karimi and Walter, 2016; Kamoun, 2008), so R&D agencies need to pay attention to public needs. Further exploration of this concept in the business model was also reported by Schiavi and Behr (2018). Measuring the user's ability to adopt technologies is an issue in Indonesia and causes the product to have less added value. For this reason, in 2020-2024, the government has intensively emphasized the need for technology that is able to improve the quality of processing so that community products can have higher added value. Recently, the National Research and Innovation Agency, for example, in a number of meeting agendas with the House of Representatives, has worked closely to seek appropriate technology that the public could directly feel. This is a very significant discussion and it is expected that the growth of the processing industry can increase and reach the target by the end of 2024.

Furthermore, the author's experience also contributes to the need concept to include this variable in the business model, considering the use of elements of technology, especially aerospace, in the community development sector is still minimal. The low literacy in technology is suspected to be the main factor. Low technology literacy constrains the application or adoption of emerging technologies . This is reinforced by a recent survey from the Directorate of Policy for Economic, Manpower, and Regional Development (2022) which explains that technological literacy is still an obstacle for most Indonesians.

Presidential Regulation Number 59 of 2017 concerning Sustainable Development Goals (SDGs), including the down streaming of R&D products, is growing, and R&D is required to to build partnership networks (R&D and/or funding) with external parties (government and private agencies). In the 2020-2024 period, LAPAN seeks to support the SDGs through Remote Sensing products for Protected Area Data, Pollution Prevention, Disasters, and Utilization of Natural Resources. In addition, LAPAN also produces Micro Satellite and remote sensing models. Those products were developed with the hope of obtaining support from businesses to adopt the emerging technologies so that they can provide benefits for the wellbeing and sustainable cities and communities.

Conclusions

The business model needs to have supporting elements that will greatly explain the involvement of these elements, such as research and development spending by businesses, welfare, sustainable cities and communities, and adoption of emerging technologies. Through these four elements, the knowledge gap to bring research and development activities closer to the community's needs will get better. The results of this study are to extend and close the gap in the concept proposed by Spieth et al. (2014), especially on how to run a business. In terms of research and development expenditure by businesses, it becomes an important variable in running a business because the business sector will be able to encourage the creation of commercialization and wealth with a high probability. Regarding wellbeing, a crucial point that needs to be noted here is that government research institutions need to pay attention to the volatility of the business cycle, as stated by Wolfers (2003). This element is important so that public needs become more attainable and facilitated. This can be achieved in the form of detailed research and development plans and the preparation of a platform for disseminating the results to the public or business people. Furthermore, the term collaborative economy (Aluchna and Rok, 2018) is important to ensure the sustainability of cities and communities. To ensure sustainability, it is necessary to establish partnerships, as described by Ordonez-Ponce et al. (2021). A transformation process is needed to encourage the adoption of emerging technologies. As explained earlier, the adoption and technology literacy process will be better with this transformation, at least for non-government business actors. Future study should focus on economic parameters such as return of investment (ROI) and cost and benefit analysis (CBA) to support sustainable development in ASEAN countries.

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