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Word Cloud Analysis and Business Model of Science Techno Park in Indonesian Universities

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A B S T R A C T

The government issued a presidential regulation on national entrepreneurship development to strengthen the economic structure, and the government will add 1 million entrepreneurs. Universities play an essential role but must involve the industry and create a conducive environment. Science Techno Park unites the sector and academia by providing an environment that fosters interaction. Presidential Regulation No. 18 of 2020 mandates the establishment of Science Techno Parks based on higher education institutions. We studied the future of science and technology parks in Indonesia by analyzing news articles from websites between 2019 and 2024. The results of the word cloud analysis showed that the word "technology" was the most frequently encountered during coding, followed by "science," "research," "zone," and "innovation," which are the main elements of the STP. From the business model canvas, the most expansive customer segments include students, alums, researchers, startups, and industry. The value proposition is oriented towards technology in line with the university's competencies. The conclusion of the business model for science technoparks in Indonesian universities is in the development stage, with a focus on strengthening the ecosystem through innovation and industry collaboration.

A R T I C L E I N F O

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INTRODUCTION

To prepare Indonesia for the phase of a developed country, the government issued Presidential Regulation (Perpres) No. 2 of 2022 on the development of national entrepreneurship in 2022. According to the explanation of the Minister of Cooperatives and Small and Medium Enterprises (Menkop UKM), this presidential regulation aims to strengthen the economic structure, and the government will add 1 million newly established entrepreneurs. Indonesia needs to continue increasing the number of young entrepreneurs in order to become a continuously developing country. According to the Project Leader of Growth Indonesia, a Triangular Approach (GITA), a European Union capacity development program in higher education projects operating at the national, regional, local, and institutional levels focusing on entrepreneurship, universities play an essential role in fostering an entrepreneurial spirit. Indonesia is still far behind other countries regarding entrepreneurs born from higher education institutions. The entrepreneurial ecosystem is important and requires collaboration between higher education institutions, industry, and the government (Sari, 2023).

The involvement of industry in the process of preparing graduates to become entrepreneurs, because the beliefs of academics and industry represent two different worlds that often do not align with each other, is the beginning of the gap between academic knowledge and industrial technology. In addition to industry involvement in the learning process, a conducive environment for academics and practitioners is needed. The implementation of STP is considered a comprehensive solution that can be pursued and is a center of excellence that can collaborate with the government, academia, community, and business (Kusharsanto & Pradita, 2016). Science Techno Park (STP) unites industry and academia by providing an environment that fosters interaction between research institutions and companies (Dierdonck, Debackere, & Rappa, 1991). According to the International Association of Science Parks/IASP (2002), STP is a special area that is professionally organized with the aim of improving the welfare of the surrounding community through the utilization of science and technology and a culture of innovation that is integrated with business and educational activities.

The government has the National Medium-Term Development Plan (RPJMN) 2015-2019, which, among other things, includes the development and expansion program of Science and Technopark (STP) throughout Indonesia as one of the national priorities. In 2016, the government, in the Draft Government Work Plan (RKP), announced the initiation of the construction and development of 100 Science and Techno Parks (STP) throughout Indonesia (Muhammad, Faisal, Anindito, & Muhyiddin, 2017). The government's initial program was the 100 STP Program, but operating and maintaining STPs is far more challenging than establishing them. According to the Director General of Institutional Science and Technology of Dikti, it takes 28-35 years for the STP to be fully completed. Since 2016, the Ministry of Research, Technology, and Higher Education, along with other ministries and agencies, has reduced the target from 100 to 22 STPs (Alamsyah, Zulhamdani, & Asmara, 2018).

According to (Muhammad, Muhyiddin, Faisal, & Anindito, 2017) who visited 7 STP locations, it was found that most of the 100 planned STPs could not be categorized as STPs, both in terms of the completeness of components (area, professional management, knowledge sources, ideas and discoveries, technology and innovation-based start-up companies, incubators, industry) and the processes within the STPs. This is because most STPs are merely forms of SME development, technology dissemination, and demonstration plots of research results, or in the form of workforce training centers. It is necessary to disseminate understanding and standards regarding the STP concept to support the sustainable implementation of STPs and the achievement of STP programs.

In Table 1 below is a mapping of the STP components at the selected locations

Table 1. Mapping Science Techno Park

No	Name	Owner/ Inisiasi	Pengelola Spesialis/ Profesional	Training/ Workshop	Inkubator / Bisnis	Industri in-wall	Knowledge Source (Innovation)
1	PUSPITEK Serpong	Pempus	X Pempus	√	√	√	√ LIPI, BPPT, BATAN
2	Pusinov LIPI Cibinong	Pempus	√	X	√	√	√ LIPI
3	Bandung Techno Park	PTS/Yayasan Telkom	√	√	√	√	√ Universitas Telkom
4	Solo Techno Park	Pemkot Solo	√	√	√	√ Esemka	√
5	IKITAS Semarang	Komunitas/ Swasta	√	√	√	√	√
6	BDI Tohpati Denpasar	Pempus	√	√	√ embrio	√	√
7	START Surabaya	Swasta	√	√	√	√	√
8	Technopark Kaur Bengkulu	Pemkab dan LIPI	√	√	√	√	√
9	PPK Sampoerna	Swasta	√	√	√	√	√
10	Bandung Innovation Park - ITB	PTN	√ (masterplan)	√ (masterplan)	√ (masterplan)	X (masterplan)	√ (masterplan)

The development of STPs in Indonesia is reinforced by Presidential Regulation No. 18 of 2020 concerning the National Medium-Term Development Plan (RPJMN) 2020-2024, which mandates the establishment of several university-based STPs as a model for STP acceleration and is part of a major project to promote national innovation and competitiveness growth. Based on the website of the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek), the Directorate General of Higher Education, Research, and Technology (Ditjen Diktiristek) launched the Promoting Research and Innovation through Modern and Efficient Science and Technology Parks Project (PRIME STeP) on February 27, 2023, to support the development of STPs at 4 State Universities with Legal Entities (PTN BH) in Indonesia. The four universities involved in PRIME STeP and supported by the Asian Development Bank (ADB) are Bogor Agricultural University, Bandung Institute of Technology, Gadjah Mada University, and the University of Indonesia. The three main focuses of PRIME STeP are the enhancement of research facilities, development, and innovation. With this support, it will be beneficial for students to conduct various research and development activities, as well as to develop an entrepreneurial ecosystem.

With the collaboration of PRIME STeP and support from ADB, Indonesian universities are expected to create more successful startups from incubation results so that the incubator contributes revenue to the universities from paid services to successful startups. This collaboration can also create job opportunities generated by startups, resulting in patents and licenses. The existence of this collaboration has a wide impact on the development of Indonesia's industry and economy in the future, not only on the entrepreneurial ecosystem. Ultimately, the university science and technology parks (STP) will support the implementation of a national economy based on innovation and technology, as outlined in the Major Project RPJMN 2020-2024, thereby helping Indonesia realize its aspiration to have superior STPs that can produce a variety of competitive innovations and technologies. This is in line with research (Link & Scott, 2006), where science parks closer to universities with a focus on specific technologies – particularly information technology, and operated by private organizations grow 8.4% per year faster than average.

Looking at the development conditions of STPs in Indonesia, the question arises: What is the future of science and technology parks in Indonesia? To

answer that question, research was conducted focusing on news about science and technology parks in Indonesia through websites from the period 2019 to 2024, conducting literature studies, and benchmarking several STPs at Indonesian universities. The data obtained is then processed using the word cloud method and the creation of a business model canvas, allowing for predictions about the future of science parks in Indonesia.

As stated in Presidential Regulation No. 2 of 2022 concerning the development of national entrepreneurship, Indonesia is at an important stage in achieving developed country status. The addition of one million new entrepreneurs is the government's target, with universities playing a strategic role in building the entrepreneurial spirit of the younger generation (Siregar, 2022). Indonesia still lags behind other countries in terms of the emergence of entrepreneurs from higher education institutions, despite the involvement of universities. This highlights a significant gap requiring collaboration between universities, industry, and government within the entrepreneurship ecosystem.

The integration of academia, industry, and government is considered a comprehensive solution through the Science and Technology Park (STP) collaboration center. The government's large-scale program to build 100 STPs since 2016 has seen many STPs constructed that do not meet operational standards and ideal functions, often focusing solely on SME development and workforce training without fully leveraging innovation and technology potential (Muhammad, Muhyiddin, Faisal, & Anindito, 2017). This indicates a gap between the ideal concept of STPs and their actual implementation on the ground.

According to research conducted (Alamsyah, Zulhamdani, & Asmara, 2018), the challenges of operating and maintaining STPs in the long term have not been thoroughly studied, given the waiting period of 28–35 years to achieve full self-sufficiency. Support from the PRIME STeP program and collaboration with international institutions such as the ADB only began in 2023, so the impact and effectiveness of these initiatives on startup development and the innovation ecosystem in Indonesia remain limited and require further evaluation. This research will fill this gap by comprehensively analyzing online news content, literature studies, and STP benchmarking at Indonesian universities during the 2019-2024 period. Using content analysis and business model canvas methods, this research aims to provide an up-to-date overview and future predictions for STP development in Indonesia, particularly in the context of increasing entrepreneurship and sustainable innovation. This research is important for understanding the inhibiting and supporting factors that can form the basis for future STP development policies and strategies.

LITERATURE REVIEW

Science Techno Park (STP)

Talking about STP cannot be separated from Stanford Research Park, which marks the beginning of STP in 1951. Initially, Frederick Terman (the Dean of Engineering at Stanford University) saw the potential and envisioned a university focused on research and development affiliated with the business district (industry and the City of Palo Alto) to advance mutual interests. This affiliation could become a beacon for high-quality new scholars and faculty, providing jobs for college graduates and generating income for the university and the community, thereby stimulating regional economic development. After Stanford Research Park, Cornell Business and Technology Park emerged, and in 1959, Research Triangle Park was established (Y. Zou, 2013). The success stories of STPs in America, such as Silicon Valley in California and Route 128, were attempted to be replicated by other countries like England (Cambridge) and France (Sophia Antipolis) in the late 1960s (Koh, Koh, & Tschang, 2005). Silicon Valley also inspired the Hsinchu Science Park STP in Taiwan in the 1980s to encourage the emergence of small and medium-sized private companies, which have now become one of the most important STPs in the world (Yoon, Yun, Lee, & Phillips, 2015). In the early 1970s, the Republic of Korea undertook major initiatives to integrate the high-tech industry with its regional development strategy. The major initiative consisted of three phases: in the 1970s, the development of science cities; in the 1980s, the initiation of the Technopolis program; and in the 1990s, the

establishment of science parks or technoparks. After the ICT revolution, the established parks experienced faster job growth, tenants engaged in the development of more complex technologies, and tenants intensified their research activities (Link & Yang, 2018).

In Indonesia, the government inaugurated the national 100 STP program as outlined in the National Medium-Term Development Plan (RPJMN) 2015-2019. Based on the website of the General Election Commission, the 100 STP Program is point number six of the nine priority agendas (Nawa Cita, towards a politically sovereign Indonesia, economically independent, and culturally distinctive) that aims to increase the productivity of the people and competitiveness in the international market so that the Indonesian nation can advance and rise alongside other Asian nations.

STP is an area that is physically adjacent to the government, industry, and academia (universities and R&D institutions) that facilitates the transformation of knowledge into innovative products with commercial value (Pitaloka & Humaedi, 2020). Science Park facilitates the commercialization of research and contributes to regional economic development, which has a significant impact on the global innovation ecosystem (Hrebennyk, Labunska, Hudakova, Litvinova, & Filipova, 2024).

To provide effective commercialization and attract large-scale investors, the location of the technology park must meet the following requirements: the availability of skilled labor; the presence of universities and other educational and research institutions in the area; the existence of an international airport and access to rail or water logistics (availability of transportation hubs) (Klyucharev, Tyurina, & Neverov, 2017).

In developing countries, STPs are expected to act as catalysts for development, helping the growth of new companies (surviving and gaining market share) and the consolidation of established high-tech companies (providing guidance for them to innovate their products and processes) (Bigliardi, Dormio, Nosella, & Petronic, 2006). On the website of the Ministry of Higher Education, Science, and Technology on November 22, 2023, it was stated that in the context of Indonesia, the development of STP areas has been initiated and is one of the strategic processes in industrialization that can be immediately utilized to promote the down streaming of research and technology results. Several studies related to STP have been conducted, but for STP in Indonesia, there is still a gap in understanding the development of sustainable and effective business models.

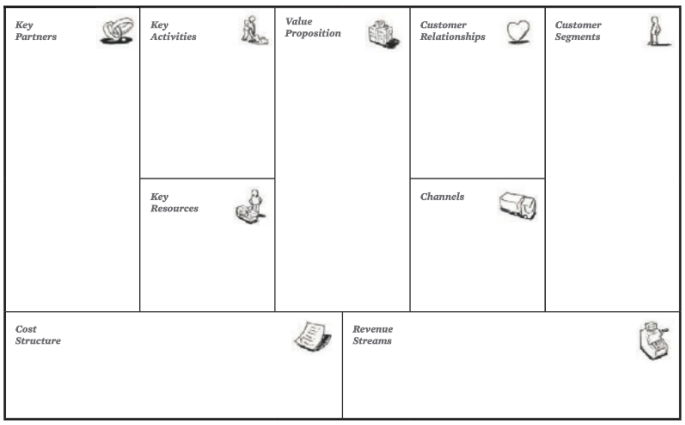

Figure 1. Business Model Canvas

The Business Model Canvas (BMC) was first introduced by Alexander Osterwalder and Yves Pigneur in 2010. According to (Osterwalder & Pigneur, 2010), the BMC is a strategic management tool in the form of a visual canvas used to describe, assess, and change a business model. BMC is

explained in detail through nine basic blocks that can be reasoned with logic regarding how a company makes money. There are four business areas in the Nine Blocks, namely customers, offerings, infrastructure, and financial feasibility. The nine blocks of the BMC consist of customer segment, value proposition, channel, customer relationship, revenue stream, key resources, key activities, key partnership, and cost structure. A customer segment is defined as one or several segments of large or small customers that the company wants to reach and serve according to the same needs, behaviors, or other attributes. Value proposition describes the value/benefits provided by the company to a specific customer segment derived from a collection of products and services. Channel explains how the company communicates and reaches its customer segments to deliver the value proposition to its customer segments. Customer relationship explains the type of relationship that the company wants to build with certain customer segments, which can range from personal to automated. The revenue stream represents the source of a company's income derived from specific customers, which involves two types of revenue streams: transaction revenue from one-time customer payments and recurring revenue from ongoing payments. Key resources describe the most important assets needed, such as physical, financial, intellectual, and human resources, to make the business model function and enable the company to create and offer value propositions, reach the market, maintain relationships, and generate revenue from customer segments. Key activities describe the activities that must be carried out by the company so that the business model can function and succeed well. Key partners describe the network of suppliers and partners to optimize the business model, reduce risks, or acquire resources so that the business model can operate. Cost structure describes the expenses incurred to operate the business model.

RESEARCH METHOD

The research conducted is descriptive in nature, using a content analysis approach to collect primary data from 100 online news articles published within the period from 2000 to 2024. Online news was chosen as the object of research because it has a wide dissemination range up to the global level. The collected data is then processed using word cloud analysis, which is a visualization of a collection of words that displays the size of each word according to its frequency of occurrence in a text or dataset (Ibrahim, Bakar, Harun, & Abdulateef, 2021). In addition to data from online news, it is supplemented with data collected during benchmarking STP at universities and secondary data from books and research journals related to STP and the business model canvas. These data are used to create the STP business model canvas from the top 5 universities in Indonesia.

Qualitative content analysis is used to systematically understand the content of media such as newspapers, radio, television, films, and others. Quantitative content analysis is a method used to measure various aspects of content with a data-based quantitative approach. The procedures applied involve measuring or calculating content aspects, which are then presented in quantitative form (Wicaksono, Mayangsari, & Aprianti, 2015).

In order to ensure the reliability and validity of the data, source triangulation was carried out by comparing the online news that had been analyzed with scientific literature and benchmarking results. In addition, experts in the field of campus innovation were involved by conducting peer debriefings to evaluate the interpretation of the analysis results. The use of standardized content analysis guidelines was used to maintain clarity of analysis categories and consistency in the coding process.

RESULT AND DISCUSSION

Based on the word cloud analysis in Figure 2, it is clear that the word “technology” is the most frequently used word during the programming process. This analysis confirms that the technological aspect in the narrative of Science and Technology Park (STP) development in Indonesia is its main element. This is in line with STP as a bridge between science and business in transferring knowledge and technology. This area contributes to strengthening the technology industry, supporting the development of technology-based companies, innovation-based companies, and fostering the emergence of spin-off organizations originating from universities (Lekashvili & Bitsadze, 2024).

In addition to the term “technology,” the term “research” also stands out because, in recent years,

businesses based on university research have emerged, including their contributions in supporting the government in addressing the COVID-19 pandemic. In the Indonesian context, universities have produced innovations such as the Flocked Swab HS-19 and Covent-20, which are research-based innovations and have made significant contributions in addressing the COVID-19 pandemic. This indicates that STP can play a strategic role in accelerating the commercialization of research outcomes into innovative products needed by society.

The next prominent term from the STP coding is "region." The term "region" indicates that STP development has a spatial dimension and is closely linked to regional development strategies. The four main keywords generated from this coding align with the definition of STP, as explained by experts. According to Bellavista & Sanz (2009), STP occupies an area used to promote integrated economic activities of companies, equipped with infrastructure and facilities supporting the production and commercialization of technology in innovative companies, startups, research institutions, and universities. STPs not only function as research and business incubation centers but also as drivers of regional economic growth through the provision of local innovation ecosystems. This aligns with national policies in the RPJMN and the development of the Regional Innovation System (SIDa), which promote the expansion of STPs to various strategic regions in Indonesia.

The emergence of the term "innovation" underscores the role of STPs as nodes within the national innovation ecosystem. The connection between STP and innovation can be seen in STP as a collaborative platform that brings together universities, industry, and government (triple helix) to develop innovative solutions with high added value. The four key words—technology, research, region, and innovation—reflect the synergy between academic, technological, regional economic, and national innovation policy aspects. According to (Lekashvili & Bitsadze, 2024), the establishment of STPs within the national innovation system is part of national policies and strategies aimed at developing science, technology, and innovation, while also promoting the transfer of innovative products to the market. Based on Presidential Regulation No. 106 of 2017 on Science and Technology Zones and Ministerial Regulation on Research, Technology, and Higher Education of the Republic of Indonesia No. 25 of 2019 on the Governance of Science and Technology Zones, Article 1 paragraph (1), a Science and Technology Zone is defined as a professionally managed facility for developing and promoting sustainable economic growth through the development and application of science and technology, as well as the cultivation of technology-based startups (PPBT).

The results of this discussion show the development of public and institutional perceptions of STPs from mere technology centers to strategic entities in knowledge-based economic development. In the future, strengthening collaboration networks, increasing research commercialization capacity, and integrating with sustainable regional development needs should be the focus of STP development.

Figure 2. Word cloud STP

Content analysis is done by coding the term "science technopark" and using a column chart as its visualization, as illustrated through matrix coding. The analysis conducted is presented in the following Table 2:

Table 2. Matrix Encoding

Word	Length	Count	Weighted Percentage (%)
Teknologi	9	1699	1,52
sains	5	1213	1,09
riset	5	853	0,76
Kawasan	7	711	0,64
inovasi	7	657	0,59
Indonesia	9	649	0,58
Berita	6	426	0,38
National	8	395	0,35
pengembangan	12	353	0,32
fasilitas	9	279	0,25
Gedung	6	259	0,23
industry	8	250	0,22
advertisement	13	233	0,21

The size of each word in the word cloud and the numbers in the matrix reflect the number of coding references. The number of counted words indicates how many coding references there are. The figures in the weight percentage column reflect the number of coding references as a percentage. The analysis of Table 2 above shows that the most significant Percentage, which is 1.52%, is dominated by the word technology, 1.09% by science, and 0.76% by the word research. These three words are the main representations in the news and documents analyzed, indicating that the narrative about Science Techno Parks (STPs) in Indonesia is dominated by issues related to technology, science, and research.

As the most dominant word, "technology" shows that the main focus of STPs is still closely related to the development and application of technology, as described in various sources. This shows that technology, both in the context of research and its application to the industrial sector, is seen as the core of the STP's function.

Technological development is inseparable from the scientific processes carried out by academic institutions, so the appearance of the word "science" reinforces the image that STPs are based on a scientific knowledge system. The link between the academic world and the industrial world through innovation is consistent with the function of STPs.

The word "research" occupies the next position, reflecting the importance of research activities in the context of STP. Research conducted at universities is closely related to the existence and function of STP, where the results of such research form the basis for further product or technology development.

STP is not only seen as an institutional structure or organization, but also as a spatial entity or area that has a physical impact on the surrounding area, as indicated by the appearance of the word "area" with a frequency of 0.64%. The development of STP is also related to spatial planning and the development of certain areas, as indicated in several news articles. In media coverage, this is clearly illustrated in an article discussing the inauguration of the STP UI Building on December 12, 2024, which states that STP is expected to serve as a bridge between science and technology and the public. This statement reinforces the role of STP as a connecting institution that not only facilitates research but also communicates its results to the public in the form of beneficial innovations.

Overall, the frequency of these words reflects that public discourse on STP in Indonesia focuses more on aspects of technology, science, and research, with additional attention to spatial aspects through the concept of technology zones or areas.

Table 3. Business Model Canvas (BMC) of Science Techno Park in Indonesian Universities

No	BMC	Universities
1	Customer Segment	UI : Student, Alumnae, Researcher, Startup, Industry IPB : Student, Alumnae, Researcher, Startup, Industry ITB : Student, Researcher UGM : Researcher ITS : Researcher
2	Value Proposition	UI: Focus on research technology development: health technology, renewable energy, information communication technology, biotechnology IPB: Focus on tropical agricultural, food, bioscience, and marine products ITB: Scope transportation, technology and health, infrastructure, and disaster management. UGM: Focus on health pharmaceuticals, agro-industry, renewable energy, manufacturing, engineering & IT, heritage, arts, culture & sustainable Management ITS: Focus on the automotive industry, maritime, creative industry, housing and environment, ICT, and nanotechnology, which are included in the Science Technopark
3	Customer Relationship	UI: Space for tenants, bridging collaboration between academic inventors' industry partners, strengthening their cooperation, inventors' royalties IPB: Space for tenants, bridging collaboration between startups, investors, industry partners ITB: Space for tenants, bridging collaboration between startups, investors, and industry partners. UGM: Space for tenants, bridging inventors, and industry players to accelerate innovation, technology transfer, grow startup businesses, founder stakeholders, and rupiah for research and development results ITS: Space for tenant, bridging university research with the industrial world
4	Channel	UI, IPB, ITB, UGM, ITS: website and office
5	Revenue Stream	• UI : Industrial cooperation, Grant • IPB : Space lease, White label production, Grant • ITB : Space lease, grant • UGM : Grant • ITS : Project, license, industrial cooperation, grant
6	Key Activities	• UI : Startup incubation and acceleration programs, connections with VC and industry partners to accelerate the commercialization, networking events • IPB : Technical services, IP management and innovation, business incubation, business services and industry/SME partners • ITB : Innovation research activities, prototyping processes to the technology transfer stage with startups, industry partners, investors, and a reliable entrepreneur community • UGM : Research, incubation, product-related event (production, launching) • ITS : Increase TKDN and strengthen collaborative educational and research institutions and the industrial world, assistance in downstream or commercializing products
7	Key Resources	• UI : High-tech labs, product testing centers, and co-working spaces, IP consulting • IPB : Intellectual property, small factory with marketing team support, teaching factory • ITB : incubators, business accelerators, laboratories, research spaces, and co-working • UGM : Intellectual property, researcher in various disciplines, factory in Purwomartani • ITS : A business incubator platform that provides complete facilities to support startups. Consultation session and make a better social impact, Technology Transfer Office Incubator and Accelerator, Capital, and Science

No	BMC	Universities
		Technology Area support from Maritime, Creative Design, ICT and Robotics, and automotive clusters
	Key Partners	• UI : Government, ADB, Universities, Research institutions • IPB : Government (central and west java), ADB, Industry • ITB : Bappenas, Kemendikbud Ristek/Brin, also the support from ADB • UGM : ADB, Pharmaceutical company, BUMN, Government (Central & DIY) • ITS : East Indonesia government, company want to expand in east Indonesia, industry
9	Cost Structure	UI, IPB, ITB, UGM, ITS: Staff, Operation

Based on the BMC above, here is a discussion of each block:

Customer Segments: UI and IPB's customers consist of students, alumni, researchers, startups, and industry. Meanwhile, other universities only target students or startup tenants under their guidance. These results show that UI and IPB are ready to become innovation centers, while others are still in the process of forming an internal ecosystem.

Value Proposition: All universities' STPs are technology-based, with UI and IPB focusing on specific technologies (e.g., medtech, green tech). Other universities focus on startup incubation or research commercialization. Campuses with technology specializations, global orientation, and strong partnerships have a competitive advantage over others.

Customer Relationship: UI encourages active participation from faculty-researchers, having already implemented royalties for inventors. Other universities rely on relationships based on incubator facilities.

Channel: All STPs use physical offices and websites as their primary channels. This indicates a conventional approach that does not fully support the growth of a digital ecosystem.

Revenue Streams: UI and IPB have developed alternative revenue streams through room rentals, white-label production, and industry collaborations. Other universities still depend on grants. Reliance on grant funding makes the sustainability of STPs a strategic issue.

Key Resources: UI, IPB, and IPB have complete infrastructure, including co-working spaces, laboratories, and incubators. Other universities are still developing gradually. Comprehensive infrastructure is the main differentiator for STPs in supporting research-based innovation.

Key Activities: UI and IPB have integrated research, incubation, and connections to investors. Other universities focus on strengthening incubation and startup mentoring. Universities with extensive partnerships are more active in bridging innovation to the real business ecosystem.

Key Partnerships: UI, IPB, and IPB have established active partnerships with the government and major industries. Other universities are still dominated by internal and local partnerships. The maturity level of partnerships determines STP's capacity to accelerate innovation.

Cost Structure: All STPs have the same cost structure, including operational, staff, and facility management costs. UI and IPB have begun to cover part of their costs through independent revenue. Diversifying revenue helps reduce dependence on the state budget or external grants.

Based on this comparative analysis, UI and IPB are at a more advanced stage in developing STPs as integrated innovation centers that not only support research but also drive technology-based economic transformation. Meanwhile, other universities are still in the early growth phase, focusing on infrastructure development and internal relationship building. This comparison shows that to achieve sustainable and impactful STPs,

universities need to strengthen strategic partnerships, diversify revenue streams, and specialize in innovation aligned with their local strengths.

CONCLUSION

Theoretical Implications

This study shows that the science and technology park (STP) business model in Indonesian universities is still in the development stage, with a primary focus on strengthening the ecosystem through innovation and industry collaboration. This study can provide benefits, particularly in the development of literature on the STP business model in Indonesian universities that focuses on collaboration between universities, industry, and government (innovation ecosystem). The results of the analysis using word clouds show that keywords such as technology, science, research, region, and innovation are the main elements related to STPs in universities. These findings indicate that the theoretical foundation of STPs in Indonesia is still rooted in the traditional triple helix approach, but faces specific local dynamics such as regulatory constraints and human resource readiness.

Managerial Implications (Practical Implications)

For university management, this research provides several important implications:

1. In developing STP, there needs to be strategic planning based on local needs. STP leaders in higher education institutions need to plan and design business models that align with campus and regional conditions, including mapping potential collaborations with industries in the surrounding area.
2. Operational and managerial capacity needs to be strengthened. This strengthening is crucial and requires training for STP management to manage tenants, establish partnerships, and secure funding access from both industry partners and the government.
3. Availability of funds and incentives. Funds, as a key to STP success, require the establishment of a specialized team by STP leadership to access alternative financing at both national and international levels.
4. A performance-based monitoring and evaluation system needs to be developed for STPs. Clear and measurable success indicators need to be developed by STP management, including the performance of existing tenants, innovation output, number of patents, and contribution to job creation.
5. Multisectoral collaboration needs to be expanded and formalized. Collaboration in the form of joint activities such as joint research and collaboration between universities and industry is needed so that collaboration is not limited to symbolic MoUs.

Research Limitations

This research has limitations, including the use of word cloud analysis based on data from online news, which does not fully reflect the managerial dynamics and actual performance of STPs in the field. Additionally, the research sample only includes five STPs from public universities in Indonesia, without comparisons to STPs abroad, limiting its global perspective. From the research sample perspective, this study focuses solely on five STPs from public universities in Indonesia, without comparisons to STPs abroad, limiting its global perspective.

Recommendations for Future Research

Further research to gain a more holistic understanding should be conducted using a mixed methods approach (quantitative and qualitative), including in-depth interviews with STP managers, tenants, and industry partners. Additionally, conducting cross-country comparisons (comparative studies) can provide global insights into best practices in the sustainable and competitive management of STPs..

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