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Review

Redesigning a position map and strategy for Indonesian testing, inspection, and certification (TIC) state-owned enterprises in the red ocean competition: A systematic literature review

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Abstract: The global Testing, Inspection, and Certification (TIC) service market is experiencing significant growth, driven by rising demand for high-quality and safety-related TIC services across various industries. This research aims to redesign a position map and strategy for Indonesian TIC State-Owned Enterprises (SOEs) in the Red Ocean competition. This systematic literature review analyzed 17 journals. The results show that the Indonesian TIC SOEs are intensively competing in the Red Ocean competition. In designing the position map in the Red Ocean competition, the SOEs must use technology in their operational activities to implement good corporate governance, collaborative strategies, resource management, and leadership styles aligned with the organizational culture.

Keywords: certification; inspection; redesign; testing; systematic review

1. Introduction

Business competition occurs in various industries, including the Testing, Inspection, and Certification (TIC) service industry. The global TIC service market is expanding rapidly, owing to rising demand for high-quality and safety-related services across various sectors (**Figure 1**). TIC users' markets include consumer goods and retail, agriculture and food, medical and life sciences, chemicals, construction and infrastructure, and energy and electricity. Each of these segments contributes to the dynamic growth of the global TIC market (Marketus, 2023).

Figure 1. Testing Inspection and Certification (TIC) Market Size, 2024–2032 (USD Billion).

The Testing Inspection and Certification (TIC) Market is projected to grow from USD 63.33 Billion in 2024 to USD 92.75 billion by 2032, exhibiting a compound annual growth rate (CAGR) of 4.88% during the forecast period (2024–2032). The market size for Testing Inspection and Certification (TIC) was also valued at USD 59.9808 billion in 2023 (Dhapte, 2023).

The Asia Pacific market share is expected to rise significantly, reaching 255.85 billion USD in 2028, with Indonesia reaching 650.96 million USD in 2027 at a CAGR of 3.83% (Industryarc, 2023). Complex and evolving regulations and the integration of advanced technologies drive market growth. Despite the volatility, uncertainty, complexity, and ambiguity (VUCA) caused by digitalization, global trade, and increased mergers and acquisitions, the global TIC market continues to grow (Brenneis, 2020).

The Global TIC companies generally focus on technological advancement, regional expansion, and service portfolio enhancement. Nevertheless, several challenges remained throughout the deployment that can impede the advancement of TIC services. The poor uptake of remote testing services is one issue facing the Testing, Inspection, and Certification (TIC) sector. However, other trends are also impacting the TIC sector. For example, as products and services grow more sophisticated and interconnected, the digitization of goods and services opens up new opportunities for TIC players. The availability of TIC services may be restricted in many places due to a lack of testing and inspection facilities.

Indonesian TIC companies have great potential for exponential growth, yet the competition in this sector is intense (Industryarc, 2023). Factors driving this growth include industrial downstream policies, green economy development, digitalization, Sharia economic development, and increased product volume. In Indonesia, major TIC companies include PT Sucofindo, PT Surveyor Indonesia, and PT Mutu Agung Lestari. They play an essential role and operate under strict regulations and national standards. However, they continue to face challenges in meeting the digitalization of services, and their revenues remain far below the projected market value for 2027.

In Indonesia, the TIC companies are governed by Law Number 20 of 2014 concerning Standardization and Conformity Assessment. These businesses are called Conformity Assessment Institutions (Lembaga Penilaian Kesesuaian, LPK). According to the list of LPKs available on the National Accreditation Committee (Komite Akreditasi Nasional, 2024), the number of TIC companies is limited to 20. It includes national private companies, State-Owned Enterprises (SOEs), and foreign investment companies (Perusahaan Penanaman Modal Asing, PMA).

The TIC industry is highly competitive, with numerous companies providing identical services (Setyoko et al., 2024). Therefore, companies must differentiate themselves from competitors to attract and retain customers. This high level of competition emphasizes the importance of companies implementing a competitive model that suits their industry structure. For the Indonesian TIC companies, the market and competitors are well understood, and the ease with which new players can enter this industry means that the competition is exceptionally tight or falls into the Red Ocean category. The Porter's Five Forces Model was proposed by Michael E. Porter (Porter, 1985). It illustrates the competitiveness model of TIC companies based on their industrial structure. It analyzes a company's competitiveness by considering

several elements, such as the threat of new entrants, substitution products, the bargaining power of buyers and suppliers, and competition among existing companies (Duran et al., 2020). In addition, it also analyzes the level of competition in an industry and develops appropriate business strategies. This model helps companies understand the competition dynamics and external factors influencing the industry's profitability (Gerard, 2018).

However, this model is less relevant in a complex industrial environment with rapid changes and technological advancements—such as what is happening in the TIC service industry in Indonesia, particularly the TIC SEOs. Several researchers argued that this model is no longer entirely relevant in modern businesses affected by digitalization, deregulation, and globalization. This model may need to be adapted to include additional factors pertinent to the current business environment (Nyanga et al., 2020). To better illustrate the competitiveness model of Indonesian TIC SOEs based on their industrial structure, Porter's Five Forces model can be combined by incorporating dynamic capability elements.

Further, the previous researchers also criticized the limitations of Porter's Five Forces Model from various journals regarding competitor analysis. Although many academics and practitioners, both at the international and local levels, still highly appreciate and use it, there is still considerable debate in the application of this model to the complex contemporary industrial environment with rapid changes and technological advances (Indiasty et al., 2014)—which is in line with the TIC market analysis report (Marketandmarkets, 2020; Marketus, 2023). According to the TIC market report, technological development's complexity and speed pose significant challenges for small and medium-sized companies (Marketandmarkets, 2020). The increasing adoption of smart devices and the need for data security (Internet of Things, IoT) increase the demand for devices and network testing (Marketandmarkets, 2020).

In business competition, the term "Red Ocean" describes a highly competitive market in which the companies compete in an existing market space and attempt to outperform their competitors through various competitive strategies. In general, the Indonesian TIC SOEs, including the national private companies, must redesign their business strategies to compete in the Red Ocean competition. This redesign of the competitive model helps identify problems in the companies, define the approach, and implement coherent actions, thus allowing the company to focus on the most crucial strategy (Rumelt, 2012).

This study reviews the literature to learn about prior efforts to redesign Indonesia's competitiveness model of TIC SOEs. These companies were selected because they modeled the competitiveness model of Porter's Force Five Model in the Red Ocean competition. Although these companies offer complete TIC services, they do not receive equipment subsidies from the government through the State Budget and their companies' parents in Indonesia. This condition reflects the implementation of strategic policies where the Non-Tax State Revenue does not fund them. However, it is stipulated in the Ministerial Decree concerning the provision of service fees.

Previous research shows a need for more literature offering a comprehensive competitiveness model of the Indonesian TIC SOEs in the Red Ocean competition. Considering that Porter's Force Five Model is less relevant according to the current trend in the TIC industry due to the complex and fast-changing TIC industry

environment, there is a need for a more flexible and dynamic analytical approach that can facilitate the market dynamics influenced by advanced technology, evolving regulations, and innovative competition. Redesigning TIC processes to be more customer-focused, efficient, and compliant with current technological and regulatory environments can be significantly facilitated by filling these research gaps. These gaps also offer creative research opportunities that can advance academic understanding and practical field applications. Therefore, this study attempts to redesign Porter's Five Forces Model adapted to the industry challenges by synthesizing elements of dynamic capabilities in the context of Indonesian TIC SEOs.

The novelty of this paper is that, especially when considering Indonesian state-owned enterprises, the TIC area might considerably profit from a systematic review method. This study can provide significant insights to guide future advancements in TIC practices by prioritizing innovative patterns, utilizing multidisciplinary approaches, and integrating stakeholder perspectives.

This research aims to redesign a position map and strategy for Indonesian TIC State-Owned Enterprises (SOEs) in the Red Ocean competition. This study's scope focuses on examining regulations, technology, and market segmentation. This study's contribution is that redesigning TIC services can have revolutionary advantages for clients and suppliers. By prioritizing efficiency, accuracy, accessibility, and sustainability, TIC services can effectively address the dynamic needs of many industries, promote compliance, and stimulate innovation. These contributions generate more comprehensive economic and social advantages and improve TIC providers' operational efficacy.

2. Materials and methods

This study was a systematic literature review (SLR). This method collected and evaluated the research results in a specific field of study (Boland et al., 2017; Mohamed et al., 2021) and found the novelty (Mengist et al., 2020). The research novelty was one of the most significant considerations while conducting research. A literature review allowed the researchers to ensure that the study was never conducted in any way. This present study was carried out through the state-of-the-art using the Scopus database to answer the research question of "How to redesign the competitiveness model of Indonesian TIC SOEs in the Red Ocean competition based on the companies' competitiveness position map in the Porter's Five Forces Model and their strategies in winning the competition?".

The data collection was done by selecting relevant journals. The journals must meet the following inclusion criteria: where they must (1) be published in 2019–2024; (2) written in English; (3) discuss the topic of redesigning the competitiveness model in the TIC sector; (4) have a research subject of SOEs, and (5) by reputable international journals (Scopus-indexed). The researchers searched the journals on Scopus, Crossref, EBSCO, and Google Scholar. The articles search was conducted on 22 April 2024. It was done by using several keywords, including "redesign," "strategic," "map," "mapping," "positions," "competitiveness," and "services."

The author used the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) 2020 to ensure systematic literature reviews that are transparent,

reproducible, and scientifically adequate (Page et al., 2021). The following **Figure 2** presents the PRISMA flow diagram:

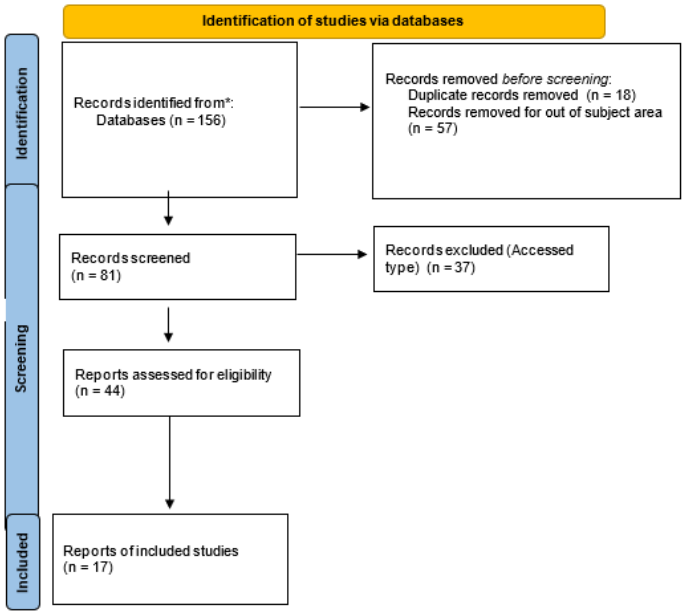

Figure 2. PRISMA flow diagram.

Further, the data was analyzed using VOSviewer, which constructed and visualized bibliometric-based networks (Eck and Waltman, 2018). Researchers can identify new areas of study and change in focus by examining clusters and how they change over time using Vosviewer analysis. The network display makes identifying essential writers and collaborators in a specific topic easier. Vosviewer facilitates the mapping of the terrain of current research, facilitating the identification of foundational works and gaps in the body of knowledge. VOSviewer is a useful tool in bibliometric and scientometric analyses since it allows for a thorough understanding of academic ties and research trends. The visualization findings were then mapped and analyzed and can be seen in the following **Figures 3** and **4**.

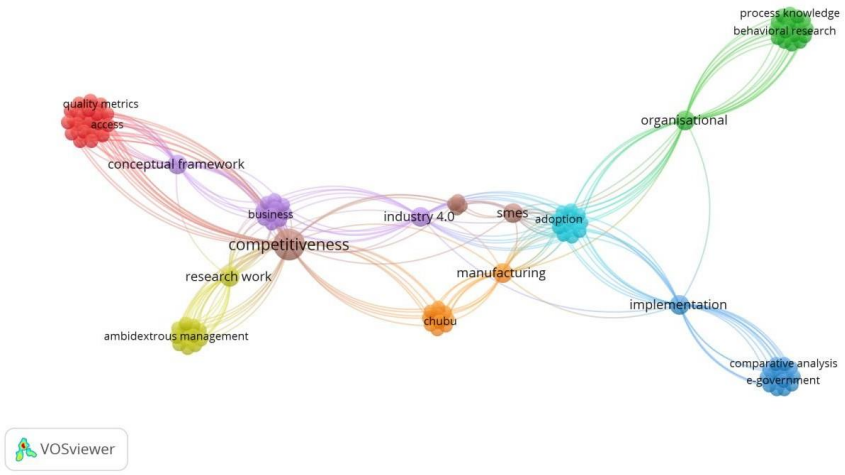

Figure 3. Trends in research themes.

Source: Processed data (2024).

Figure 3 illustrates that from 2019 to 2024, there are 206 documents, consisting of 156 journals, 23 conference papers, 1 conference review, 21 book chapters, 1 review, 3 books, and 1 note. There are 8 clusters, but research has yet to be explicitly categorized for the TIC cluster.

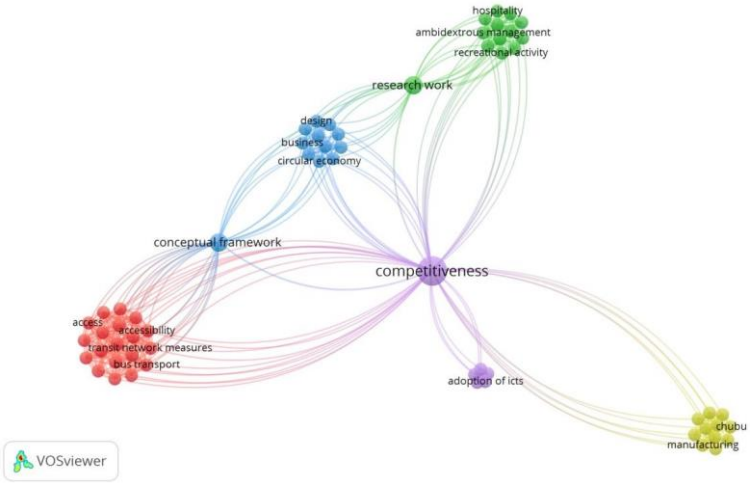

Figure 4. Trends in research themes based on Q1–Q2 Scopus-indexed journals.
Source: Processed data (2024).

Meanwhile, **Figure 4** illustrates the trends based on the research themes, limited to only the Q1–Q2 Scopus-indexed journals. There are 84 documents, including 81 journals, 2 book chapters, 4 reviews, and 1 note. There are 5 clusters, yet no research has been explicitly categorized for the TIC cluster.

3. Results and findings

The results present the outcomes of a synthesized examination of the 17 selected papers. The researcher outlines previous theoretical frameworks or significant constructs used by other scholars. **Table 1** shows the review results of papers chosen based on inclusion and exclusion criteria.

Table 1. Articles reviewed.

No.	Author	Method	Data collection and Analysis Method	Key Finding
1	Rahman and Kusumastuti (2024)	Qualitative	FGD; SWOT	The Strength, Weakness, Opportunity, and Threat (SWOT) analysis revealed five main strategies for improving the performance of PT BKI Belawan in providing independent insurance services. First, the company must maintain and enhance its quality to compete with international or rival companies that work with other parent companies. This could be accomplished through competition analysis, which assessed the strengths and weaknesses of the rival companies. Second, the company must make a standard memorandum of understanding (MoU) with external partners in several cities. Third, the company must continue improving business ethics and shareholder accountability. Fourth, the company must conduct equipment tests for different equipment or perform the test in another laboratory that meets the standards. Fifth, technicians must be retrained by certified project workers if they follow incorrect methods.

Table 1. (*Continued*).

No.	Author	Method	Data collection and Analysis Method	Key Finding
2	Billy et al. (2024)	Quantitative	Questionnaire; SEM PLS	Organizational success depends on strong governance practices and collaborative strategies. Good governance promotes transparency, accountability, and ethical decision-making, which improves operational efficiency and strategic positioning. On the other hand, business collaboration allows knowledge exchange, resource collection, and access to complementary capabilities, which enhances innovation and market competitiveness.
3	Azis Kusnaya et al. (2022)	Quantitative	Questionnaire; SEM	PT Sucofindo Padang should immediately improve and design a more structured, integrated, and sustainable system and implement a leadership style that fits the culture and work environment to achieve the effectiveness of its implemented strategies.
4	Nasution et al. (2023)	Qualitative	Interview; Miles and hurban analysis	PT Sucofindo Medan must adapt during the COVID-19 pandemic. The company's systems developed based on various standards, regulations, criteria, frameworks, approaches, and others were implemented in the same business processes so that system integration could be interpreted as how the company ensured that all business processes accommodated all criteria in an integrated, simple, practical, and effective manner.
5	Cundeva-Blajer (2022)	Quantitative	Secondary data; Algorithm	The application of data science in the TIC decision-making process must involve experimental "measurement" and complementary "data science," with a case study estimating the recalibration interval of instruments using a data fusion approach.
6	Yuen et al. (2022)	SLR	Article; content analysis	A specially designed framework, which was easy to create, could considerably benefit the TIC industry by supporting the key technologies that supported Industry 4.0.
7	Li et al. (2024)	SLR	Article; content analysis	In Industry 5.0, the TIC industry must propose the potential of complementing technologies to be applied to adapt to the transition.
8	Mak et al. (2020)	SLR	Article; content analysis	In adopting virtual reality (VR) technology in the laboratory, VR training systems have many pros and cons. The VR technology has provided training in various areas, including product design and manufacturing, facility maintenance, and regional teaching. A typical VR system consisted of four essential elements: 1) Input device – to imitate work behavior; 2) Output device—such as VR headsets, to allow users to experience a virtual environment; 3) A graphical system—to generate simulated scenarios; 4) Database – to store different conditions to replicate the working environment.
9	Budi Sulistiyo and Fitriati (2023)	Qualitative	Interview and observation; content analysis	The planned acquisition strategy was projected to help PT BKI improve its efficiency, including budget control, time management, and service quality. Given PT BKI's high demand for underwater inspections, the acquisition strategy was one of the most effective approaches to address these needs while making a profit. Adopting the acquisition strategy would improve PT BKI's performance in conducting underwater inspections, ensuring that the products delivered by PT BKI met inspection standards. By making an acquisition, the acquiring company could gain control of the target company and make many decisions, including managing the acquired company's assets, without requiring shareholder approval.
10	Kumar (2023)	SLR	Article; content analysis	The Red Ocean strategy occurred when companies attempted to outperform their competitors to capture a larger share of the current market demand. As the market space filled up, the opportunities for profit and growth diminished. Products became commodities, and fierce competition transformed what should have been an ocean into a bloody market, like the Red Ocean.

Table 1. (*Continued*).

No.	Author	Method	Data collection and Analysis Method	Key Finding
11	Prakoso and Fitriati (2023)	Qualitative	Interview; content analysis	BKI had planned various business strategies. However, a strong commitment was required to address project management problems through improved integrated digital governance.
12	Isharyadi and Kristiningrum (2021)	Quantitative	Data from KAN; quality infrastructure (QI)	Several criteria were met, particularly in terms of legality and national recognition. However, several areas still need improvement so that the certifying organization can do its job and ensure the quality of products and services.
13	Martins et al. (2020)	Qualitative	industrial sensors data; content analysis	Calibration certification allows companies to ensure and confirm the effectiveness of their measures, employ adequate data, and eliminate measurement errors.
14	Kushadianto and Ciptomulyono (2022)	Quantitative	Questionnaire; AHP–COPRAS model	The company must evaluate the surveyor selection process that has been adopted.
15	Ichsan and Kusumastuti (2023)	Qualitative	FGD; SWOT analysis	This position was achieved due to the presence of a sizeable non-classification force. Internal and external factors developed the following business strategies: 1) Working on Human Resource Development – through research and development activities; 2) Always signing the MoUs with external partners in many cities; 3) Optimizing uniqueness to compete with foreign companies; 4) Improving the marketing activities by using new technological approaches; 5) Expanding the business through the Company's Holding; 6) Synergizing with subsidiaries and other SOEs in carrying out the business strategies; and 7) Implementing the same technology and management system as other businesses.
16	Wibowo et al. (2021).	Qualitative	FGD; SWOT analysis	The Statutory Inspection Department (SID) business units could use the Quantitative Strategic Planning Matrix (QSPM) strategy of reducing product pricing by up to 5% to improve sales volume. The recommended QSPM strategy for Voluntary Inspection Department (VID) business units was to create possibilities to cooperate or join consortiums with competitors, especially in large-scale tenders with complex scopes of work.
17	Genta et al. (2020)	SLR	Article; content analysis	Quality inspections were performed in every production system to prevent non-conforming products from reaching the end customer or user. The inspections were conducted using specified procedures, which varied depending on the production process.

4. Discussion

Based on the SLR method approach, several implications are related to the Indonesian TIC SOEs. First, the Indonesian TIC SOEs are currently extensively competing in the Red Ocean competition. The Red Ocean strategy was implemented when the companies sought to outperform their competitors to gain a larger share of the current market demand (Kumar, 2023). While increasing market share is the short-term objective, long-term success will depend on developing strategies that prioritize value creation and adaptability in a quickly changing environment (Sołoducho-Pelc and Sulich, 2020). Red ocean competition can be overcome by concentrating on innovation, differentiation, and improved customer experience (Iruthayasamy, 2021).

Second, the Indonesian TIC SOEs had a minimum business scope: testing, inspection, and certification. The certifying organizations in Indonesia were among the companies providing TIC services with a balanced number of clients. The number

of certificates awarded to organizations in Indonesia was relatively high. However, compared to other countries, this figure remained very small, especially compared to the number of certifications granted in countries with significant populations near Indonesia, such as China and the United States (Isharyadi and Kristiningrum, 2021).

Third, the Indonesian TIC SOEs supported the production activities that affected practically every area of everyday life. The key technologies that underpinned Industry 4.0 could considerably benefit the TIC industry with a specially designed framework that was easy to create (Ichsan and Kusumastuti, 2023; Prakoso and Fitriati, 2023; Yuen et al., 2022). To adapt to Industry 5.0, the TIC industry must propose corresponding technologies (Li et al., 2024). The TIC industry desperately needed data science to manage a business. The use of data science in the TIC decision-making process was based on the use of experimental "measurement" and complementary "data science," with a case study in estimating the recalibration interval of an instrument using the data fusion approach (Cundeva-Blajer, 2023).

Fourth, the Indonesian TIC SOEs could also adopt VR technology in the laboratory despite the pros/cons of VR Training systems. A typical VR system consisted of four essential elements: 1) Input device—to imitate work behavior; 2) Output device—such as VR headsets, to allow users to experience a virtual environment; 3) A graphical system – to generate simulated scenarios; 4) Database—to store different conditions to replicate the working environment (Mak et al., 2020).

Fifth, the TIC SOEs in Indonesia must practice good governance. Strong governance practices are essential for the success of an organization. Good governance promotes transparency, accountability, and ethical decision-making, improving operational efficiency and strategic positioning (Billy et al., 2024). Further, the companies must implement a collaborative strategy, which is also essential for organizational success (Billy et al., 2024; Rahman and Kusumastuti, 2024). Following the planned acquisition strategy was also expected to help them improve their efficiency in various aspects, including budget control, time management, and service quality (Budi Sulistiyo and Fitriati, 2023). In addition, the companies must also improve business ethics and accountability to the shareholders (Rahman and Kusumastuti, 2024).

Finally, the Indonesian TIC SOEs must employ a leadership style that fits the culture and work environment to achieve corporate effectiveness. Leaders who execute a specific leadership style thoroughly understand their subordinates, including their strengths and weaknesses, to optimize their employees' abilities to support the organizational goals (Kusnaya et al., 2022).

5. Conclusion

The Indonesian TIC SOEs are participating in the Red Ocean competition. While Indonesian TIC SOEs operate within a narrow business scope focused on testing, inspection, and certification, and despite maintaining a balanced client base with a relatively high number of certificates awarded, their performance remains modest in comparison to other countries, particularly China and the United States, which have significantly larger certification outputs. To design the position map, they must use technology in their operational activities and implement good corporate governance,

collaborative strategies, resource management, and leadership styles that align with the organizational culture. Indonesian TIC SOEs could employ advanced technologies such as VR in their TIC services. Good governance encourages openness, accountability, and ethical decision-making, which enhances operational efficiency and strategic positioning. Leaders who implement a leadership style to maximize their employees' skills to support the company goals.

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