COSTING: Journal of Economic, Business and Accounting
Volume 8 Nomor 4, Tahun 2025
e-ISSN : 2597-5234

AN INTEGRATED METHOD FOR EVALUATING MANUFACTURING INDUSTRY STRATEGY MAP IN THE DIGITAL TRANSFORMATION ERA USING DEMATEL ANP AND BALANCED SCORECARD METHODS

METODE TERINTEGRASI UNTUK MENILAI PETA STRATEGI INDUSTRI MANUFAKTUR DI ERA TRANSFORMASI DIGITAL MENGGUNAKAN METODE DEMATEL ANP DAN BALANCED SCORECARD

Fatih Khamdani[1], Firdaus Alamsjah[2]
Binus University, Jakarta[1,2]
fatih.khamdani@binus.ac.id, alamsjah@binus.edu

ABSTRACT
Digital transformation has played a pivotal role in shaping corporate strategies, influencing the selection of the most effective approaches to optimize benefits while minimizing the disruptive impact of technological change. This study aims to identify suitable digital transformation strategies within Indonesia's textile and automotive manufacturing industries to support the country's economic goals for 2030. The research methodology involves developing a strategy map and determining the most influential and prioritized strategic objectives through a quantitative approach, using interviews and questionnaires based on the Balanced Scorecard framework. The collected data is analyzed using DEMATEL and ANP techniques. The developed strategy map reveals that "Industrial Transformation 4.0" is the most influential strategic objective, while "Increasing Profitability" is identified as the top priority.
Keywords: *Digital transformation, Strategy Map, Balanced Scorecard, DEMATEL Method, ANP Method*

ABSTRAK
Transformasi digital memiliki dampak besar terhadap penyusunan strategi perusahaan, terutama dalam menentukan strategi yang paling efektif untuk memperoleh keuntungan maksimal sekaligus menghindari dampak negatif dari perkembangan teknologi. Penelitian ini bertujuan untuk mengidentifikasi strategi transformasi digital pada sektor industri manufaktur tekstil dan otomotif di Indonesia dalam rangka mendukung tercapainya visi ekonomi tahun 2030. Pendekatan yang digunakan meliputi penyusunan peta strategi serta penentuan sasaran strategis yang paling berpengaruh dan prioritas utama melalui analisis kuantitatif berdasarkan wawancara dan penyebaran kuesioner, dengan mengacu pada perspektif Balanced Scorecard serta pengolahan data menggunakan metode DEMATEL dan ANP. Dari hasil penelitian diperoleh bahwa sasaran strategis yang memiliki pengaruh terbesar adalah "Transformasi Industri 4.0", sedangkan sasaran strategi dengan prioritas tertinggi adalah "Peningkatan Profitabilitas".
Kata Kunci: Transformasi digital, Peta Strategi, Balanced Scorecard, Metode DEMATEL, Metode ANP

INTRODUCTIONS

The "World in 2050" initiative outlines six modular SDG transformations essential for achieving the Sustainable Development Goals: (1) education, gender equality, and inequality; (2) health, welfare, and demographics; (3) energy decarbonization and sustainable industry; (4) sustainable management of food, soil, water, and oceans; (5) sustainable cities and communities; and (6) the digital revolution for sustainable development (Jeffrey et al., 2019). Meanwhile, over 80 % of CEOs report implementing digital business transformation initiatives, and it is projected that by 2030 over 70 % of new economic value creation will depend on digital platforms (World Economic Forum, 2018). In Indonesia, the digital economy is forecasted to reach IDR 2,040 trillion by 2025 (Ministry of Communication and Informatics of the Republic of Indonesia, 2019), in line with the country's ambition to rank among the top 10 global economies by 2030.

A key challenge posed by digital platforms is disruption at the low end and in new markets across industries (Christensen et al., 2015). Disruptive technologies stimulate industry growth by introducing products and services that are significantly cheaper, more efficient, and easier to use. These innovations often enable newcomers with minimal technical expertise to compete in industrial sectors. While disruptive technologies can overhaul traditional processes, they also deliver major economic benefits including productivity gains, the birth of new industries, and GDP growth (Brynjolfsson & McAfee, 2014). In particular, automation and artificial intelligence are increasing production efficiency, enabling higher output with fewer resources, which further contributes to GDP (Brynjolfsson & McAfee, 2018).

In 2019, Indonesia launched the "Making Indonesia 4.0" program to drive digital transformation in key industries. This initiative targets five sectors, aiming to grow net exports by 10% of GDP and boost productivity to help Indonesia reach its goal of being a top-ten economy by 2030. However, manufacturing GDP growth between 2018 and 2022 fell short of expectations despite the 2019 digital transformation readiness index indicating strong industrial readiness (see Table 1). This raises questions: Why did outcomes not align with the readiness index? Was the digital transformation strategy flawed? For success, four dimensions must align: (i) technology adoption, (ii) organizational restructuring, (iii) changes in value creation, and (iv) financial considerations (Chanias & Hess, 2016; Chanias et al., 2018; Ghosh et al., 2018; Hess et al., 2016; Matt et al., 2015). Among the prioritized sectors, the textile and automotive industries present puzzles. The textile sector despite having the highest digital readiness score at the time experienced a decline in GDP growth. Meanwhile, the automotive sector.

The industry is currently grappling with significant challenges. To navigate these difficulties, companies must possess a well-defined strategic map that enables them to adapt to evolving customer demands and technological advancements, thereby maintaining their competitiveness in a dynamic market. In response to these shifts, organizations are urged to embark on digital transformation initiatives with key priorities such as enhancing efficiency, reducing operational costs, fostering innovation, and developing new revenue streams—ultimately increasing operational value and improving productivity.

Table 1. **INDI score vs GDP growth**

Manufacturing	INDI Score 2019	GDP Growth 2019	GDP Growth 2022
Textile	2,51	15,35%	9,34%
Food & Beverage	2,47	7,78%	4.9%
Chemical	2,31	8,48%	0,69%
Electronic	1,84	-0,51%	6,71%
Automotive	1,72	-3,43%	10,67%

Recent research has introduced methodologies to evaluate digital transformation maturity and develop strategic roadmaps for elevating digital maturity, particularly in chemical and machinery manufacturing sectors. One such model is the Digital Transformation Capability Maturity Model (Digital Transformation-CMM) by Ebru Gökalp et al. (2021). Additional studies by Felipe et al. (2019) utilized fuzzy DEMATEL and the Balanced Scorecard (BSC) to construct a strategic map for a Colombian bank, building on previous work by Quezada and Lopez-Ospina (2017) and Wu (2012), who adapted optimization models to strategic mapping. These investigations share a common focus on individual company-level analysis.

This presents an opportunity for broader research. The present study proposes expanding the scope to the national industrial level, particularly targeting the textile and automotive manufacturing sectors in Indonesia. By employing the DEMATEL and ANP methods, the study aims to develop an effective and resilient strategy map applicable to these industries. The research will center on evaluating the current status of digital transformation, then designing an ideal strategic framework to enhance both processes and outcomes in Indonesia's textile and automotive manufacturing industries. The objectives are twofold: (1) to identify strategic approaches to digital transformation within these industries, and (2) to determine the most influential and high-priority strategic objectives that should serve as development targets, enabling the industries to better navigate the challenges posed by the digital transformation era.

Digital Transformation

Digital transformation refers to the profound impact of emerging technologies that disrupt traditional business models, creating new ways of operating across all sectors. Organizations are reconfiguring their operations through technologies such as digital twins (Annunziata & Biller, 2015), the Internet of Things (IoT) and connected devices (Gilchrist, 2016), artificial intelligence (Schuh et al., 2017), cyber-physical systems (Kagermann et al., 2013; Schuh et al., 2017), XaaS (Everything-as-a-Service), robotics, drones, and data analytics (Gökalp et al., 2021b; 2021c).

Pre-digital organizations those that were established and thrived in traditional sectors like retail, automotive, and finance are now facing existential threats from the emerging digital economy (Ross et al., 2016). Unlike digital-native firms such as Alphabet, Amazon, or Tencent, these pre-digital firms must undertake fundamental changes to their organizational structures, business models, and operational processes to integrate digital technologies (Bharadwaj et al., 2013; Sebastian et al., 2017; Tumbas et al., 2017a).

Digital technologies have the potential to transform a company's products, services, operations, business strategies, and competitive environment (Fichman et al., 2014; Hess et al., 2016; Lucas et al., 2013; Yoo et al., 2012). For pre-digital organizations, digital transformation is a comprehensive process of business reformation enabled by information systems, and it is driven by deep economic and technological shifts both within organizations and across entire industries (Besson & Rowe, 2012; Crowston & Myers, 2004; Venkatraman, 1994).

Strategy Map

The core purpose of a strategic approach lies in formulating a clear vision and the foundational framework that guides top management or organizational experts in setting their strategic priorities, which will be translated into derivative activities that support the vision. To facilitate this, techniques like focus group discussions (Krueger, 1994), the Delphi method (Dalkey & Helmer, 1963), and expert evaluations are commonly employed. These methods assist in aligning strategic viewpoints (Porter, 2008). Additionally, SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) (Bell & Rochfordm, 2016; Romero Gutierrez et al., 2016) plays a critical role in developing strategies that convert threats into opportunities, capitalize on strengths, anticipate challenges, and mitigate the impact of weaknesses. One visual representation of strategic planning is the strategy house model (Rohm & Montgomery, 2011), where each focus area contributes to forming a cohesive and sustainable strategy.

Balanced Scorecard

Organizations set goals which are translated into actionable strategies that align across different business scales whether large enterprises (Niven, 2006), MSMEs (Mehmood & Tzeng, 2014), or small businesses (Gumbus & Lyons, 2002). The causal links in the Balanced Scorecard (BSC) framework vary depending on contextual variables such as organizational size and type (Liach et al., 2017). BSC, developed by Kaplan and Norton (1991, 1996), establishes performance indicators across four perspectives: (1) Financial, (2) Customer, (3) Internal Business Processes, and (4) Learning & Growth. Traditionally, organizations primarily relied on financial metrics to evaluate performance. However, in the 1980s, there was a shift toward integrating operational indicators, recognizing the limitations of purely financial measures. The BSC framework captures both financial and non-financial metrics to offer a more comprehensive understanding of organizational performance (Kaplan & Norton, 1996a, b, c). It serves as a strategic tool that helps management communicate, execute, and monitor strategies effectively through linked performance indicators.

Several studies support the use of BSC for strategy mapping. For example, Naqi Sayed and Camillo Lento (2017) explored how to identify key performance indicators (KPIs) in environmental consulting firms for BSC-aligned strategy maps. In another study, Ming-Lang Tseng (2017) applied a hybrid fuzzy synthetic evaluation method combined with DEMATEL to assess sustainability in Taiwan's textile industry, concluding that social responsibility needed significant improvement. Similarly, Zhang and Tzeng (2011) emphasized identifying critical success factors and their interrelations to build robust strategy maps, while Batarseh and Tzeng (2015) highlighted how aligning these maps with strategic goals can significantly enhance institutional big success.

DEMATEL and ANP Methods

Multi-Criteria Decision Making (MCDM) techniques are widely used across numerous domains, including the development of strategic maps using a combination of DEMATEL and ANP methods (Jena & Bhoi, 2017). These methodologies have been applied in a variety of industries such as the high-tech sector (Ting & Shieh, 2011), manufacturing (Jena & Bhoi, 2017), automotive (Sharma & Soni, 2015), and smart manufacturing (Elahi & Tzeng, 2017). Additionally, Lopez-Ospina et al. utilized DEMATEL and Linear Programming to analyze causal relationships in strategy maps, while Quezada et al. (2018) integrated ANP with DEMATEL to construct strategic maps. In supply chain management, these methods have been employed to formulate integrated sustainability strategy maps (Zhang & Zhong, 2014; Zhou & Tzeng, 2015). They have also supported strategic planning in the energy sector (Mehmood & Tzeng, 2014; Güleryüz, 2016) and guided the development of corporate social responsibility strategy maps (Almeida & Lima, 2017; Wu & Lee, 2015). DEMATEL and ANP have proven particularly useful in evaluating interdependencies and constructing strategy maps that inform decision-making for digital transformation and smart manufacturing initiatives.

The Decision Making Trial and Evaluation Laboratory (DEMATEL) method was originally developed by Fontela and Gabus (1973) under the Science and Human Affairs Program at the Battelle Memorial Institute in Geneva (1972–1976). This method was designed to analyze and resolve complex, interdependent problems by quantifying the degree of influence between elements in a system (Chung-Wei, 2007). Due to its strength in identifying cause-effect relationships, DEMATEL has become a popular tool in areas such as management, performance evaluation, and strategic planning, helping to deconstruct complex problems into clear causal structures.

The Analytic Network Process (ANP), an evolution of the Analytic Hierarchy Process (AHP), is another powerful MCDM method that allows for more flexible modeling by considering interdependencies and feedback loops between decision elements (Saaty, 1999). Unlike AHP, which assumes a strictly hierarchical structure, ANP accounts for reciprocal influences among elements, making it suitable for real-world decision problems that involve mutual relationships between factors. As explained by Aziz (2003), ANP enables the systematic integration of both tangible and intangible criteria in decision-making.

The ANP methodology is built upon three key concepts:

a. **Decomposition** – Complex decisions are broken down into clusters, sub-clusters, and alternatives, forming a network with feedback loops rather than a strict hierarchy.
b. **Comparative Assessment** – Elements within each cluster are evaluated in pairs to determine their relative importance. This involves constructing a pairwise comparison matrix (n × n) and deriving local priorities using eigenvectors.
c. **Synthesis (Hierarchical Composition)** – Local priorities are aggregated by multiplying them with the global priorities of the parent nodes, producing the global priorities of elements at the lowest level.

Together, DEMATEL and ANP method offer a robust framework for developing strategic maps that capture complex interrelations and prioritize key strategic objectives, making them highly effective tools for guiding transformation efforts in dynamic and uncertain environments.

Indicators

A critical component in applying the Balanced Scorecard (BSC) framework is the development and selection of performance indicators to effectively monitor organizational progress (Kaplan & Norton, 2004). For successful implementation, it is essential to ensure alignment between strategy formulation and its execution (Moraes & Gomes, 2021). This alignment supports continuous improvement and maintains strategic coherence. Additionally, validation from domain experts is necessary to confirm the relevance and feasibility of each strategic objective in achieving the overarching goals. Indicators should be derived from information that is closely aligned with organizational targets, using benchmarks based on the SMART criteria; Specific, Measurable, Achievable, Reasonable, and Timely. These indicators must be carefully deliberated, agreed upon, and properly documented.

LITERATURE REVIEW

This study builds upon previous research integrating multi-criteria decision-making methods such as DEMATEL and ANP with the Balanced Scorecard framework to evaluate and develop strategy maps in manufacturing industries. In the context of the digital transformation era, these combined approaches provide a comprehensive tool to identify key strategic objectives, analyze their interrelationships, and prioritize initiatives that enhance operational performance and competitiveness. Prior studies have demonstrated the effectiveness of DEMATEL and ANP in clarifying causal relationships and decision priorities, while the Balanced Scorecard offers a balanced view of financial and non-financial performance metrics, making their integration highly suitable for industries undergoing digital transformation.

RESEARCH METHOD

This study is quantitative research designed to examine the condition of a subject, with the researcher serving as the primary instrument. Data collection was conducted in a systematic manner, followed by deductive analysis to highlight objective findings. The focus of this research is an evaluation of the current progress in implementing strategies aimed at achieving Indonesia's national economic vision for 2030, specifically in textile and automotive manufacturing industry. Expert opinions were sought to assist in the evaluation and subsequent planning within the context of a digital strategy map. Table 2 provides detailed profiles of the experts in their respective fields, offering diverse perspectives that contribute to comprehensive and in-depth understanding of the phenomenon under investigation.

Table 2. Profile of Expert

Expert Judgement		Textile Industry	Automotive Industry
Level	Experience		
Businessmen	> 10 years	1	1
Lecturer		1	1
Practitioner	> 20 years	2	2
Community	> 20 years	1	1

Business leaders often rely heavily on quantitative data and analyses to draw conclusions, underscoring the significant value they place on data-driven decision-making. Practitioners and professionals in the field frequently help bridge the gap between theoretical concepts and practical applications in real-world settings. By integrating an academic viewpoint, the research gains greater depth by linking theory with practice, thereby enhancing its credibility and rigor. Additionally, experts from the community represent either the general public or specific groups relevant to the study, ensuring that the findings reflect not only institutional perspectives but also the needs and realities experienced by the wider population. The research steps are outlined in Table 3.

A. Industrial Transformation Assessment

Organizational digital transformation maturity refers to the extent to which a company consistently applies digital transformation processes to achieve the desired level of success. This maturity is evaluated by determining whether the process capability thresholds for a specific process profile, as defined in a maturity model, have been reached. The assessment of digital transformation maturity is conducted in phases, focusing on the organization's process capabilities as it transitions toward digitalization. The model comprises six levels of maturity, ranging from Level Level 0 to Level 5 (Ebru Gökalp & Veronica Martinez, 2021).

Level 0: Incomplete – The digital transformation process has not yet begun.

Level 1: Initiated – The digital transformation efforts have started. A clear vision for digital transformation is established, and a strategic roadmap for the transition has been developed, although full implementation has not yet occurred. A portfolio of digital transformation projects has been identified, assessed, prioritized, and approved. Furthermore, a specific team or department has been designated to lead the digital transformation efforts.

Level 2: Managed – At this stage, digital transformation is actively managed, with the creation of digital representations (digital shadows) of physical assets beginning to take place. This level requires several supporting processes to be carried out. Business processes are digitized through the use of technology, and the IT department publishes an IT strategy to support these initiatives. Migrate to the desired future environment as outlined in the organization's digital transformation strategy; initiate digital transformation-related projects; conduct feasibility studies for these projects, carry out pilot programs, and define the requirements for each project.

Level 3: Established – At this stage, digital transformation is firmly established. Key processes are clearly defined and adhere to relevant standards. Vertical integration has been achieved, including the internal integration of IoT devices with enterprise resource planning systems or customer requirement management systems. The developed enterprise architecture (EA) is integrated, and organizational change is effectively managed.

Level 4: Predictable – Quantitative methods are applied to real-time data collected from products, services, or processes. Horizontal integration is realized, meaning integration across business networks. Data analytics are actively utilized.

Level 5: Innovating – The organization leverages collected data for continuous improvement, fosters a culture of innovation, and promotes dynamic collaboration. Transparency increases through extended operational visibility and automated, seamless information exchange across the network.

Table 3. Flow chart, tools for collecting, and analysis data

Research Step	Data Collection Tools	Data Analysis Tools
Literatur Study	Literature study	
Industrial Transformation Assesement	Literature study and business expert interviews	*FGD* Experts (Krueger, 1994)
Internal and External Analysis	*SWOT Matrix (Harrison, J., & St. John, C. H., 2020)*	*Expert evaluation*
Define Strategy Map	*FGD* Experts (Krueger, 1994); *assessment, Experts Judgment*; SWOT matrix; BSC perspective (Kaplan & Norton, 2004	*FGD Experts* (Krueger, 1994); DEMATEL dan ANP Integration (Sharma, R., & Soni, G., 2015) ; (Liou, J. J. H., & Tzeng, G. H. , 2009)
Define KPI	Indicators from the engineering sheet (Kaplan & Norton, 1992, 1995, 2001a, 2001b)	*Expert evaluation*
Proposal Improvement	*Experts feedbacks*	*Expert evaluation*
Result Validation	Survey Validation (Platts & Gregory, 1990)	*Expert evaluation* (Platts & Gregory, 1990)

B. Internal and External Analysis

SWOT analysis is a structured approach for examining an organization's internal and external environments to support decision-making. It ensures that strategy development considers both the organization's strengths and weaknesses as well as market opportunities and potential threats (Harrison & St. John, 2020). When applied, SWOT analysis is often combined with PESTLE analysis.

It also provides valuable insights into the relationships between SWOT results and specific strategic goals (Chakravarty & Khatri, 2021).

C. Define Vision and Mission

The vision and mission are set by top management or experts and then translated into a strategy map (Aaltonen & Ikävalko, 2016; Hussain & Khan, 2021). This process highlights the use of strategy maps to align the organization's core values with its long-term objectives (Cameron & Quinn, 2018). To support this, discussion methods such as focus groups (Krueger, 1994), the Delphi technique (Dalkey & Helmer, 1963), and expert evaluations can be utilized.

D. Define Strategic Objectives

According to Quezada, Cordova, Palominos, Godoy, and Ross (2009), information collected during the initial phases of internal and external organizational analysis should guide the determination of strategic objectives for Balanced Scorecard implementation. This is often done using a SWOT analysis (Bell & Rochford, 2016; Romero-Gutierrez, Jimenez-Liso, & Martinez-Chico, 2016) to develop clear tactics that transform threats into opportunities, leverage strengths, anticipate threats' impacts, and mitigate the effects of weaknesses.

E. Define Strategy Map

The purpose of this stage is to develop a strategy map that links strategic objectives causally using the DEMATEL method and helps select key strategies through the ANP method. Hybrid decision support systems combining DEMATEL method (see Tabel 4) and ANP method (see Table 5) have been applied across various industries to create strategy maps emphasizing critical factors affecting strategic decision-making (Sharma & Soni, 2015).

The strategy map is constructed based on the Balanced Scorecard framework and translated into cause-and-effect relationships through DEMATEL calculations, categorizing factors as either "cause" or "effect." These maps demonstrate how objectives in one perspective influence those in others. The cause-effect diagrams help. Stakeholders

Table 4. **Stages of DEMATEL Method**

STEP	DESCRIPTION
Gather input data	**Experts through questionnaires can establish causal relationships between strategic objectives.. The questionnaire is filled in on a scale; no effect (0), very low influence (1), low influence (2), moderate influence (3), high influence (4)**
Determining the average matrix on the direct relation matrix	**The given score of each expert is formed into n x n non-negative answer matrix X^k = by 1≤ k ≤ H. Thus X^1 , X^2 ,....., X^H is the answer of H expert, and each element of the matrix X^k is an integer annotated with x_y^k. The diagonal elements of the matrix X^k are all zero-valued. Next**

	can be calculated the average matrix A n x n.
Calculate normalized initial direct-relation matrix	**Normalized initial direct-relation matrix D is obtained from the average matrix A normalized by: Normalized initial direct-relation matrix D is obtained from the average matrix A normalized by: X=kA** **X=kA** $k = \min 1/ \left(\max_{1 \le i \le n} \sum_{j=1}^{n} a_{ij}, \max_{1 \le i \le n} \sum_{i=1}^{n} a_{ij} \right)$ **Information:** **X = normalization of the direct-relation matrix** **A = direct-relation matrix**
Calculating the total relation matrix	**The total relation matrix can be calculated using the following formula:** **T=|$X(I-X)-1$|** **In addition, r and c are calculated as vector n x l which is the sum of the rows and columns of the total relation matrix T as follows:** $r = [r_i]_{nx1} = \left(\sum_{j=1}^{n} t_{ij}\right)_{nx1}$ $c = [c_j]'_{1xn} = \left(\sum_{i=1}^{n} t_{ij}\right)_{1xn}$ **r_1 indicates the total effect of the relationship that factor i gives to other factors. c_j shows the total relationships received by factor j from other factors. When j and i, the sum of (r_i + c_j) given an index that presents the total effect both received and given by factor i. In other words, (r_i + c_i) indicates degrees of interest (the total amount of effect given and received) that factor i play inside the system. Meanwhile (r_i - c_i) shows the effect that factor i contributes to the current system (r_i - c_i) is positive, factor i is the net causer, when (r_i - c_i) is negative, factor i is a net receiver.**
Set a threshold value	**Set a threshold value to explain structural relationships while to keep the complexity of the structure itself at the appropriate level and a threshold value p is**

	needed to eliminate negligible relationships in the matrix T. Threshold value can be obtained through brainstorming with experts. Only a few effects of a matrix T greater than the threshold value are selected and depicted on the netork relation map (NRM). In this study, the threshold value is the average of all element numbers in the matrix T. Digraph can be obtained by mapping points (r +c, r-c).

Table 5. Stages of ANP Method

STEP	DESCRIPTION
Building ANP Model	**The ANP method is used to connect network diagrams between objective strategy which are the result of DEMATEL causality relationship processing. ANP model processing is carried out using Super Decision software with data input in the form of pairwise comparisons between strategic objectives by Expert Judgement.**
Gather input data	**ANP weighting of strategic targets begins by obtaining pairwise comparison data carried out by Expert Judgement by filling out a questionnaire with the conditions:** • 1 : Equally important • 3 : Slightly more important • 5 : More important • 7 : Definitely more important • 9 : Very more important • 2, 4, 6, 8 : Values between two adjacent assessments
Create Pairwise Comparison Matrices	**Pairwise comparisons between strategic objectives are performed**
Normalize the Pairwise Comparison Matrices	**Normalize it by dividing each element and calculate the priority vector**
Construct the Supermatrix	**Supermatrix Structure: The Supermatrix is a block matrix that contains all the interdependencies between the elements of the system. It is typically organized as follows:** **Block Structure: The Supermatrix will have blocks corresponding to each element (criteria and alternatives)**
The Initial Influence Matrix	**The Supermatrix will contain the following blocks:** **Self-influence: The diagonal elements represent the influence of each element on itself (i.e., how much it contributes to its own importance or performance).** **Inter-element Influence: Off-diagonal elements represent the influence between elements. For example, how the performance of an alternative affects a criterion or how criteria influence each other**

Limit the Supermatrix (Convergence)	**The final Supermatrix is obtained by raising the weighted Supermatrix to powers until it converges (i.e., the elements stop changing significantly). In mathematical terms, this means multiplying the Supermatrix by itself multiple times:** $\text{Supermatrix}_{\text{final}} = \lim_{n \to \infty} (Supermatrix)^k$ **After several iterations, the Supermatrix should converge to a stable matrix, where the relative weights of the alternatives can be extracted.**
Construct the Weighted Supermatrix	**Once the initial Supermatrix is constructed, the next step is to weight it by multiplying each block by the corresponding priority vector from the pairwise comparisons.**
Extract the Priority Vector	**The columns of the final converged Supermatrix represent the relative priorities of each alternative with respect to each criterion. The overall priority of each alternative is calculated by combining the values in the final matrix across all criteria.** **Final Decision: The alternative with the highest priority across the criteria is typically chosen as the best option.**

understand the interconnections within the organization, illustrating the relationship between strategic initiatives and their anticipated results.

F. Define Key Performance Indicators (KPIs)

Another essential element in implementing a Balanced Scorecard is the development and selection of management indicators (Kaplan & Norton, 2004). Specific criteria for these indicators include: (1) contributing to the verification of strategic goal achievement; (2) being established at all organizational levels; (3) having valid and controllable information sources; and (4) being supported by initiatives that facilitate strategy fulfillment (Piatt, 2012).

G. Proposal for Improvement

Once the strategic objectives and their corresponding indicators are defined, improvement activities should be proposed that focus on the implementation and adherence to the strategy within the Balanced Scorecard framework. Strategy maps serve as a valuable tool to monitor performance over time and ensure the organization remains aligned with its long-term objectives. By breaking down broad strategic goals into smaller, achievable targets, the organization's plan gains clearer structure and direction. After completing the mapping process, it is important to review the strategy map to confirm that all critical goals are addressed and that the cause-and-effect relationships are logical. Finally, relevant Key Performance Indicators (KPIs) should be assigned to each goal to measure progress effectively.

H. Result Validation

This stage aims to verify that the selected strategies, causal links, and priority rankings align with the defined objectives, specifically regarding how both the textile and automotive sectors succeed in meeting their targets and supporting the national economic vision for 2030. Expert feedback is sought to validate the overall findings from the preceding steps. 2030. Expert feedback is sought to validate the overall findings

from the preceding steps to make it robust.

RESULT AND DISCUSSION

This section discusses the evaluation of applying theoretical concepts to develop a strategy map in the digital transformation era. The analysis is based on real data collected from expert opinions, gathered through brainstorming sessions and discussions reflecting their perspectives.

Between 2018 and 2022, the Indonesian textile industry faced significant challenges, particularly in 2020 due to the COVID-19 pandemic. However, the sector showed notable recovery in 2021 and 2022. In 2022, the textile sector demonstrated strong recovery, supported by government and private sector initiatives to revive pandemic-impacted areas. Export growth reached approximately 15-20%, focusing on apparel, fabrics, and yarns, with primary markets. Innovation and diversification increasingly target high value-added products such as eco-friendly textiles and sustainable fashion, alongside renewed investments in production capacity and technology to boost global competitiveness.

The automotive industry, despite government support during the pandemic in 2021 and 2022, suffered a sharp decline in demand in 2020 due to COVID-19. Growth in electric vehicles since 2021 has been driven by increased electricity capacity, with substantial investments in energy development and power infrastructure. Government incentives like Sales Tax on Luxury Goods (PPnBM) discounts promote environmental protection efforts within the sector. Nonetheless, global economic conditions and international trade challenges have negatively affected consumer purchasing power in Indonesia. Despite this, the automotive industry remains a vital contributor to the economy. These dynamics influence the national GDP growth, highlighting the importance of conducting proper evaluations and developing strategy maps based on analyses to successfully achieve Indonesia’s 2030 national vision.

Digital Transformation Positioning

Based on discussions with experts, it was agreed that the textile and automotive industries currently occupy the second level of digital transformation maturity, classified as "Managed," as illustrated in Fig. 1. This status is influenced by both internal and external factors. While sectors such as fintech and e-commerce are rapidly advancing, the pace of adopting advanced technologies in other industries like manufacturing remains relatively low compared to more developed countries. Key challenges facing Indonesia include limitations in technological infrastructure, gaps in digital literacy, and regulatory issues affecting small and medium-sized enterprises within the digital ecosystem.

Steps in Formulating the Strategy Map Textile Industries

A. Internal and External Analysis

Experts were given a platform to engage in brainstorming sessions and collaborative discussions focused on the textile and automotive sectors, as well as the progress of digital transformation in relation to Indonesia’s economic vision. A SWOT analysis was conducted based on these discussions, as illustrated in Fig. 1.

B. Define Vision and Mission

The Indonesian government, through the Ministry of Industry, has established an economic vision for 2030 aimed at positioning the country among the top 10 global economies, emphasizing five key industrial sectors. In this study, the experts formulated a vision and mission to guide the strategy map for achieving the national targets of the textile industry, which are:

Vision:

"Contributing to Indonesia's national economic vision 2030 by making the country one of the top 10 global economies."

Mission:

"Increasing textile industry productivity by strengthening upstream and downstream industry synergies based on Industry 4.0 principles."

C. Define Strategic Objectives

Experts has defined strategic objectives as shown in Table 6. A critical challenge facing the textile industry is the need for regulatory reform, especially concerns regarding the government's policy of allowing increased imports that threaten the growth of the domestic textile sector. In 2021, there was a significant discrepancy in import data, with a $1.5 billion difference between the Indonesian Central Bureau of Statistics and Chinese Customs figures, which is projected to increase to $4 billion by 2023. Despite these challenges, the textile industry's growth rate was estimated at 6.5% in 2022. The government continues to provide support to the sector to sustain its development. The textile industry's transformation is supported by tax incentives and initiatives that encourage the adoption of new technologies. Additionally, the strategy of material reuse and recycling has been recognized as an effective way to lower production costs. Sustainability is also a key focus for advocates within the textile sector. According to the Ministry of Environment and Forestry (KLHK) in 2021, Indonesia generates 2.3 million tons of clothing waste annually, which accounts for approximately 12% of household waste. The textile industry must begin adopting circular economy principles to reduce the volume of waste produced Effective textile waste management not only helps preserve the environment but also creates new economic opportunities through recycled material innovation.

Table 6. Strategic Objective of Textile Industry

Perspective	Objective Strategy	Code
Finance	*Increase Business Profitability*	F1
	Increase Productivity	F2
	Increase Market Share	F3
Customer	*Increase Customer Satisfaction*	C1
	Increase Customer Engagement	C2
Internal Process	*Industrial Transformation 4.0*	IP1
	Regulatory Reform	IP2
	ESG Implementation	IP3
	Material Reuse & Recycle	IP4
Learning & Growth	*Increase Digital Capabilities*	LG1
	Build Industrial Ecosystem	LG2

D. Define Strategy Map

Analysis and processing of questionnaire data using the DEMATEL method identified five strategic objectives classified as "effects" and six as "causes." Notably, the strategic objective with the greatest influence on others is "Industrial Transformation 4.0," with a Ri+Ci value of 2.8603, as illustrated in Fig. 2. Following this are "ESG Implementation" and "Material Reuse & Recycling," ranking second and third respectively. Overall, the internal process perspective plays a central role in achieving the objectives. This aligns with previous research indicating that efficient and effective internal processes significantly improve an organization's ability to implement strategies and achieve performance goals (Elbanna & Child, 2007).

STRENGTH	***OPPORTUNITY***
New oroduct innovation	Industry 4.0 implementation
Extensive marketplace facilities	Green manufacturing (sustainability)
National defense and security	
Labor cost is cheap	
Availability of land	

WEAKNESS	***THREAT***
Licensing bureaucracy is long & fast changing	Covid-19 pandemic
Limited of local raw materials	Illegal import of goods
High logistics costs	The diverse character of human resources in each province
Local machinery is not available	Globalization market
Smart-ecology industry is still lack	Declining of purchasing power

Fig. 1. SWOT Analysis of Textile Industry

	Ri	Ci	Ri+Ci	Ri-Ci	Identify
F1	0,3943	1,9416	2,3360	-1,5473	Effect
F2	0,3317	2,0180	2,3497	-1,6863	Effect
F3	0,3585	1,8287	2,1871	-1,4702	Effect
C1	0,7817	0,9497	1,7314	-0,1680	Effect
C2	0,7690	0,9035	1,6726	-0,1345	Effect
IP1	1,8800	0,9804	**2,8603**	0,8996	Cause
IP2	1,5301	0,8434	2,3734	0,6867	Cause
IP3	1,8134	1,0200	2,8334	0,7933	Cause
IP4	1,8493	0,8686	2,7179	0,9806	Cause
LG1	0,9605	0,1271	1,0876	0,8334	Cause
LG2	0,9399	0,1271	1,0670	0,8128	Cause

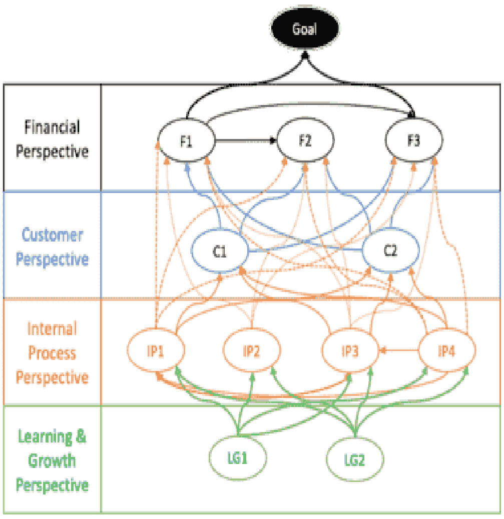

Fig. 2. DEMATEL Causality Analysis & Strategy Map of Textile Industry

Icon	Name	Normalized by Cluster	Limiting
No Icon	Increase Customer Engagement	0.50000	0.016747
No Icon	Increase Customer Satisfaction	0.50000	0.016747
No Icon	Increase Business Profitability	0.33132	0.088244
No Icon	Increase Market Share	0.32705	0.087108
No Icon	Increase Productivity	0.34163	0.090992
No Icon	Build Industrial Ecosystem	0.00000	0.000000
No Icon	Increase Digital Capabilities	0.00000	0.000000
No Icon	ESG Implementation	0.02392	0.016747
No Icon	Industrial Transformation 4.0	0.02392	0.016747
No Icon	Material Reuse & Recycle	0.00000	0.000000
No Icon	Regulatory Reform	0.00000	0.000000

Fig. 3. Priority Strategy of Textile Industry (from the Limiting Supermatrix)

According to the Supermatrix calculation from the ANP method analysis using Super Decision software, derived the priority weights (Fig. 3) with the highest importance are "Increase Productivity" (0.34163), "Increase Business Profitability" (0.33132), and "Increase Market Share" (0.32705). This indicates that the financial perspective holds the greatest significance. It suggests that the core focus of organizations in the textile industry is to enhance their financial performance in order to support the achievement of their overall goals through existing operational plans.

Automotive Industry

a. Internal and External Analysis

Fig. 4 presents a SWOT analysis of Indonesia's automotive industry. Regarding internal factors, experts emphasize the key strength of Indonesia's large and continuously growing market, supported by substantial resources and growing public awareness about transitioning to electric vehicles (EVs). However, challenges remain in the form of inadequate infrastructure and resource constraints. On the external side, Indonesia's potential to become a central automotive hub in the ASEAN region presents a major opportunity to boost national productivity and service quality. Nonetheless, external threats such as disruptions in the global supply chain, foreign competition, and cyber-security risks should drive Indonesia toward greater self-reliance.

b. Define Vision and Mission

Vision

"To position the automotive industry as a globally competitive sector by 2030."

Mission

"To enhance competitiveness across all sectors by reinforcing the supply chain and producing globally certified products, supported by Industry 4.0."

c. Define Strategic Objective

Experts have identified several key strategic priorities for the automotive industry, namely: developing infrastructure, enhancing sourcing capabilities, and enforcing regulations (see Table 7). Consumer interest in EV's must be met with the development of adequate supporting infrastructure. According to (SPKLUs) to support the target of 2 million EVs. As of the end of 2022, only 1,114 projections, by 2030, Indonesia will require 25,600 public electric vehicle charging stations SPKLUs were installed, with 80% concentrated in Bali, West Java, and Jakarta. In January 2020, the number of four-wheeled vehicle sales totaled 80.4 thousand units, marking a 1.1% decline from the previous period. This downward trend continued in February. 2020, with sales dropping to 79.5 thousand units a 3.1% decrease primarily due to the global chip shortage following the COVID-19 pandemic. The strategy model

Table 7. Strategic Objective of Automotive Industry

Perspective	Objective Strategy	Code
Finance	Increase Business Profitability	F1
	Increase Revenue	F2
Customer	Increase Customer Retention	C1
	Increase Customer Engagement	C2
Internal Process	Industrial Transformation 4.0	IP1
	Build Infrastructure	IP2
	ESG Implementation	IP3
	Strengthen Sourcing	IP4
	Law Enforcement	IP5
Learning & Growth	Increase Digital Capabilities	LG1
	Link & Match between Campus - Industry	LG2

employed was BSC framework, designed to offer a more holistic perspective on organizational performance by incorporating both financial and non-financial dimensions.

d. Define Strategy Map

Using the DEMATEL method to process and analyze questionnaire data, the study identified four strategic objectives categorized as "effects" and eight as "causes." Among these, the objective with the greatest influence on others is "Industrial Transformation 4.0," which recorded a Ri+Ci value of 2.5099, as illustrated in Figure 5. Following this are "Strengthen Sourcing" and "Build Infrastructure," ranked second and third, respectively. Similar to the textile industry, the automotive sector places strong emphasis on the internal process perspective. Fierce competition in the market is driving operational changes aimed at improving efficiency through technological innovation then influencing every aspect, not merely to survive, but to lead in critical areas such as sustainability and digital integration. In this context, the capacity to innovate is no longer a strategic advantage, but a fundamental necessity for maintaining relevance and achieving long-term competitiveness. The race to dominate the future of mobility, including autonomous driving and electrification, defines the current landscape of global automotive competition. To remain competitive in the global automotive market, companies must invest in innovation, particularly in the areas of electric vehicles, autonomous driving technology, and sustainability. Collaboration with technology firms, adoption of digital transformation, and responsiveness to regional consumer demands are also crucial. Furthermore, improving supply chain resilience and building strong brand loyalty through quality and customer service can help manufacturers maintain a strong market position to face of increasing global pressures.

STRENGTH	*OPPORTUNITY*
• Large population	• A growing market
• Big market	• People's purchasing power is high
• Have basic raw materials	• Vehicle electricity awareness
• The number of UMKM that support the economy	• There are options related to sensors
• The income of the middle class is moving up • Level of community consumption	• Many technologies and materials are emerging to support Industry 4.0
	• Indonesia will become a market center for the ASEAN region
WEAKNESS	*THREAT*
• Supporting tools and machines are still weak	• Competitors from outside
• Human resources for industry 4.0 are still weak	• Supply chain disruption due to global issues
• Regulations do not favor local entrepreneurs	• Global economic instability
Internet speed is not supported	• Cyber system is leak
• Cloud server is not yet independent	• The difficulty of semi-conductor materials in the world
• High government taxes	• Increasing unemployment rate
• High supply chain costs	

Fig. 4. SWOT Analysis of Automotive Industry

	Ri	Ci	Ri+Ci	Ri-Ci	Identify
F1	0,1841	1,6760	1,8602	-1,4919	Effect
F2	0,1662	1,7632	1,9293	-1,5970	Effect
C1	0,4968	0,8181	1,3148	-0,3213	Effect
C2	0,5067	0,6177	1,1244	-0,1109	Effect
IP1	1,4322	1,0777	**2,5099**	0,3545	Cause
IP2	1,2159	0,7877	2,0036	0,4282	Cause
IP3	1,0448	0,6227	1,6675	0,4221	Cause
IP4	1,5212	0,6126	2,1338	0,9086	Cause
IP5	0,9204	0,7663	1,6867	0,1541	Cause
LG1	0,7420	0,1546	0,8966	0,5874	Cause
LG2	0,7674	0,1013	0,8686	0,6661	Cause

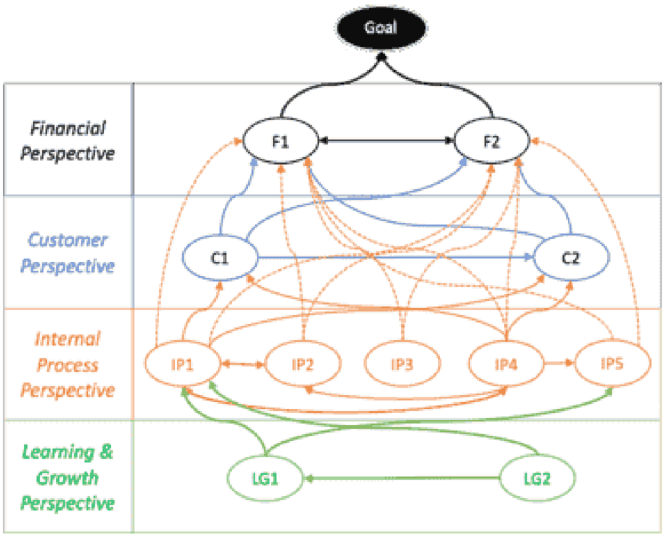

Fig. 5. DEMATEL Causality Analysis & Strategy Map of Automotive Industry

Icon	Name	Normalized by Cluster	Limiting
No Icon	Increase Customer Engagement	0.00000	0.000000
No Icon	Increase Customer Retention	0.00000	0.000000
No Icon	Increase Profitabilty	0.50000	0.250000
No Icon	Increase Revenue	0.50000	0.250000
No Icon	ESG Implementation	0.00000	0.000000
No Icon	Industrial Transformation	0.00000	0.000000
No Icon	Infrastructure Development	0.00000	0.000000
No Icon	Law Enforcement	0.00000	0.000000
No Icon	Law Enforcement-	0.00000	0.000000
No Icon	Strengthen Sourcing	0.00000	0.000000
No Icon	Increase Digital Capabilities	0.00000	0.000000
No Icon	Link & Match Campus-Industry	0.00000	0.000000

Fig. 6. Priority Strategy of Automotive Industry (from the Limiting Supermatrix)

According to the Supermatrix calculation from the ANP method analysis using Super Decision software, derived the priority weights (Fig. 6) with the highest weights are "Increase Profitability" (0.5000) and "Increase Revenue" (0.5000). Similar to the textile industry, the financial perspective holds the most critical strategic importance in the automotive sector. This is understandable, as the automotive industry is highly technology-driven and demands substantial investment to mobilize skilled resources aimed at boosting capacity and productivity.

Table 8. Initiative Validation by Experts

	Strategic Objective	KPI	Initiative	DA	QA	A	SA
Textile Industry	Increase Profitability	Net Profit Margin : 6%	Reduce OPEX & CAPEX costs			1	4
	Industrial Transformation	INDI Score > 3	Implementation of Industry 4.0 transformation				5
			Using appropriate technology for product innovation			2	3
Automotive Industry	Increase Profitability	Net Profit Margin : 8%	Reduce production operational costs				5
			Implementing Lean Manufacturing			1	4
			Implementing Lean Procurement			3	2
	Industrial Transformation	INDI Score > 3	Building a standalone cloud server				5
			Network addition to strengthen internet speed				5
			Implementing operational excellence support tools based on smart factory			1	4

DA (Don't Agree) ; QA (Quite Agree) ; A (Agree) and SA (Strongly Agree)

Proposal Improvement and Validation

After completing the development of the strategy map along with the calculations used to determine the highest-priority strategic objectives, the proposal was submitted for validation, including associated performance indicators reviewed by the expert. The expert was presented with a list of strategic objectives, indicators, and initiatives related to the two top-priority targets "Increase Profitability" and "Industrial Transformation" and asked to respond using the options: "disagree," "slightly agree," "agree," and "strongly agree." Essentially, the business unit already possesses sufficient measurable and reliable indicators, as well as information sources, to fully evaluate eight strategic objectives. This aligns with the performance indicator frameworks outlined by Kaplan and Norton (2004) and Piatt (2012).

The results show that expert responses were generally positive, as reflected in Table 8. No disagreement was expressed regarding any part of the proposal. This indicates a strong level of validation for the strategic framework addressing digital transformation in Indonesia's textile and automotive sectors. The proposed approach beginning with the identification of internal and external factors and culminating in validation demonstrates a clear and structured method for strategic work planning. It supports the broader goal of contributing to Indonesia's national economic vision for 2030 through the development of the textile and automotive industries.

CONCLUSIONS AND RECOMMENDATION

The authors highlight two key findings in discussing the methodology proposed in this study. First, there is a notable similarity in the causal analysis of strategic objectives between the textile and automotive industries (as illustrated in Figures 3 and 6), despite their differing production approaches labor-intensive in textiles and capital-intensive in automotive. Both sectors align in their strategic direction toward achieving the overarching vision for national industrial development.

Second, based on the results of the ANP method (Figures 3 and 6) and the positively validated strategic proposals by experts (Table 8), it is evident that initiatives aimed at increasing profitability and laying the groundwork for sustainable business growth particularly in the era of digital transformation are well-founded. Recent literature supports these findings. Digital transformation has been shown to enhance operational efficiency, cut costs, and streamline production through automation of repetitive tasks (Liu & Zhang, 2022), reduce downtime, and accelerate product development (Westerman et al., 2021), all of which directly contribute to improved profitability. Organizations that integrate digital transformation into their strategic objectives are more likely to gain sustainable competitive advantages and outperform competitors (Bharadwaj et al., 2018). Furthermore, Zhang & Xie (2021) identified a strong positive correlation between digital technology adoption and profitability in the manufacturing industry.

This study contributes valuable insights for developing digital transformation strategy maps in Indonesia's textile and automotive sectors. However, it also acknowledges that this represents only a small portion of the broader industrial landscape that impacts the national economy. Future research should explore additional industries with a larger and more diverse sample size to ensure more representative expert input. While methods like DEMATEL and ANP offer detailed structural analysis and evaluation, they come with limitations such as complexity in implementation, dependence on high-quality data, subjectivity, and limited adaptability to environmental changes. In contrast, the Delphi method may be better suited for scenarios requiring consensus-based decision-making and forecasting, which is highly relevant when constructing strategic maps.

ACKNOWLEDGEMENT

The authors express their sincere gratitude to everyone who supported the completion of this study. It is our hope that this research will contribute meaningfully to the advancement of the national industry and support the realization of Indonesia's ambitious vision to become one of the world's top ten economies by 2030.

REFERENCES

Acuña-Carvajal, F., Moraga, J. A., Quezada, L. E., Espinoza, J., & Gutiérrez, S. (2019). An integrated method to plan, structure and validate a business strategy using fuzzy DEMATEL and the balanced scorecard. *Expert Systems with Applications, 122,* 351–368.

Behn, R. D. (2003). Why measure performance? Different purposes require different measures. *Public Administration Review, 63*(5), 586–606.

Bharadwaj, A. S., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital business strategy: Toward a next generation of insights. *MIS Quarterly, 37*(2), 471–482.

Bhatia, M. S., & Kumar, S. (2020). Critical success factors of Industry 4.0 in automotive manufacturing industry. *IEEE Transactions on Engineering Management.* https://doi.org/10.1109/TEM.2020.3015033

Chanias, S., & Hess, T. (2016). Understanding digital transformation strategy formation: Insights from Europe's automotive industry. *Proceedings of the 37th International Conference on Information Systems (ICIS), Dublin, Ireland.*

Chanias, S., Myers, M. D., & Hess, T. (2019). Digital transformation strategy making in pre-digital organizations: The case of a financial services provider. *The Journal of Strategic Information Systems, 28*(1), 17–33.

Christensen, C. M., Raynor, M. E., & McDonald, R. (2015). Disruptive innovation: An intellectual history and directions for future research. *Journal of Product Innovation Management, 32*(1), 9–27. https://doi.org/10.1111/jpim.12163

Fichman, R. G., Dos Santos, B. L., & Zheng, Z. E. (2014). Digital innovation as a fundamental and powerful concept in the information systems curriculum. *MIS Quarterly, 38*(2), 329–353.

Jeffrey, S. N., Rockström, J., Sachs, J. D., Narasimhan, V., Oviedo, M., & Espey, J. (2019). Six transformations to achieve the Sustainable Development Goals. *Nature Sustainability, 2,* 805–814.

Kaplan, R. S., & Norton, D. P. (1992). The balanced scorecard: Measures that drive performance. *Harvard Business Review, 70*(1), 71–79.

Kaplan, R. S., & Norton, D. P. (1996). Using the balanced scorecard as a strategic management system. *Harvard Business Review, 74*(1), 75–85.

Kaplan, R. S., & Norton, D. P. (2000). *The strategy-focused organization: How balanced scorecard companies thrive in the new business environment*. Harvard Business School Press.

López-Ospina, H., Quezada, L. E., Barros-Castro, R. A., Gonzalez, M. A., & Palominos, P. I. (2017). A method for designing strategy maps using DEMATEL and linear programming. *Management Decision, 55*(8), 1802–1823. https://doi.org/10.1108/MD-08-2016-0597

Matt, C., Hess, T., & Benlian, A. (2015). Digital transformation strategies. *Business & Information Systems Engineering, 57*(5), 339–343.

Meade, L. M., & Sarkis, J. (1998). Strategic analysis of logistics and supply chain management systems using the ANP model. *Journal of the Operational Research Society, 49*(9), 889–899.

Mitroulis, D., & Kitsios, F. (2019). Digital transformation strategy: A literature review. *Proceedings of the 6th National Student Conference of HELORS, Xanthi, Greece.*

Moraga, J. A., Acuña-Carvajal, F., Gutiérrez, S., & Quezada, L. E. (2020). A quantitative methodology to enhance a strategy map. *International Journal of Production Economics, 219*, 43–53.

Nadeem, A., Abedin, B., Cerpa, N., & Chew, E. (2018). Editorial: Digital transformation & digital business strategy in electronic commerce—The role of organizational capabilities. *Journal of Theoretical and Applied Electronic Commerce Research, 13*(2), i–viii. https://doi.org/10.4067/S0718-18762018000200101

Parviainen, P., Tihinen, M., Kääriäinen, J., & Teppola, S. (2017). Tackling the digitalization challenge: How to benefit from digitalization in practice. *International Journal of Information Systems and Project Management, 5*(1), 63–77.

Quezada, L. E., & López-Ospina, H. A. (2014). A method for designing a strategy map using AHP and linear programming. *International Journal of Production Economics, 158*, 244–255. https://doi.org/10.1016/j.ijpe.2014.08.007

Quezada, L. E., Moraga, J. A., & Gutiérrez, S. (2018). Identifying causal relationships in strategy maps using ANP and DEMATEL. *Computers & Industrial Engineering, 118*, 170–179.

Ross, J. W., Sebastian, I. M., Beath, C. M., Mocker, M., Moloney, K. G., & Fonstad, N. O. (2016). Designing and executing digital strategies. *Proceedings of the 37th International Conference on Information Systems (ICIS), Dublin, Ireland.*

Saaty, T. L. (2001). *Decision making with dependence and feedback: The analytic network process.* RWS Publications.

Saaty, T. L. (2006). *Fundamentals of decision making and priority theory with the analytic hierarchy process.* RWS Publications.

Shieh, J. I., & Wu, H. H. (2008). Applying DEMATEL method with linguistic weights to establish a cause-effect model of technology innovation in department stores. *WSEAS Transactions on Information Science and Applications, 5*(6), 953–964.

Tzeng, G. H., & Huang, J. J. (2011). *Multiple attribute decision making: Methods and applications*. CRC Press.

Valmohammadi, C., & Sofiyabadi, J. (2015). Modeling cause and effect relationships of strategy map using fuzzy DEMATEL and fourth generation of balanced scorecard. *Benchmarking: An International Journal*.

Varmazyar, M., Dehghanbaghi, M., & Afkhami, M. (2016). A novel hybrid MCDM model for performance evaluation of research and technology organizations based on BSC approach. *Evaluation and Program Planning*, *58*, 125–140.

Wankhede, V. A., & Vinodh, S. (2021). State of the art review on Industry 4.0 in manufacturing with the focus on automotive sector. *International Journal of Lean Six Sigma*