



Analysis of IoT Business Strategy Development in the Transportation Sector at Telkom Indonesia Based on the PESTEL-SWOT Paradigm Analysis

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ABSTRACT

This research aims to analyze the development of IoT business strategies in the transportation sector at Telkom Indonesia. The analysis used is based on the PESTEL-SWOT analysis paradigm. The research approach employed is qualitative with a descriptive method focused on the internal informality of Telkom Indonesia within the IoT Tribe. Data collection techniques include in-depth interviews, observations, and literature studies. Data analysis utilizes data triangulation obtained from the integration of PESTEL-SWOT analysis. The research results indicate that combining internal strengths and external opportunities can form a structured business strategy for Telkom Indonesia in the transportation sector. The SO strategy allows companies to leverage infrastructure and reputation for digital service innovation. The WO strategy encourages collaboration with the government and state-owned enterprises to address weaknesses and develop the necessary infrastructure. In facing competitive threats, the ST strategy encourages Telkom to utilize innovative products to maintain consumer trust. The WT strategy emphasizes resource optimization and infrastructure strengthening to sustain competitiveness. Through this approach, Telkom Indonesia can tackle challenges while enhancing its position as a leader in the IoT industry.

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1. INTRODUCTION

The growth of digital business in Indonesia is expected to reach IDR 4,531 trillion by 2030 (Anggraeni, 2022). One of the business potentials in Indonesia that is experiencing rapid development is the business that utilizes the Internet of Things (IoT). By 2025, the IoT business market in Indonesia is predicted to reach IDR 572.7 trillion, with 678 connected IoT devices (Yulianto, 2023). Several business sectors that utilize IoT include the food and beverage sector, manufacturing, logistics, healthcare, and agriculture (Ali & Aboelimged, 2022; Vimal A et al., 2015).

In the transportation business, the use of IoT is not yet widely adopted by several companies, so there are not many key players who are truly maximizing its potential. Several IoT products in transportation refer to fleet management, real-time vehicle tracking, and more accurate route optimization. Telkom Indonesia, known as a company in the telecommunications and networking business, is currently starting to develop its IoT business in the transportation sector.

The IoT-based products developed by Telkom Indonesia are IndiCar and IndiTrans. Both products are designed to provide innovative solutions that can address the main challenges in the transportation industry. IndiCar focuses on fleet management, enabling real-time vehicle monitoring and tracking, driver behaviour analysis, fuel consumption monitoring, and maintenance alerts to enhance efficiency, productivity, and reduce operational costs for transportation companies. On the other hand, IndiTrans offers route optimization and logistics management solutions, using real-time data such as traffic and weather conditions to help companies determine the best routes, reduce travel time, and improve the accuracy of goods delivery.

The IndiCar and IndiTrans products are the standout offerings of Telkom Indonesia's IoT business in the transportation sector. Telkom Indonesia positions itself as a key player in the Business-to-Business (B2B) IoT ecosystem related to IoT business in the transportation sector. Referring to the business domains of Telkom Indonesia, which consist of digital connectivity, digital platforms, and digital services, this

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leads to the provision of integrated and comprehensive IoT solutions. With these three business pillars, Telkom Indonesia not only provides technology but also acts as an enabler that drives the digitalization of the transportation sector. However, the issue shows that in 2021, Telkom Indonesia's total revenue was still dominated by non-digital sector products, contributing 66%, while digital sector products only reached 34%. This indicates a gap between the potential of digital business, including IoT, and the revenue realization that is still not optimal at Telkom Indonesia.

The challenges faced by Telkom Indonesia in developing its IoT business in the transportation sector specifically involve building a value chain that requires significant capital investment. In establishing the value chain for the IoT business, investment support needs to be comprehensive, focusing on the development of devices, networks, platforms, and applications (Hakanen & Rajala, 2018; Raj & Raman, 2017). In the case of Telkom Indonesia, the issue of device provision remains a challenge, as Telkom Indonesia is not a manufacturing company and thus is not yet able to provide this aspect of the value chain. The devices currently supplied by Telkom Indonesia still rely on other partners, which certainly carries risks regarding quality, timing, and the potential for unexpected additional costs.

In the Business-to-Business (B2B) market, the demand for IoT business consumers for transportation products provided by Telkom Indonesia tends to be relatively low, primarily due to the significant initial investment required. For example, one of the IoT business use cases developed by Telkom Indonesia took up to seven years to break even. This indicates that although there are growth opportunities, the IoT business faces challenges of low profitability due to the large initial investment.

In previous research, Aulia & Gunawan (2019) explained that analyzing the development of IoT business strategies using SWOT analysis can reveal advantages in the implementation of IoT businesses. With this strength, a company can take advantage of the significant opportunities offered by IoT to strengthen its position. In addition, in the study by Saragih et al., (2018), the use of IoT business strategy development through PESTEL analysis can identify how political, economic, social, technological, environmental, and legal factors influence the implementation and development of IoT.

Based on the results of the previous research, the state of the art in this study will combine SWOT and PESTEL analysis for the development of business strategies for IoT products in the transportation sector at Telkom Indonesia. Both analyses will provide comprehensive insights into the internal strengths and weaknesses of the company, as well as the external opportunities and threats it faces. The use of SWOT analysis in this research will identify strengths such as the established telecommunications infrastructure and the technological capabilities possessed by Telkom Indonesia, as well as potential weaknesses in terms of market knowledge or adaptation to innovation. On the other hand, the PESTEL analysis will evaluate the political, economic, social, technological, environmental, and legal factors that influence the transportation sector and the adoption of IoT technology, thereby providing a clearer picture of the relevant external context.

By integrating both analyses, the research is expected to formulate effective business strategies for IoT products in the transportation sector, maximizing potential opportunities and minimizing risks that may be encountered. In addition, this approach will also enable Telkom Indonesia to develop more innovative and responsive solutions to market needs, as well as strengthen its position as a leader in the telecommunications and technology industry in Indonesia.

2. METHOD

This research uses a qualitative approach with a descriptive method. The informant in this research is an internal party from Telkom Indonesia who plays a role in developing IoT business in the transportation industry. The sources of data used are primary, secondary, and tertiary data.

The primary data was obtained through in-depth interview techniques with internal human resources at Telkom Indonesia, consisting of Senior or Middle Managers in the IoT Tribe within the Digital Business & Technology Division of Telkom Indonesia. The reason for the involvement of these informants is that they have a deep understanding of the strategies and implementation of IoT technology at Telkom Indonesia. Senior and Middle Managers in the IoT Tribe have first-hand experience in managing digital projects related to the development and application of IoT, as well as an understanding of the challenges and opportunities faced during the digital transformation process in the company. Their involvement as informants also aims to explore the strategic and operational perspectives necessary for identifying the key factors that influence the success of IoT initiatives, as well as to understand how this division contributes to innovation and competitive advantage at Telkom Indonesia. The implementation of in-depth interviews was conducted with informants who play a role in decision-making and strategy determination in Telkom Indonesia's IoT business, allowing the research to explore deep insights into the company's vision, strategy implementation, and industry dynamics.

Then, secondary data was obtained from various academic publications such as journals, proceedings, and government policies. This secondary data provides a theoretical foundation and relevant external context for the analysis, while the tertiary data from Telkom Indonesia's archives offers specific historical and operational insights. Finally, the tertiary data was obtained from a review of Telkom Indonesia's archives related to the research theme. The use of these three types of data enables comprehensive analysis, combining academic perspectives, policy, and industry practices. By integrating information from these sources, this research can identify trends, challenges, and opportunities faced by Telkom Indonesia, as well as evaluate the effectiveness of the strategies that have been implemented in developing IoT business strategies in the transportation sector. The combination of primary, secondary, and tertiary data also strengthens the validity of the findings, resulting in more accurate and relevant recommendations for future business and technology development.

2.1 PESTEL Analysis

The PESTEL analysis approach is used to analyze the external environment that affects IoT business strategies. PESTEL Analysis includes six factors: political, economic, social, technological, environmental, and legal. The purpose of

using PESTEL Analysis is to identify external factors that can influence the development and implementation of IoT strategies in the transportation sector. The use of this framework is employed to gain a comprehensive understanding of the external conditions that can influence the success of IoT business strategies, such as government regulations related to technology, economic trends, new technological developments, and social changes that may affect market demand. Based on the data collection results, there are identified opportunities and external threats relevant to Telkom Indonesia in developing IoT business strategies in the transportation sector, as well as an understanding of how these external factors can be leveraged or anticipated.

2.2 SWOT Analysis

SWOT Analysis is used in this study to evaluate the strengths, weaknesses, opportunities, and threats faced by Telkom Indonesia in developing IoT business strategies in the transportation sector. The purpose of using SWOT Analysis is to identify internal and external factors that influence Telkom Indonesia’s ability to formulate and implement effective IoT strategies. The use of this framework is to integrate the results of the PESTEL Analysis with the internal analysis of the company, so as to provide a comprehensive picture of Telkom Indonesia’s competitive position. Strengths and weaknesses are identified based on internal analysis, such as technological capabilities, human resources, and infrastructure. Opportunities and threats are identified based on external analysis, such as market developments, regulations, and competition. Based on the data collection results, there is a strategic mapping that guides Telkom Indonesia to understand and leverage existing strengths and opportunities, as well as to address weaknesses and threats to strengthen the company’s

position in developing IoT business in the transportation sector.

2.3 Data Analysis

The data analysis process is conducted through triangulation, which combines the results of PESTEL Analysis and SWOT Analysis. The data triangulation technique is used to ensure the validity and reliability of the research findings by consolidating various data sources and perspectives (Farquhar et al., 2020). PESTEL Analysis provides insights into the external factors that influence the business environment, while SWOT Analysis evaluates strengths, weaknesses, opportunities, and threats from both internal and external perspectives.

Data from these two analyses were integrated to create a holistic understanding of IoT business strategy in the transportation sector. This research uses Analytic Hierarchy Processing (AHP) which is a decision-making method in business development integrating SWOT and PESTEL analysis to formulate a more comprehensive strategy. In AHP, elements from SWOT and PESTEL are prioritized through the integration of their data, enabling in-depth identification of opportunities and challenges (Vardopoulos et al., 2021; Tsangas et al., 2019). As a result, the proposed strategies can be more targeted, relevant, and adaptive to fast-changing market dynamics. Thus, the integration of the two can ensure that the resulting conclusions are based on verified information from various points of view, thereby increasing the accuracy of the proposed strategy recommendations for Telkom Indonesia in developing the IoT business in the transportation sector. An explanation of the data analysis model will be explained in Figure 1 below:

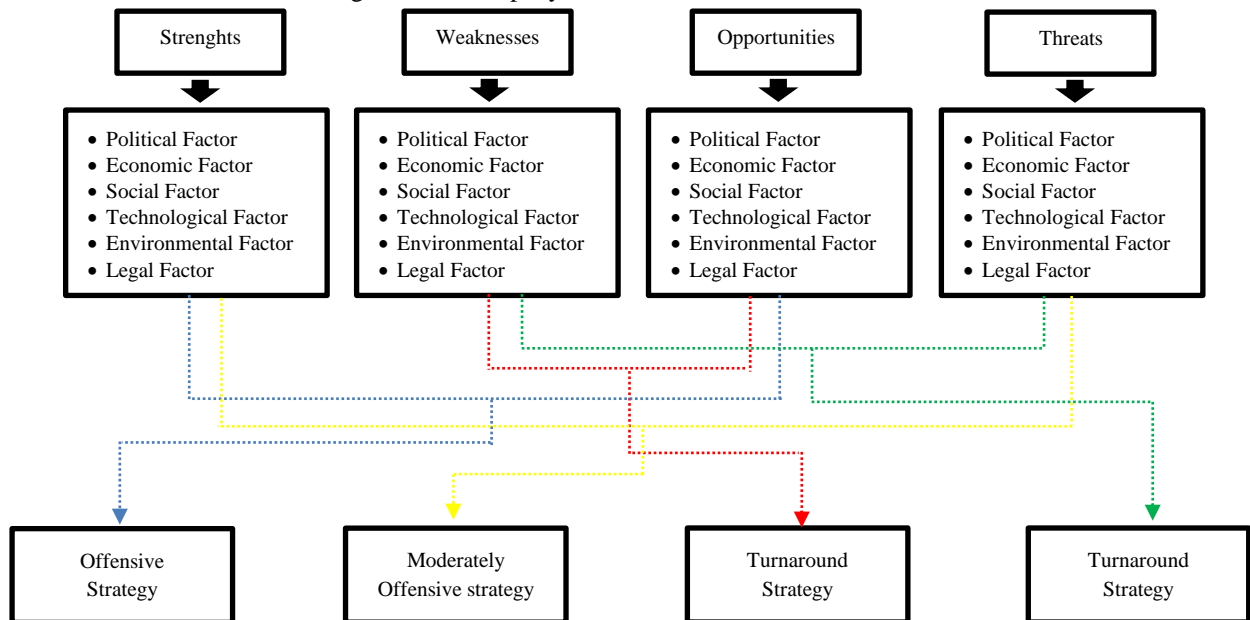


Fig. 1. Analytic Hierarchy Processing (AHP) Framework Based on the Integration of SWOT and PESTEL

An integration analysis of SWOT and PESTEL findings can provide a deeper understanding of the IoT business strategy in Telkom Indonesia's transportation sector. By mapping strengths and opportunities (SO), companies can develop offensive strategies that leverage internal strengths to explore external opportunities, such as digitalization and sustainability trends. On the other hand, a combination of weaknesses and opportunities (WO) can result in an improvement strategy to overcome internal weaknesses by taking advantage of existing opportunities. In addition, mapping threats against strengths (ST) helps identify strategies that can strengthen the company's position amid market challenges, while the combination of weaknesses and threats (WT) provides a defensive approach to mitigate risks. By combining these two analyses, Telkom Indonesia can formulate strategies that are comprehensive and responsive to market dynamics, strengthening competitiveness and innovation in the transportation sector.

3. RESULTS AND DISCUSSION

3.1 PESTEL and SWOT Analysis in the Development of IoT Business Strategy in the Transportation Sector at Telkom Indonesia

A. Strengths

1) Political Factor

Telkom Indonesia is widely recognized as the best IT service provider in Indonesia, with a high level of trust from the public. This advantage provides a positive political boost, especially with the support from Telkom Group as the network and IT platform provider. Telkom Indonesia's role in supporting the development of national transportation infrastructure, which aligns with the National Medium-Term Development Plan 2020-2024 and the SDGs goals, demonstrates the company's commitment to supporting the growth of the transportation industry through IoT technology.

Indirectly, this political power strengthens Telkom Indonesia's position as a strategic partner of the government in accelerating digital transformation in various sectors. This support is not only limited to infrastructure development, but also to efforts to encourage inclusive and efficient connectivity, which is important to support national economic growth (Challoumis, 2024). The political power and public trust held by Telkom Indonesia also enable the company to continue to develop as a pioneer of innovative digital solutions, while maintaining the relevance and sustainability of its business in the digital era.

2) Economic Factor

Telkom Indonesia has a key strength in its robust and widespread telecommunications infrastructure, particularly on Java Island, which is the center of IoT technology development. Services like LoRaWAN enable companies to integrate IoT technology into the transportation sector, enhancing operational efficiency and productivity. Telkom Indonesia dominance in providing digital services in the transportation sector offers a significant competitive advantage.

The strength of the economic factor in the development of IoT technology by Telkom Indonesia lies in the company's ability to optimize long-term investment in digital infrastructure. This provides a strong foundation for operational cost efficiency while creating added value for service users (Field et al., 2018). In addition, the economies of scale obtained from Telkom Indonesia extensive network allow for a reduction in the cost per unit of service, thus encouraging massive adoption of IoT. This factor strengthens the competitiveness of the national economy, while attracting the interest of domestic and foreign investors to contribute to Indonesia's digital ecosystem. Thus, the development of IoT by Telkom Indonesia not only supports the growth of the transportation sector, but also has a positive impact on the economy as a whole.

3) Social Factor

Telkom Indonesia leverages its strong and widespread telecommunications infrastructure, along with products like IndiCar and IndiTrans that offer integrated IoT solutions, enhancing the convenience and efficiency of transportation. Focusing on social needs, such as comfort and entertainment during travel, reinforces a positive image and enhances customer loyalty.

The social factor that is a strength for Telkom Indonesia is the company's ability to understand the needs of modern society that is increasingly dependent on connectivity and digital technology. By providing solutions that support a digital lifestyle, such as Wi-Fi in public vehicles and IoT-based applications for trip tracking, Telkom Indonesia not only improves the user experience, but also supports more efficient and environmentally friendly mobility patterns. By utilizing this social strength, strengthens its position as a company that is not only profit-oriented, but also contributes to the welfare of society at large (Glaveli & Geormas, 2018).

4) Technological Factor

Telkom Indonesia has a strong telecommunications infrastructure and innovative IoT services such as fleet management with a monthly recurring charge (MRC) per cellular connection. The application of IoT technology in products like IndiCar and IndiTrans not only enhances operational efficiency but also brings about digital transformation through the Internet of Vehicles (IoV). With real-time monitoring capabilities, vehicle performance analysis, and the integration of regulation-compliant LoRa technology, Telkom has successfully created a solution that enhances security, productivity, and customer experience.

Technology as a strength factor gives Telkom Indonesia a competitive advantage in supporting digital transformation in the transportation and logistics sector. By utilizing IoV and LoRaWAN, Telkom Indonesia not only offers sophisticated solutions that are in line with market needs, but also ensures that the adopted technology is widely accessible. The ability to provide technology-based

services that are cost-effective, easy to implement, and scalable strengthens Telkom Indonesia's position as a pioneer in IoT innovation in Indonesia. This technology also enables cross-platform data integration, providing valuable insights for strategic decision-making by both corporate and government customers (Shrivastav et al., 2023).

5) *Environmental Factor*

Telkom Indonesia has the ability to enhance security in transportation through IoT technology. The use of sensors and evaluation systems allows for increased caution and personal protection, creating a safer and more responsive transportation environment. Initiatives like IndiCar and IndiTrans position Telkom as a driving force in delivering intelligent systems that meet user needs, while also supporting the Sustainable Development Goals (SDGs) through the principles of People-Planet-Profit.

Environmental awareness is a factor of Telkom Indonesia's strength in encouraging environmentally friendly technological innovation and supporting sustainability. Through products such as IndiCar and IndiTrans, Telkom optimizes fuel use through more efficient route monitoring and driver behavior analysis. This innovation not only reduces carbon footprint but also provides a positive economic impact for users by reducing operational costs (Ganda, 2019). Energy-efficient LoRa technology further strengthens Telkom's commitment to providing technological solutions that are in line with the principles of sustainability.

6) *Legal Factor*

Clear and structured regulations support Indonesia's readiness to implement IoT in the transportation sector. The existence of regulations regarding frequency and national standards, such as the National Work Competency Standards of Indonesia, creates a strong foundation for the development of IoT. Furthermore, collaboration involving various stakeholders, including the Ministry of Transportation, the Ministry of Communication and Information, and transportation operators, ensures that the development of services like IndiCar and IndiTrans complies with regulations, supporting efficiency and safety in the transportation industry.

From the legal side as a strength, it can be seen that Telkom Indonesia has an advantage in complying with and utilizing the regulatory framework to encourage technological innovation that is in line with government policies. Telkom Indonesia's success in adapting to dynamic regulations is also a strategic advantage. Because it provides flexibility in developing new products while ensuring protection against legal risks (Young et al., 2018). Thus, compliance with regulations is not only an obligation, but also an important capital that strengthens Telkom Indonesia's position as a leader in the technology and telecommunications industry in Indonesia.

B. *Weaknesses*

1) *Political Factor*

Although Telkom Indonesia has great potential, the implementation of IoT technology in the transportation sector still faces regulatory challenges and the need for smart physical infrastructure. Additionally, reliance on government regulations to support the development of infrastructure and IoT technology can become a hindrance if these policies are not implemented effectively.

Regulatory limitations or uncertainties can hamper the pace of innovation, so Telkom Indonesia needs to act as an advocate in encouraging policies that support IoT development, including accelerating the development of digital infrastructure that is evenly distributed throughout Indonesia. By supporting regulatory strengthening and providing empirical data that supports the benefits of IoT, it can help create a more stable and conducive policy ecosystem for technological growth in the transportation sector (Remotti, 2021).

2) *Economic Factor*

The main weakness lies in the diverse geographical challenges of Indonesia, which hinder the spread of IoT infrastructure, especially in remote and hard-to-reach areas. This condition limits Telkom Indonesia's ability to provide IoT services evenly across the region, which could reduce market potential outside of Java Island. In addition, the shift in focus from Business-to-Consumer (B2C) to Business-to-Business (B2B) may require adaptations that are not easy for companies and consumers.

The weakness in these economic factors shows that Telkom Indonesia needs to make strategic investments to expand its infrastructure reach, especially in remote areas that have growth potential. The challenge of high costs in developing infrastructure in areas with difficult geographical conditions shows the need for innovation in technology and more efficient business models, such as utilizing satellite-based networks or collaboration with local partners (Nneka Adaobi Ochuba et al., 2024).

3) *Social Factor*

Although Telkom Indonesia has solid infrastructure, geographical challenges and technological access gaps in remote areas pose significant obstacles. Additionally, the dependence on government regulations and the community's adaptation to new technologies adds complexity to the implementation.

The weakness of this social factor indicates that Telkom Indonesia needs to be more active in improving digital literacy in the community, especially in remote and less developed areas. The low adoption rate of IoT technology in some areas is often caused by a lack of understanding of the benefits of this technology (Padyab et al., 2020). This social weakness also shows the importance of Telkom Indonesia to understand the specific needs of local communities, so that the solutions offered can be culturally and economically relevant. By addressing these

challenges, Telkom Indonesia can not only expand its service reach, but also strengthen its role as a company that encourages equal access to technology throughout Indonesia.

4) *Technological Factor*

The regulatory and technical challenges related to frequency and transmission power of LoRa in Indonesia are the main weaknesses. Although regulations are supportive, the stringent technical requirements can limit flexibility and innovation, especially in delivering more advanced IoT solutions. In addition, the awareness and adoption of IoT technology by transportation operators may still be limited, hindering the full implementation of the offered solutions.

The weakness of this technological factor requires Telkom Indonesia to continue to innovate in developing solutions that not only meet technical requirements, but are also flexible and easy to adopt by users. The strict regulations regarding LoRa transmission frequency and power can be an obstacle if it is unable to create efficient and standard-compliant technology, so further investment in research and development is needed to overcome this obstacle (Abdallah et al., 2024).

5) *Environmental Factor*

One of the weaknesses faced by Telkom Indonesia is the complexity of integrating various IoT technologies into the existing transportation systems. This challenge includes high costs for the development and maintenance of infrastructure, as well as difficulties in ensuring that all components of the IoT system can work harmoniously. In addition, dependence on a stable and secure network has become an important issue, considering the risks of disruptions that can affect service performance.

Environmental factors that are weaknesses faced by Telkom Indonesia include challenges in maintaining the sustainability and resilience of IoT infrastructure. Telkom needs to ensure that the IoT solutions implemented are not only efficient in the use of resources but also environmentally friendly. It is necessary to pay attention to the social and environmental impacts of infrastructure expansion, including the potential for disruption to local ecosystems and the need to maintain the sustainability of natural resources (Chapin et al., 2009). Therefore, the development of IoT technology in Indonesia requires careful planning related to environmental risk mitigation, and needs to be combined with policies that support long-term sustainability and create added value for the community and the surrounding environment.

6) *Legal Factor*

The complexity in regulations between the central and regional governments, which often lack alignment, creates obstacles for the comprehensive implementation of IoT across Indonesia. Inconsistency in operational policies and permits can hinder the integration of IoT systems, particularly in the context

of logistics transportation. This poses challenges in ensuring that regulations supporting the growth of the IoT ecosystem in the transportation sector can be effectively implemented across various regions.

This legal weakness causes uncertainty for companies like Telkom Indonesia in planning the expansion and development of consistent IoT solutions across regions. Differences in regulations between central and regional governments can slow down implementation and cause irregularities in service operations, especially in the transportation sector which requires uniformity in policies and technical standards (Dutta et al., 2020). This not only increases operational costs, but also hinders the potential for innovation and adoption of IoT technology in areas that require special attention.

C. *Opportunities*

1) *Political Factor*

The Indonesian government prioritizes the acceleration of the 4.0 industrial revolution, which creates significant opportunities for Telkom Indonesia to expand its IoT services through products such as Antares, IndiCar, and IndiTrans. Collaboration with the government and other state-owned enterprises in the development of transportation infrastructure also opens up opportunities for Telkom Indonesia to become a leader in the digital transformation of this sector.

The opportunities in this political factor provide with a great opportunity to take advantage of government policies that support the development of digital technology and industrial transformation, especially in the transportation sector (Hanna, 2018). Close cooperation with the government and other SOEs not only strengthens Telkom Indonesia position in the digital ecosystem, but also provides access to large-scale infrastructure projects that have the potential to have a positive impact on the wider community. In addition, Telkom Indonesia can take advantage of government policies that support investment in smart technology and sustainability to expand its service portfolio and reach a wider market.

2) *Economic Factor*

A great opportunity arises from the increasing demand for digitalization in the transportation sector, especially after the COVID-19 pandemic, which has driven the need for digital solutions and efficiency in supply chains and logistics. Collaboration with the information and communication sector and the government in national infrastructure projects also opens opportunities for Telkom to expand its services and enhance its contribution to economic development.

This economic opportunity provides Telkom Indonesia with significant growth potential, especially in terms of IoT service expansion and digitalization of the transportation sector. The increasing demand for solutions that improve operational efficiency, such as fleet management and route optimization, allows Telkom Indonesia to offer more sophisticated products

and services, which can reduce logistics costs, accelerate the distribution of goods, and improve the overall performance of the transportation sector. With the growing digital economy and increasing adoption of technology in various sectors, this opportunity is taken to expand its reach, increase revenue, and strengthen its role in national economic development (Teece, 2018).

3) *Social Factor*

The Indonesian government, which is promoting the 4.0 industrial revolution, is opening up significant opportunities for Telkom Indonesia to expand its IoT services. The increasing dependence on technology post-COVID-19 has also created opportunities for digital solutions in the transportation sector, enhancing efficiency and reducing traffic congestion.

This social factor opportunity provides Telkom Indonesia with the opportunity to go deeper in presenting digital solutions that can improve people's quality of life, especially through technology that improves mobility and transportation. With the increasing dependence on technology post-COVID-19, the need for services that make travel easier, minimize congestion, and increase comfort is increasingly urgent (Docherty et al., 2021). Products such as IndiCar and IndiTrans, which offer real-time monitoring and route optimization, are very relevant in this context.

4) *Technological Factor*

The increase in digitalization in the transportation sector post-COVID-19 has created significant opportunities for Telkom to expand its IoT services. The trend towards smart cities and smart transportation paves the way for the development of more integrated and innovative solutions. In addition, the use of open-source technology in IoT allows Telkom Indonesia and transportation operators to be more responsive to the ever-evolving market needs, as well as to enhance competitiveness by offering more diverse and secure services.

This technological opportunity provides Telkom Indonesia with the opportunity to take advantage of the latest innovations in developing more flexible and scalable IoT solutions. This technological opportunity also paves the way for the development of more secure and reliable platforms. Data security and privacy are top priorities in the digital world, and by using open source technology that can be audited openly, it can increase customer trust levels and meet strict regulatory standards (Pasquier et al., 2018).

5) *Environmental Factor*

The global trend towards smarter and more sustainable transportation opens up significant opportunities for Telkom Indonesia. By focusing on sustainability, companies can reduce their environmental impact, such as alleviating congestion and emissions, particularly in large cities like Jakarta. The development of environmentally friendly IoT-based transportation solutions also enables Telkom Indonesia to contribute to climate change mitigation efforts, as

well as enhance operational efficiency that can provide economic benefits for users and the wider community.

The opportunity to support these environmental factors provides Telkom Indonesia with the opportunity to become a leader in creating more environmentally friendly and sustainable transportation solutions. By developing IoT technology that can reduce emissions, optimize vehicle routes, and increase fuel efficiency (Nižetić et al., 2020b). With increasing attention to sustainability, Telkom Indonesia can take advantage of this opportunity to strengthen its position as a socially and environmentally responsible company.

6) *Legal Factor*

Regulations that support the use of IoT technology in transportation, such as fleet management, can enhance operational efficiency and the safety of public transport. The development of IoT-based transportation systems backed by Traffic and Road Transport regulations can yield innovative solutions that not only boost company productivity but also contribute positively to the national economy. With the existence of the national logistics system roadmap, Telkom Indonesia has the opportunity to expand IoT integration in the logistics sector, supporting growth and enhancing the sustainability of the national logistics sector.

The opportunity in the support of this legal factor opens the way for Telkom Indonesia to strengthen its position as an integrated IoT solution provider in the transportation and logistics sector. Regulations that support the use of IoT technology, such as fleet management and intelligent transportation systems, provide a strong foundation for Telkom Indonesia to develop and launch services that comply with existing standards and policies. This provides a competitive advantage for the company in providing safer, more efficient, and more regulatory-compliant solutions, both for transportation operators and service users (Teece, 2018).

D. *Threats*

1) *Political Factor*

Competition with other companies, both local and international, that also want to take advantage of opportunities in the transportation IoT industry, is a real threat. In addition, political uncertainty and regulatory changes can affect business stability and investment in this sector. Telkom Indonesia's involvement in transportation infrastructure projects may also face challenges from an operational and data security perspective, which must be managed carefully to maintain the company's reputation.

These political factors make Telkom Indonesia vulnerable to uncertainties that can affect long-term planning and operational stability. Unexpected changes in policies or regulations can create challenges in adapting business models and innovation, which ultimately has the potential to hinder the company's growth and expansion (Foss & Saebi, 2018). In addition, inconsistent political

policies between the central and regional governments can also slow down the effective implementation of IoT solutions throughout Indonesia, given the differences in standards and regulations that apply in each region.

2) *Economic Factor*

The biggest threat comes from the intense competition in the IoT technology market, as well as the potential regulatory uncertainties that could impact the implementation and development of IoT infrastructure. Additionally, the risks of technological disruptions and data security also pose challenges for the long-term sustainability of Telkom Indonesia's IoT business.

These economic threats can indirectly affect Telkom Indonesia's competitiveness, as economic uncertainty and market fluctuations can affect investment in infrastructure and technology. The tight competition in the IoT market, both from local and international players, has the potential to reduce profit margin and slow down the innovation process (Paiola & Gebauer, 2020).

3) *Social Factor*

The intense competition in the IoT market, both from local and international companies, poses a threat to Telkom Indonesia's market share. Regulatory uncertainty and the risks of technological disruptions and data security can threaten the stability and consumer trust in the services offered.

These social factor threats indicate that changes in consumer preferences and behaviour can affect the adoption of IoT technology, especially if the public is unsure about the security or benefits of the technology (Dutta et al., 2020). Social uncertainty about the acceptance of new technologies, especially in terms of personal data management and privacy, can hinder users' desire to join the IoT system offered by Telkom Indonesia.

4) *Technological Factor*

Intense competition in the global IoT market, especially from large technology companies and other local players, poses a significant threat. The risks of technological disruption, data security, and regulatory uncertainty can also threaten operational stability and consumer trust. In addition, reliance on transportation operators for the adoption of new technologies can also be a barrier to the expansion and sustainability of services.

These technological threats can hinder the development and implementation of more advanced IoT solutions, especially if there is a system outage, hardware failure, or integration issues between different technologies. In the IoT industry, reliance on stable and secure infrastructure is critical to ensuring service continuity (Aripawira & Kurniawan, 2020). Risks related to technological outages, such as downtime or compatibility issues, can lead to a loss of consumer trust and harm Telkom Indonesia's reputation as a reliable IoT service provider.

5) *Environmental Factor*

Despite having strengths and opportunities, Telkom Indonesia also faces threats from stringent environmental regulations and pressure from stakeholders to continuously improve sustainability. In addition, the increasing competition in the IoT industry could affect Telkom Indonesia's market share and position as a leading service provider. The risk to data security also poses a threat, as the widespread use of IoT technology requires stricter data protection to avoid potential privacy breaches and cyberattacks.

The environmental threats faced by Telkom Indonesia are related to increasingly stringent environmental regulations, especially those related to carbon emissions, e-waste management, and the environmental impact of technology infrastructure. Tighter regulations on sustainability and environmental responsibility may force companies to invest more in environmentally friendly technologies, which may require additional costs and changes in operational models (Ghosh, 2020).

6) *Legal Factor*

The regulatory discrepancies between the central and local governments can be a significant barrier to the implementation of IoT in the transportation sector. Additionally, the risk of overly strict or inflexible regulations can limit innovation and the adaptation of new technologies within the IoT transportation ecosystem. The increasingly fierce global competition in the field of IoT technology can also pose a threat, especially if domestic regulations fail to compete or support the rapid development of technology.

This legal threat exposes Telkom Indonesia to regulatory uncertainty and misalignment that could affect the smooth expansion and implementation of IoT solutions throughout Indonesia. Regulatory misalignment between the central and regional governments has the potential to slow down the technology adoption process, as each region may have different rules regarding technology use, security standards, or system implementation (Rahajoeningroem & Rufiyanto, 2018). This could create irregularities in the development and operation of IoT systems, hindering the economies of scale and operational efficiency desired by Telkom Indonesia.

3.2 *Matrix in the Development of IoT Business Strategy in the Transportation Sector at Telkom Indonesia*

The SWOT analysis matrix for creating a business development strategy for IoT in the transportation sector at Telkom Indonesia is structured based on a SWOT-PESTEL analysis. The selection of such a strategy is essentially a strategic matching process based on a combination of internal conditions and external environmental factors for the development of the IoT business strategy in the transportation sector at Telkom Indonesia (See Table 1). The measurement of this matrix is adopted from Liu (2017) to integrate business strategies that align with the PESTEL approach and SWOT Analysis paradigm.

Table 1. Matrix for Developing IoT Business Strategies in the Transportation Sector at Telkom Indonesia

Internal conditions	Strengths	SP	Weaknesses	WP
		SE		WE
		SS		WS
		ST		WT
		SE		WE
		SL		WL
External environment				
Opportunities	OP	SO combination strategy (Offensive strategy)	WO combination strategy (Turnaround strategy)	
	OE			
	OS			
	OT			
	OE			
	OL			
Threats	TP	ST combination strategy (Moderately offensive strategy)	WT combination strategy (Defensive strategy)	
	TE			
	TS			
	TT			
	TE			
	TL			

Based on Table 1, it is divided into aspects of internal conditions, namely strengths and weaknesses, and then aspects of the external environment, namely opportunities and threats. Each component consists of political, economic, social, technological, environmental, and legal factors as internal strengths present in the IoT business sector of transportation at Telkom Indonesia. The combination of internal strengths and external opportunities can be used to develop business strategies for the IoT transportation sector at Telkom Indonesia, forming four types of strategies: SO, WO, ST, and WT.

A. Proactive Innovation: the offensive strategy (SO)

Telkom Indonesia plays a strategic role in supporting proactive innovation, particularly through IoT services in the transportation sector. As part of the offensive strategy, also known as the Strengths-Opportunities (SO) strategy, Telkom utilizes its internal strengths to capitalize on external opportunities. The offensive strategy, with a focus on proactive innovation, is an integral part of a business approach aimed at creating a competitive advantage (Radomska et al., 2021; Medeiros et al., 2020). An innovation in business strategy development can quickly respond to changes according to consumer needs and create opportunities that have not been exploited by competitors.

From a political standpoint, the government’s support for the development of technology and digitalization in the transportation sector creates a conducive environment for innovation. The government's policies supporting digital transformation, particularly in the context of the fourth industrial revolution, pave the way for Telkom to introduce and develop IoT-based solutions. One example is the

development of services like IndiCar and IndiTrans, which aim to digitize transportation systems and enhance operational efficiency in this sector. Telkom Indonesia plays a strategic role in creating networks and platforms that support IoT in transportation by leveraging external opportunities such as the increasing demand for smart transportation in line with urbanization and digitalization developments.

In addition, another political aspect related to the public’s trust in Telkom Indonesia as a leading technology service provider provides a positive boost, especially in supporting the development of national transportation infrastructure. In an offensive strategy, companies are required to take the initiative in exploring and leveraging opportunities, especially those arising from external changes such as government policies and technological trends (Peñarroya-Farell & Miralles, 2021). Telkom Indonesia, with political support in the form of government backing and public trust, has the opportunity to continue developing digital infrastructure that strengthens national connectivity and enhances Indonesia’s competitiveness in the global digital economy era.

In supporting the global economy, Telkom Indonesia has a significant advantage in terms of strong telecommunications infrastructure, particularly in the Java Island region, which is the economic centre of Indonesia. This strong infrastructure enables more effective integration of IoT technology into the transportation sector. The integration of IoT technology into transportation infrastructure allows for better traffic management, route optimization, and reduced energy consumption through smart transportation (Oladimeji et al., 2023). With an established telecommunications network, Telkom Indonesia can provide more efficient and productive solutions for the transportation sector, benefiting both government and private interests.

This reliable telecommunications infrastructure also supports the provision of sustainable smart transportation services, which are greatly needed in the post-pandemic era where the demand for digitalization continues to rise. This opportunity arises from the government's priority on the 4.0 industrial revolution, creating space for Telkom Indonesia to expand services such as IndiCar and IndiTrans. There has been a significant increase in demand due to changes in consumer behaviour that rely more on digital and technology-based transportation solutions (Molenaar, 2022). With strong telecommunications infrastructure support, Telkom Indonesia can continue to innovate in data-driven transportation services, promoting efficiency and sustainability in the transportation sector in Indonesia. The increasing demand for digitalization post-pandemic presents opportunities for the development of smarter and more sustainable transportation solutions, supporting sustainability and operational efficiency that benefit society (Estrada & Álvarez, 2023; Strielkowski et al., 2022).

B. Harnessing Strengths for Market Opportunities: the turnaround strategy (WO)

Telkom Indonesia as the largest telecommunications service provider in Indonesia, is currently facing significant challenges in the implementation of IoT technology in the transportation sector. One of the main challenges is the regulations that have not yet fully supported and the infrastructure needed to support the technology (Nižetić et al., 2020a). On the other hand, this challenge also opens up very

significant opportunities for Telkom Indonesia, especially in the context of the government's priorities regarding the 4.0 industrial revolution. By leveraging its strengths, Telkom Indonesia can adopt a turnaround strategy to transform these weaknesses into competitive advantages.

The weaknesses faced by Telkom Indonesia include evolving regulations and the need for adequate infrastructure to support the implementation of IoT technology. However, the Indonesian government has made the 4.0 industrial revolution one of its priority agendas, creating significant opportunities for companies to innovate and adapt. The weaknesses faced include unstable regulations and the need to improve infrastructure, which have become primary concerns. In this case, the implementation of a turnaround strategy becomes very important by involving a comprehensive assessment and improvement of the existing business structure and processes to address the emerging challenges (Shahri & Sarvestani, 2020). In practice, Telkom Indonesia can focus on several key steps. Involvement of stakeholders in the process of formulating regulations that better support innovation. By being part of the dialogue between the government and industry, Telkom Indonesia can provide valuable insights and help create regulations that facilitate the growth of the IoT sector.

In addition, the geographical challenges and the gap in technology access in Indonesia are issues that need to be addressed. Many regions outside of Java Island still lack adequate telecommunications infrastructure, which can hinder the development of IoT services. However, this can also be seen as an opportunity. With the increasing demand for digital solutions post-pandemic, Telkom Indonesia has the opportunity to expand its service reach to previously neglected areas. Leveraging the rise of digitalization, Telkom Indonesia can introduce IoT technology on a larger scale, creating relevant solutions for the local community. Simpler and more affordable innovations can take over a larger market (Botelho et al., 2021).

Closer collaboration with the government and state-owned enterprises (SOEs) is key to this turnaround strategy. By establishing a more solid collaboration, Telkom Indonesia can accelerate the development of the infrastructure needed to support IoT services. The strategic partnership program with the government allows Telkom Indonesia to participate in major infrastructure projects aimed at enhancing connectivity across Indonesia. In this context, Telkom Indonesia not only plays the role of a service provider but also as a partner in building more inclusive infrastructure. This will not only accelerate the development of the necessary infrastructure for IoT services but also ensure that all parties can contribute to creating a better ecosystem in the development of IoT in the transportation sector (Vermesan & Friess, 2022; Abbas et al., 2021).

By combining its strengths with existing opportunities, Telkom Indonesia can make significant transformations in facing competition in the transportation market. Through an effective turnaround strategy, the company can turn weaknesses into strengths and contribute to the development of a smarter and more integrated transportation sector. Thus, Telkom will not only be able to survive in a tight competition but also play an active role in shaping a more sustainable and efficient transportation future in Indonesia.

C. *Leveraging Core Competencies to Mitigate Risks: the moderately offensive strategy (ST)*

In facing the increasingly complex dynamics of the transportation industry, Telkom Indonesia possesses significant strengths in telecommunications infrastructure and IoT services. These strengths serve as an important foundation for addressing various threats present in the market (Aghasafari et al., 2020). One of the core strengths of Telkom Indonesia is its extensive and integrated telecommunications infrastructure, which enables the company to develop and provide IoT services efficiently. This established infrastructure allows Telkom Indonesia to implement smart transportation solutions that can enhance efficiency and security.

Political support, one of which is clear regulations, also provides significant opportunities for Telkom Indonesia. The Indonesian government is actively promoting the development of digital technology and industrial transformation, including in the transportation sector. This creates a conducive environment for Telkom Indonesia to strengthen its position as a leader in the IoT industry. However, behind these opportunities, there are threats that need to be faced, particularly the intense competition in the IoT market. Many companies, both local and international, are racing to capitalize on this continuously growing market potential, thereby creating greater pressure for Telkom Indonesia to maintain and increase its market share.

One of the main threats faced by Telkom Indonesia is regulatory uncertainty that could impact business operations. Changes in government policy or the introduction of stricter regulations can impact business strategies, particularly in terms of IoT service development (Majid et al., 2022; Medeiros et al., 2020). To address this risk, Telkom Indonesia needs to take a proactive approach by leveraging its core strengths. Innovative products like IndiCar and IndiTrans, which are IoT-based transportation solutions, can be used as tools to enhance efficiency and safety. By offering services that not only meet customer needs but also align with government policies in the development of smart transportation, Telkom Indonesia can strengthen its position in the market.

Collaboration with various stakeholders is also a very important strategy in facing existing threats. Collaboration with the government, transportation companies, and other stakeholders can help to better understand the needs and challenges faced in the industry (Radomska et al., 2021). Through closer collaboration, Telkom Indonesia can develop more relevant and innovative solutions, as well as ensure that the services offered align with government policies. Additionally, this partnership can also strengthen consumer trust in the services provided by Telkom Indonesia.

Strengthening internal policies is key to maintaining consumer trust and enhancing competitiveness in an increasingly competitive market (Hidayat, 2022; Carnahan et al., 2010). Telkom Indonesia needs to ensure that the products and services offered meet high-quality standards and are responsive to changing market needs. Through enhancing internal capacity and continuous innovation, Telkom Indonesia can minimize the risks arising from intense competition and regulatory changes. Continuous innovation will also help Telkom Indonesia remain relevant and quickly adapt to the changing market dynamics.

By leveraging core strengths in IoT infrastructure and services, as well as collaborating with stakeholders and strengthening internal policies, Telkom Indonesia can effectively address existing threats in the transportation industry. This approach will not only assist strategies in maintaining a position in an increasingly competitive market, but will also contribute to the development of more efficient and sustainable transportation (Cruz & Sarmento, 2020; Gallo & Marinelli, 2020). Thus, Telkom Indonesia will not only be able to reduce the risks it faces, but also take advantage of opportunities to grow and innovate in this highly dynamic sector.

D. Resource Optimization: the defensive strategy (WT)

Telkom Indonesia as one of the leaders in the telecommunications industry in Indonesia, faces various weaknesses that affect the implementation of IoT technology in the transportation sector. One of the biggest challenges is Indonesia's highly diverse geographical conditions. Many remote areas outside of Java still have minimal telecommunications infrastructure, which hinders the spread of IoT technology. This limitation not only reduces Telkom Indonesia's ability to provide IoT services evenly, but also restricts growth potential in the increasingly digital transportation market.

Another weakness is the dependence on government regulations that often change and the lack of alignment between central and regional policies. Inconsistent policies can create confusion and add complexity to the implementation of IoT technology (Retnandari, 2022). For example, strict regulations in one area can slow down the development process of IoT services, while another area may have more supportive policies. This situation creates its own challenges for Telkom Indonesia in managing and adjusting its services to comply with the regulations in each region.

Telkom Indonesia also has to face threats from intense competition in the IoT market, both from local and international companies. Many new companies are emerging with innovative solutions targeting the same market segment, creating additional pressure for Telkom Indonesia to remain competitive. Regulatory uncertainty also adds risk for businesses, as policy changes can affect the overall strategy and operations of the company (Darby et al., 2020; Griffin, 2018).

To address these weaknesses and threats, a defensive strategy focused on resource optimization becomes very important (Furr & Eisenhardt, 2021). Telkom Indonesia needs to leverage and strengthen the existing infrastructure to enhance the capability of IoT service deployment. One step that can be taken is to improve the efficiency in managing the existing telecommunications infrastructure (Brockhaus et al., 2023). By leveraging the latest technology and innovations in network management, Telkom Indonesia can improve service quality and expand coverage in underserved areas.

Telkom Indonesia needs to focus on developing products and services that meet market needs. Innovation in user-oriented IoT services will help Telkom Indonesia maintain its position in an increasingly competitive market. By offering unique and relevant solutions, Telkom Indonesia can attract more customers and strengthen its presence in the transportation sector. To address existing weaknesses and threats, Telkom Indonesia must focus on optimizing resources

by enhancing existing infrastructure and increasing awareness of IoT technology. Through this approach, Telkom Indonesia can not only maintain its competitive position but also contribute to the development of a more efficient and sustainable transportation sector in Indonesia. In facing the existing challenges, it is important to continuously adapt and innovate, so that we can take advantage of emerging opportunities and enhance consumer confidence in the services provided (Ciarli et al., 2021).

4. CONCLUSION

The combination of internal strengths and external opportunities can be developed into a structured business strategy, which includes SO (Strengths-Opportunities) strategies for proactive innovation, WO (Weaknesses-Opportunities) strategies to address weaknesses, ST (Strengths-Threats) strategies to mitigate risks, and WT (Weaknesses-Threats) strategies for resource optimization. In the context of the SO strategy, Telkom can leverage its infrastructure strengths and reputation to develop new services that support digitalization and transportation efficiency. Through the WO strategy, the company can enhance collaboration with the government and state-owned enterprises to address existing weaknesses and develop the necessary infrastructure. The ST strategy encourages Telkom to leverage existing innovative products to face competitive threats and maintain consumer trust. Lastly, the WT strategy emphasizes the importance of resource optimization and strengthening existing infrastructure to sustain competitiveness in an increasingly tight market. With this approach, Telkom Indonesia can not only tackle existing challenges but also strengthen its position as a leader in the IoT industry in the transportation sector.

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