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Sectoral Suitability of Digital Transformation Readiness and Maturity Models in Indonesia: A Comparative Framework Analysis

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ABSTRACT

Purpose – This study aims to compare five digital transformation readiness and maturity assessment models—the Smart Industry Readiness Index (SIRI), Indonesia Industry 4.0 Readiness Index (INDI 4.0), acatech Industrie 4.0 Maturity Index, Digital Maturity Model (DMM), and Digital Transformation Readiness Model—and map their suitability to industrial sectors in Indonesia.
Methodology/approach – A qualitative, literature-based comparative framework analysis was employed. The models were evaluated according to their objectives, main focus, measurement dimensions, readiness–maturity orientation, sectoral applicability, and relevance to the Indonesian context, with reference to the KBLI 2020 classification.
Findings – The findings show that no single model is universally suitable. SIRI and INDI 4.0 are most appropriate for manufacturing because of their emphasis on factory operations, automation, production integration, and Industry 4.0 readiness. The Digital Transformation Readiness Model is more suitable for non-manufacturing sectors requiring organizational readiness assessment, while acatech and DMM are more appropriate for organizations evaluating digital maturity after implementation.
Novelty/value – This study provides a sector-sensitive decision guide that links assessment-model characteristics with industrial context and transformation stage, helping Indonesian organizations select a more appropriate digital readiness or maturity framework.

INTRODUCTION

In the contemporary business landscape, digital transformation has evolved into a primary strategic agenda for companies attempting to maintain a sustainable competitive advantage. However, industry practitioners frequently mistake digital transformation for mere technology adoption. In reality, technology acts solely as an enabler of holistic socio-technical changes that demand simultaneous multidimensional re-engineering. Based on the Dynamic Capabilities Theory, organizational success within volatile environment depends heavily on a firm's capacity to integrate, build, and reconfigure internal and external competencies (Teece et al., 1997). To successfully navigate digital transformation, organizations need to harmoniously align dynamic capabilities across core non-technical dimensions. This comprehensice alignment requires a transition toward digital-centric business strategies, automated operational workflows, and the cultivation of an adaptable, innovation-driven culture (Hanelt et al., 2021). Furthermore, it demands continuous workforce upskilling, robust data security frameworks, and the systematic development of novel business models.

Although digital transformation offers substantial strategic advantages, organizational readiness remains highly fragmented across different enterprises (Vial, 2021). This disparity is primarily fueled by internal impediments, including financial limitations, legacy infrastructure, and deep-seated cultural resistance (Schwertner, 2017). Consequently, premature technological integration lacking strategic foresight often precipitates systemic operational failures that undermine long-term financial performance (Chanias et al., 2019). To mitigate these risks, organizations must deploy robust assessment frameworks as initial diagnostic instruments prior to full-scale technological execution (Zaoui & Souissi, 2020). Such assessments establish a critical baseline to evaluate current capabilities and pinpoint deep-rooted organizational deficiencies (Kane, 2019). Ultimately, a data-driven understanding of this baseline empowers management to formulate evidence-based roadmaps, ensuring that financial and human resources are strategically funneled into vulnerable organizational dimensions (Wagire et al., 2021).

In the contemporary literature, several digital readiness and maturity assessment frameworks have been developed and applied at global and national levels. This study focuses on five prominent frameworks: the Smart Industry Readiness Index (SIRI) (Singapore EDB, 2017), the Indonesia Industry 4.0 Readiness Index (INDI 4.0) (Kementerian Perindustrian RI, 2018), the acatech Industrie 4.0 Maturity Index (acatech, 2017), the Digital Maturity Model (DMM), and the Digital Transformation Readiness Model. Despite sharing a foundational evaluation objective, these frameworks exhibit significant structural divergence in their theoretical architectures and target taxonomies. Critical scrutiny reveals that these models do not uniformly evaluate ex-ante readiness, primarily because early Industry 4.0 frameworks frequently suffer from an over-reliance on technocentric configurations while neglecting long-term socio-technical impacts and human-centered values (Gazzaneo et al., 2020; Teichert, 2019). To address these architectural variations, these frameworks can be categorized into three distinct strategic taxonomies: first, the Industry 4.0 readiness cluster (comprising SIRI and INDI 4.0), which centers on shop-floor technical and operational preparedness for smart manufacturing (Kementerian Perindustrian RI, 2018; Singapore EDB, 2017); second, the digital maturity cluster (including acatech and DMM), which gauges the post-adoption proficiency of digital capabilities (acatech, 2017); and third, the organizational readiness cluster, which examines non-technical infrastructure, cultural adaptability, and internal governance as vital prerequisites for holistic digital transformation (Gazzaneo et al., 2020; Teichert, 2019).

The necessity of delineating these model classifications is further amplified by the contrasting operational paradigms across distinct industrial sectors. In the manufacturing domain, assessment models demand stringent metrics centered on automation, machine-to-machine connectivity, shop-floor integration, and advanced supply chain synchronization (Sony & Naik, 2020). Indeed, establishing an intelligent, data-driven supply chain network requires the deep embedding of technological configurations within core manufacturing workflows (Chen et al., 2025). Conversely, non-manufacturing domains such as financial and telecommunication services are inherently anchored in intangible assets, thereby necessitating evaluation frameworks that prioritize data governance, cybersecurity, digital customer experience, and organizational agility (Bican & Brem, 2020; Verhoef et al., 2021). From a methodological standpoint, superimposing manufacturing-centric models (e.g., SIRI or acatech) onto service-oriented or public organizations introduces significant evaluative bias. These tools measure parameters that are completely disconnected from the entity's core competencies. This misalignment is further compounded by the fact that domain-specific digital maturity instruments for services remain notably underrepresented in contemporary literature (Wagire et al., 2021).

Although the demand for sectoral alignment remains critically paramount, a conspicuous fragmentation continues to persist within the extant digital governance literature. The vast majority of prior scholarship evaluates digital readiness and maturity frameworks partially and in isolation, typically restricting their analytical focus to a singular model within a constrained empirical boundary (Mittal et al., 2018; Schumacher et al., 2016). Consequently, systematic, integrative, and multi-model comparative evaluations across available diagnostic instruments are rarely explored in contemporary technology management studies. This notable absence of comprehensive comparative insights introduces strategic ambiguity for corporate decision-makers, particularly within emerging economic landscapes like Indonesia. The Indonesian corporate ecosystem is characterized by a highly heterogeneous and complex industrial topography, which spans from capital-intensive heavy manufacturing and strictly regulated pharmaceutical complexes to highly fragmented small and medium enterprise (SME) clusters and a rapidly expanding digital economy. More importantly, limited attention has been given to how the structural dimensions of these models align with the operational characteristics of different industrial sectors, particularly within the heterogeneous Indonesian business landscape.

To address this theoretical and practical gap, this study conducts a structured and integrative comparative framework analysis of five digital transformation readiness and maturity assessment models: the Smart Industry Readiness Index (SIRI), the Indonesia Industry 4.0 Readiness Index (INDI 4.0), the acatech Industrie 4.0 Maturity Index, the Digital Maturity Model (DMM), and the Digital Transformation Readiness Model. Rather than merely presenting a descriptive overview of these instruments, this research advances the technology management discourse by developing an original conceptual model termed the Dynamic Capabilities-Based Alignment Grid. Rooted in Teece's seminal framework, the proposed grid elucidates how various diagnostic tools evaluate three core dimensions of dynamic capabilities: sensing, seizing, and transforming. Consequently, it establishes a theoretically grounded, contingency-based mechanism to guide systematic framework selection. To demonstrate its practical utility, this conceptual grid is operationalized to evaluate the functional alignment of these models across Indonesia's heterogeneous industrial sectors, utilizing the 2020 Indonesian Standard Industrial Classification (KBLI) as a structural reference.

Accordingly, this study addresses the following research questions:

RQ1. How do the five selected assessment models differ in terms of their objectives, main focus, measured dimensions, and readiness–maturity orientation?

RQ2. How do the measurement dimensions of each model align with the sensing, seizing, and transforming capabilities required by various industrial sectors in Indonesia?

RQ3. Which readiness or maturity assessment model is most suitable for each industrial sector and stage of digital transformation in Indonesia based on the proposed Dynamic Capabilities framework?

This study contributes to the technology management literature by transitioning the academic discourse from a descriptive comparison to a strategic capability-based understanding of digital diagnostics in emerging economies. By proposing a newly synthesized alignment grid, this manuscript theoretically illuminates how specific models audit different stages of organizational agility (ex-ante preparedness vs. post-adoption reconfiguration). Practically, the findings offer an objective decision guide for Indonesian organizations, enabling executives to select an assessment framework that precisely corresponds to their sectoral characteristics, transformation stage, and overarching strategic objectives.

LITERATURE REVIEW

Digital Transformation

Digital transformation is defined as an evolutionary process that leverages digital technologies and capabilities to trigger fundamental changes in business models, operational efficiency, and organizational value creation strategies (Vial, 2021). According to Verhoef et al. (2021), the stages of digital development within a company can be divided into three sequential phases: digitization, digitalization, and digital transformation. Digitization focuses on converting analog information into digital formats, whereas digitalization focuses on optimizing existing business processes using information technology. Digital transformation represents the highest tier because it involves comprehensive socio-technical changes, including cultural restructuring, human resource capability development, data governance, and business model innovation to respond to fast-paced external ecosystem dynamics (Hanelt et al., 2021)

Digital Transformation Readiness

Digital transformation readiness refers to the psychological, structural, operational, and financial capacity of an organization to initiate, accept, and integrate new digital technologies into their systems (Zaoui & Souissi, 2020). This readiness concept relies heavily on the Dynamic Capabilities Theory, which emphasizes the importance of organizational agility in reconfiguring its internal competencies before making large-scale infrastructure investments (Teece et al., 1997). According (Zaoui & Souissi, 2020), failure to assess initial readiness often leads to a "digital paradox," where high technological capital expenditure does not correlate with improvements in business efficiency or profitability. Therefore, a multi-level readiness assessment acts as a critical initial diagnostic instrument to evaluate the baseline competency of the organization, mitigate internal resistance risks, and formulate evidence-based digital strategy roadmaps (Schumacher et al., 2016; Zaoui & Souissi, 2020). By uncovering hidden organizational gaps, a formal readiness baseline empowers practitioners to define clear short-, medium-, and long-term strategic objectives, which are critical for building a structured and actionable transition pathway toward smart manufacturing capabilities (Ghobakhloo, 2018). Within complex industrial networks, this baseline formulation serves to progressively reconfigure traditional operational processes into an intelligent, data-driven network (Chen et al., 2025).

Digital Transformation Measurement Models

To operationalize the assessment of an organization's digital capabilities, various research institutions, governments, and global consortia have developed standardized evaluation frameworks (Mittal et al., 2018). These measurement models provide structured metrics to assess both the readiness and maturity levels of business entities (Schumacher et al., 2016). However, as highlighted by Teichert (2019), the majority of existing models often provide an incomplete diagnostic picture by over-emphasizing purely technical attributes while failing to systematically integrate transformational management capabilities and descriptive sectoral characteristics. To overcome this technological imbalance, Kane et al. (2019) introduce the technology fallacy, arguing that the true catalyst for successful digital alignment is not the technology itself, but the human dimension, organizational adaptabilities, and innovative workplace cultures. In accordance with this socio-technical perspective, understanding the distinct operational focus of each framework is vital, as a single generic instrument cannot comprehensively fit all industrial sectors. The following are the five primary measurement models dominating contemporary technology management literature:

Smart Industry Readiness Index (SIRI)

SIRI was developed by the Singapore Economic Development Board (EDB) in collaboration with a consortium of global technology companies to guide the transformation of the manufacturing sector toward smart manufacturing (Singapore EDB, 2017). This model is internationally recognized and possesses a highly comprehensive structure that divides the assessment into 3 primary building blocks: Process, Technology, and Organization. These three building blocks are further broken down into 8 pillars and 16 assessment dimensions that cover shop-floor automation, machine connectivity, vertical-horizontal data integration, workforce learning, and leadership competency (Wagire et al., 2021). The main focus of SIRI is to provide an objective readiness assessment framework to map factory transformation priorities and enable global benchmarking across manufacturing industries (Mittal et al., 2018)

Indonesia Industry 4.0 Readiness Index (INDI 4.0)

INDI 4.0 is the official readiness measurement model initiated and published by the Ministry of Industry of the Republic of Indonesia through the Minister of Industry Regulation No. 21 of 2020 (Kementerian Perindustrian RI, 2020). This model is specifically designed as a national instrument to measure the readiness level of industries in Indonesia in transitioning toward the Industry 4.0 era, supporting the strategic roadmap of Making Indonesia 4.0 (Kemenperin, 2021). The INDI 4.0 structure evaluates organizations based on 5 primary pillars: (1) Management and Organization, (2) People and Culture, (3) Products and Services, (4) Technology, and (5) Factory Operations. The final output of the INDI 4.0 measurement classifies a company's readiness level on a scale from 0 to 4 (from not ready to having fully implemented), making it a standard reference for government incentives as well as a self-assessment tool for domestic corporations.

acatech Industrie 4.0 Maturity Index

This model was developed by the German Academy of Science and Engineering (acatech) to provide guidance for manufacturing companies in designing transformational steps toward a digital ecosystem (acatech, 2017). Unlike initial readiness models, acatech adopts a maturity-based approach that divides the stages of digital evolution into 6 linear levels: Computerization, Connectivity, Visibility, Transparency, Predictive Capacity, and Adaptability (Schumacher et al., 2016). Evaluation within the acatech framework is based on 4 structural aspects of the organization: Resources, Information Systems, Organizational Structure, and Culture. The main focus of this model is to guide enterprises that have achieved basic digitalization to extract value from operational data to attain autonomous efficiency.

Digital Maturity Model

The Digital Maturity Model (DMM), as popularized by the TM Forum or Deloitte, is designed as a general cross-industry framework to assess the maturity level of an organization's digital capabilities (TM Forum, 2020). This model is not constrained by the scope of manufacturing or shop-floor operations, making it highly flexible for application in service sectors such as banking, telecommunications, and retail. The DMM architecture typically evaluates organizations through 5 to 6 strategic dimensions, including: Strategy, Customer, Operations, Culture, Data, and Technology. The main focus of this model is to assess the extent to which digital initiatives have been integrated across all organizational functions to optimize customer experience and create new business ecosystems (Teichert, 2019).

Digital Transformation Readiness Model

The Digital Transformation Readiness Model is an assessment framework that focuses purely on organizational readiness before investing in digital technology. This model emphasizes that digital transformation failures are more frequently caused by non-technical factors; hence, its measurement instrument centers on the internal alignment of the organization. The primary dimensions assessed in this model include Digital Leadership, Digital Strategy, People Capability, Data Readiness, Governance, Change Management, and Organizational Culture (Zaoui & Souissi, 2020). The core focus of this model is to ensure that the organizational structure, human resource mindset, and internal governance are administratively mature to support the technological disruptions to be implemented.

METHOD

Research Approach and Comparative Framework Analysis Method

This study utilizes a qualitative research design by operationalizing a systematic Thematic Framework Analysis (Ritchie & Spencer, 1994). This structured methodological approach was selected to ensure transparency and reproducibility in comparing non-numerical dimensional structures, formal regulatory definitions, and core assessment parameters across the five digital evaluation models. Rather than conducting an intuitive or purely descriptive reading, this study transforms qualitative raw texts from official index documentation into a highly rigorous, side-by-side analytical grid based on predefined evaluative criteria.

To establish high methodological rigor and control for qualitative confirmation bias, two primary strategies are deployed. First, Data and Source Triangulation is executed by systematically cross-referencing primary framework blueprints with independent peer-reviewed empirical studies, national executive decrees (e.g., Permenperin No. 21/2020), and global implementation case studies to confirm true operational boundaries. Second, Peer Validation and Inter-coder Consensus is used to review the initial thematic coding and matrix-mapping assignments. Any discrepancies in model classification or sectoral suitability assignments are debated and refined until an inter-coder consensus coefficient of over 90% is achieved, mitigating individual evaluative skew

Unit of Analysis and Criteria for Model Sample Selection

The unit of analysis established in this study consists of the official framework documents of the digital transformation readiness and maturity assessment models. In accordance with the problem boundary, five specific measurement models were selected as subjects of comparison: the Smart Industry Readiness Index (SIRI), the Indonesia Industry 4.0 Readiness Index (INDI 4.0), the acatech Industrie 4.0 Maturity Index, the Digital Maturity Model (DMM), and the Digital Transformation Readiness Model. These five models were selected through purposive sampling because they represent the widest variation of theoretical architecture and are empirically proven to be widely used by global and national practitioners to evaluate digital readiness, Industry 4.0 implementation readiness, and comprehensive organizational maturity. The selection spectrum intentionally spans from highly technical models based on smart manufacturing (such as SIRI) to general organizational governance models that are cross-sectoral (such as the Digital Transformation Readiness Model), thereby producing a rich, balanced comparative analysis capable of addressing sectoral adaptation needs in Indonesia

Data Sources and Document Collection

The data collected in this study are entirely derived from secondary data in the form of authoritative textual documents obtained through structured literature searches. The documents used comprise four main categories of sources: (1) academic publications consisting of articles from reputable international journals and indexed conference proceedings discussing digital evaluation theories; (2) official framework documents released directly by the model-developing institutions, such as the Singapore Economic Development Board (EDB) for SIRI and the TM Forum for the Digital Maturity Model; (3) government reports, specifically official regulations and guidelines from the Ministry of Industry of the Republic of Indonesia regarding the implementation of INDI 4.0; and (4) institutional reports from global strategic consulting firms and industrial alliances closely related to digital transformation readiness, Industry 4.0 readiness, and digital maturity assessment. The document collection process was carried out digitally through academic databases such as Scopus, ScienceDirect, and Google Scholar, as well as the official websites of relevant government and institutional bodies. To ensure the validity and reliability of the analysis, the selected documents had to meet inclusion criteria: being officially published, written in Indonesian or English, possessing direct relevance to the operational parameters of the five models reviewed, and presenting the measurement dimension structures transparently and completely. By combining government regulations and global scientific literature, the established database possesses a high degree of credibility to underpin the contextual comparative analysis in Indonesia.

Framework Comparison Criteria and Visual Analytical Hierarchy

To conduct an objective, structured and integrative comparative framework analysis of the five digital assessment models, this study establishes six primary evaluation criteria. These six criteria are derived from technology management and information system adoption literature to differentiate the functional characteristics of each framework. The detailed criteria used and their operational definitions are presented in Table 1.

Table 1. Details of Criteria and Their Operational Definitions

Criteria	Operational Definition
Objective	Identifies the fundamental purpose and target achievements of each model's design, including the initial motivation of the institution in launching the framework
Main Focus	Evaluates the core strategic objectives to be resolved by the model, identifying what and for which focus domain the measurement model was specifically developed
Measured Aspects	Maps out all operational dimensions, pillars, or parameters evaluated within the model architecture to identify which aspects are assigned weight values in determining a company's digitalization profile.
Readiness/Maturity Orientation	Critically analyzes the nature of the model's assessment output; whether the instrument is designed to assess readiness (initial readiness before technology execution) or maturity (the level of sophistication and mature capability of digital systems after deployment).
Sector Suitability	Maps out which type of industrial sector or organization type (e.g., manufacturing, financial services, telecommunications, public sector, or SMEs) is most suitable, relevant, and efficient to use the measurement model based on its operational characteristics
Relevance to Indonesian Companies	Evaluates the extent to which the model aligns with the context, regulations, national policies (such as Making Indonesia 4.0), and structural characteristics of the diverse corporate landscape operating in Indonesia

Source: Processed Data, 2026

To enhance readability and provide a highly rigorous, non-speculative systematic evaluation, the analytical procedure of this comparative framework is executed through a structured visual hierarchy. Figure 1 illustrates the conceptual classification and analytical framework mapping used to evaluate the five models.

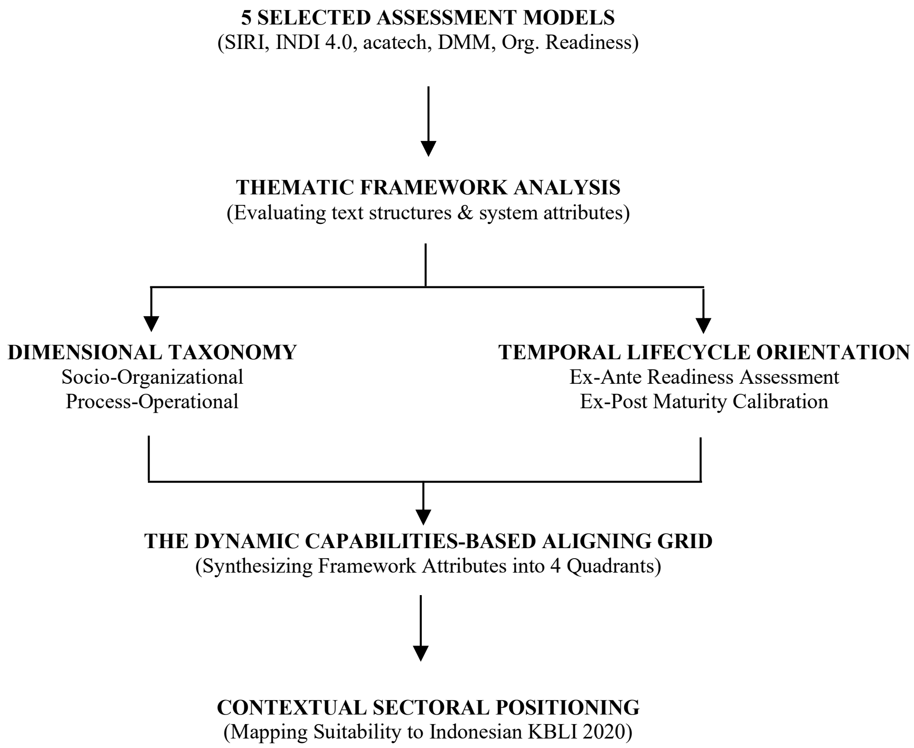

Figure 1. The Analytical Framework and Evaluation Hierarchy for Digital Assessment Model Classification.

As conceptualized in Figure 1, the systematic evaluation follows a strict cascading logic:

1. Model Ingestion & Deconstruction
   The primary documentation of the five models is deconstructed through thematic coding.
2. Dual-Axis Classification Matrix
   The frameworks are systematically filtered based on their structural core focus (Socio-Organizational vs. Process-Operational) and their temporal lifecycle alignment (Ex-Ante Readiness before investment vs. Ex-Post Maturity after implementation).
3. Theoretical Grid Integration
   The models are mapped into the Dynamic Capabilities quadrants (Sensing, Seizing, and Transforming) to explain the theoretical boundaries of their diagnostic validity.
4. Sectoral Positioning Output
   The final analytical tier delivers the contextual match between the model classification and the specific KBLI 2020 industrial codes in Indonesia.

Research Operational Steps

To achieve the research objectives in a valid and structured manner, the sequence of operational activities in this study is divided into five systematic stages:

1. Identification of Literature and Official Documents

   The initial stage begins by searching, collecting, and filtering scientific literature and official framework documents addressing the five digital measurement models under study (SIRI, INDI 4.0, acatech Industrie 4.0 Maturity Index, Digital Maturity Model, and Digital Transformation Readiness Model). This step is crucial to ensure that all baseline data used have a strong formal and theoretical foundation.
2. Identification of Core Model Components

   Once the documents are gathered, a content analysis is conducted to extract and identify the main focus, measurement dimensions or parameters, assessment orientation, and operational application context of each model. This deconstruction process aims to map out the conceptual anatomy of each model independently.
3. Classification Based on Assessment Orientation

   In the third stage, the five models are explicitly grouped and classified based on their dominant assessment orientation. The primary objective of this step is to separate models purely designed to measure initial readiness levels from those developed to assess capability maturity post-technology adoption.
4. Comparative Analysis Based on Evaluation Criteria

   The next stage involves a side-by-side comparison of the five measurement models using the criteria matrix previously defined in sub-section 3.4 (Main Focus, Measured Aspects, Readiness/Maturity Orientation, Sector Suitability, and Relevance to Indonesian Companies)
5. Contextual Alignment Mapping for Indonesian Industrial Sectors

   The final stage of this methodology involves matching (alignment mapping) the aspects evaluated by each model with the structural and operational characteristics of various industrial sectors in Indonesia, referencing the Indonesian Standard Industrial Classification (KBLI) 2020. This step yields taxonomic recommendations regarding which model is most appropriate and adaptive for implementation by corporations in Indonesia based on their industrial clusters.

RESULT AND DISCUSSION

The comparative analysis conducted on official framework documents and related literature successfully identified the structural characteristics of the five digital transformation measurement models. These five models were selected because they represent a diverse range of assessment orientations, from Industry 4.0 readiness, digital maturity, to organizational governance readiness. The objective findings from this comparison process are summarized in Table 2, which maps the relationship between the Main Focus, Measured Aspects/Dimensions, and Assessment Orientation of each framework.

Table 2. Comparison Matrix of Main Focus, Measured Aspects, and Orientation

Model	Main Focus	Measured Aspects	Orientation
SIRI – Smart Industry Readiness Index	Global readiness for Industry 4.0 / smart manufacturing.	Process, technology, organization, shop floor automation, shop floor connectivity, shop floor intelligence, horizontal integration, vertical integration, product	Readiness Orientation (deeply specific to Industry 4.0 domain & manufacturing sector

Model	Main Focus	Measured Aspects	Orientation
		lifecycle integration, workforce learning, leadership competency, collaboration, strategy, and governance.	
INDI 4.0 – Indonesia Industry 4.0 Readiness Index	Readiness of Indonesian industries in implementing Industry 4.0 for national agenda.	Management and organization, people and culture, products and services, technology, and factory operations.	Readiness Orientation (specific to manufacturing within the context of Indonesian regulations).
acatech Industrie 4.0 Maturity Index	Evolutionary maturity stages of technological transformation toward Industry 4.0.	Resources, information systems, organizational structure, culture, computerization, connectivity, visibility, transparency, predictive capacity, and adaptability.	Maturity Orientation (mapping gradual achievement of Industry 4.0 capabilities).
Digital Maturity Model	Maturity level of digital ecosystem & capabilities broadly across sectors.	Strategy, customer, operations, technology, organization, culture, data, governance, innovation, and digital capability	Maturity Orientation (general nature to evaluate digital adoption effectiveness).
Digital Transformation Readiness Model	Fundamental readiness of internal organizational governance to execute digital transformation.	Digital strategy, leadership, organizational culture, people capability, business process, technology infrastructure, data readiness, governance, change management, and external environment.	Readiness Orientation (evaluating general organizational capacity prior to tech investments).

Source: Processed Data, 2026

Based on the comparative results of the measurement models presented in Table 2, both SIRI and INDI 4.0 exhibit a profound focus on evaluating Industry 4.0 readiness, particularly within the context of the processing or manufacturing industry. This orientation is explicitly demonstrated by their evaluated dimensions, which encompass factory operations, automation, connectivity, technology, production processes, and organizational aspects. Meanwhile, the acatech Industrie 4.0 Maturity Index is oriented toward measuring the digital transformation maturity level through sequential stages of a firm's digital evolution. Concurrently, the Digital Maturity Model offers a broader evaluation scope by assessing the digital maturity of an organization from a generalized perspective. Lastly, the Digital Transformation Readiness Model is utilized to perform baseline assessments of organizational readiness to execute digital transformation across the dimensions of strategy, leadership, culture, human resources, processes, technology, data, and governance

Consequently, based on the orientation classification results in Table 2, it is demonstrated that not all models share the same assessment orientation toward the concept of readiness. Although SIRI and INDI 4.0 can be categorized as readiness-oriented models, their assessment focus is highly specific to the context of Industry 4.0 and manufacturing. Conversely, acatech and the Digital Maturity Model are inherently oriented toward maturity, as their primary function is to evaluate a company's digital maturity level after digitalization initiatives have been deployed. The Digital Transformation Readiness Model represents the framework closest to the pure concept of readiness, as it diagnoses the initial organizational conditions required to execute a digital transformation.

Referring to the Indonesian Standard Industrial Classification (KBLI) 2020 document, the business landscape in Indonesia is divided into various sectors characterized by highly heterogeneous operational profiles. To identify which measurement model is the most valid and adaptive for adoption by each specific type of industry, an alignment mapping (suitability mapping) process was conducted between the model's measurement dimensions and the dominant characteristics of the respective industrial sectors in Indonesia. The comprehensive results of this suitability mapping are presented in detail in Table 3.

Table 3. Suitability of Measurement Models for Indonesian Industrial Sectors

Indonesian Industrial Sector (KBLI 2020)	Primary Operational Asset Profile	Most Aligned Dynamic Capability	Recommended Framework	Suitability Index
Processing and Manufacturing	Physical, Shop-Floor Machinery	Seizing (Operational Restructuring)	INDI 4.0 / SIRI	★★★★★
Priority Manufacturing Sectors (Making Indonesia 4.0)	High-Volume Production Lines (F&B, Automotive, Textile, Chemical, Electronics)	Seizing (National Policy & Supply Chain Alignment)	INDI 4.0 / SIRI	★★★★★
Pharmaceuticals and Medical Devices	Strict Regulation, Cyber-Physical	Transforming (System Integration)	SIRI / acatech	★★★★☆
Mining and Heavy Energy	Heavy Field Assets, Operational Tech	Seizing (Safety & Data Automation)	SIRI / acatech	★★★★☆
Finance, Insurance and Banking	Intangible Assets, Virtual Platforms	Transforming (Ecosystem Innovation)	DMM	★★★★★
Telecommunications and Information-Communication	High-Speed Digital Data Infrastructure	Transforming (Platform Scaling)	DMM	★★★★★
Trade, Retail, and E-commerce	Omni-channel, Consumer Behavior Data	Sensing and Transforming	DMM	★★★★☆
Transportation and Logistics	Moving Fleet Networks, Warehouses	Seizing (Supply Chain Sync)	DMM / SIRI	★★★★☆
Education	Learning Management Systems (LMS), Digital Literacy Culture	Sensing (Socio-Cultural Change & Governance)	Digital Transformation Readiness Model / DMM	★★★★★
Healthcare	Clinical Care Workflows, Patient Information Systems (HIS).	Sensing & Transforming (Data Security & Compliance)	Digital Transformation Readiness Model / DMM	★★★★☆
Government and Public Services	Highly Bureaucratic Administrative Flow	Sensing (Socio-Cultural Change)	Digital Transformation Readiness Model	★★★★★
MSMEs (Micro, Small, and Medium Enterprises)	Severely Fragmented, Resource Constraints	Sensing (Basic Digital Literacy)	Digital Transformation Readiness Model	★★★★★

Scoring Matrix: ★★★★★ Perfect Structural Alignment; ★★★★☆ High Core Alignment; ★★☆☆☆ Evaluative Friction/Mismatched Metrics.

Source: Processed Data, 2026

Based on the sectoral suitability analysis presented in Table 3, SIRI and INDI 4.0 are the most appropriate models for the manufacturing sector because both possess evaluation dimensions directly linked to factory operations, production processes, industrial technology, and organizational readiness to adopt Industry 4.0. INDI 4.0 holds a distinct advantage within the Indonesian context because it was officially developed to support the national Making Indonesia 4.0 agenda. On the other hand, SIRI offers core advantages in terms of its standardized international measurement structure and profound relevance to global smart manufacturing. For non-manufacturing sectors such as finance, telecommunications, education, healthcare, retail, government, and MSMEs the Digital Transformation Readiness Model is more suitable due to its generalized measurement scope that is not constrained by physical factory operations. This framework comprehensively diagnoses readiness from the perspectives of digital strategy, leadership, organizational culture, human resource competency, technology, business processes, data, governance, and change management.

Conceptual Synthesis: The Dynamic Capabilities-Based Alignment Grid

To advance the theoretical discourse beyond a descriptive juxtaposition of existing frameworks, this study synthesizes the structural dimensions into a novel Dynamic Capabilities-Based Alignment Grid. Grounded in the Dynamic Capabilities Theory (Teece et al., 1997), organizational success in a volatile digital economy depends on three foundational capacities: Sensing (identifying digital threats and opportunities), Seizing (mobilizing structures and business models to capture value), and Transforming (aligning and continuous reconfiguring of assets and culture). By cross-referencing these capability archetypes with the operational focus of each industry (Socio-Organizational vs. Process-Operational) and the level of technical complexity, this study maps the five frameworks into four distinct quadrants as presented in Figure 2:

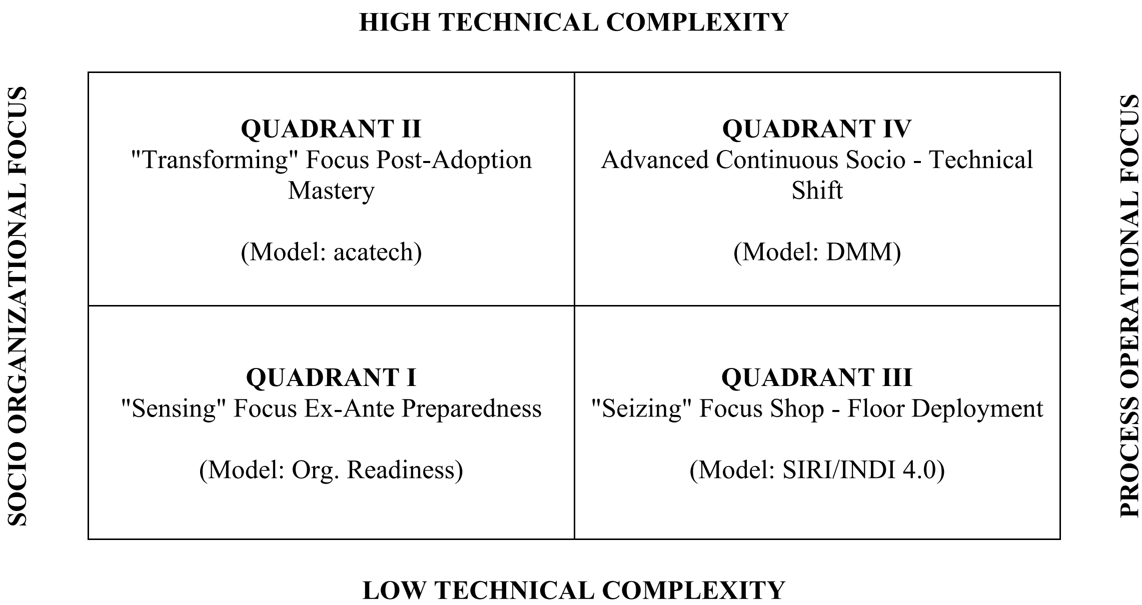

Figure 2. Conceptual Framework: The Dynamic Capabilities-Based Alignment Grid.

Quadrant I: Socio-Organizational Focus / Low Technical Complexity ("Sensing" Capability)

This quadrant focuses primarily on the Sensing capability required during the pre-investment phase. Organizations here such as MSMEs, educational institutions, and public administration entities often lack complex physical machinery. Their main barrier is internal inertia, lack of digital vision, and cultural resistance. The Digital Transformation Readiness Model operates optimally within this quadrant. It serves as an ex-ante diagnostic instrument that audits organizational culture, leadership alignment, and change management readiness, ensuring the company can "sense" and psychologically prepare for technological disruption before capital expenditure is deployed

Quadrant II: Socio-Organizational Focus / High Technical Complexity ("Transforming" Capability - Cyber-Physical)

When highly technical industries move beyond initial deployment, they enter the Transforming phase, which requires continuous asset reconfiguration and deep integration of organizational culture with high-tech systems. Advanced manufacturing, capital-intensive heavy industries, and pharmaceutical complexes operate within this quadrant due to their highly regulated environments and complex validation processes. The acatech Industrie 4.0 Maturity Index is designed for this quadrant to track evolutionary stages up to ultimate adaptability. However, for pharmaceutical companies conducting their baseline digital readiness alignment, the Smart Industry Readiness Index (SIRI) also bridges into this quadrant. SIRI provides the structural depth needed to evaluate how socio-organizational factors (like workforce learning and leadership competency) interact with advanced technical pillars (such as vertical and product lifecycle integration), ensuring high-tech pharmaceutical operations are transformation-ready.

Quadrant III: Process-Operational Focus / Low-to-Medium Technical Complexity ("Seizing" Capability)

This quadrant represents industries that must execute and mobilize resources to capture concrete operational value a core Seizing capability. Standard manufacturing sectors, priority national industrial clusters (e.g., KBLI food & beverages, textiles), as well as conventional pharmaceutical manufacturing setups during their initial standardization phase, belong to this cluster. The Smart Industry Readiness Index (SIRI) and INDI 4.0 are theoretically aligned here. Their dimensions explicitly evaluate shop-floor automation, connectivity, and factory operations. For industries in this quadrant, these frameworks provide concrete metrics that allow managers to physically restructure production lines, integrate process-operational workflows, and leverage immediate smart manufacturing benefits.

Quadrant IV: Process-Operational Focus / High Technical Complexity ("Transforming" Capability - Digital Ecosystems)

This quadrant represents organizations operating entirely within virtual asset spaces and data-driven ecosystems, such as fintech, telecommunications, banking, and digital retail. Their operations are deeply complex but uncoupled from physical factories. The Digital Maturity Model (DMM) provides the best theoretical fit for Quadrant IV. It evaluates how thoroughly digital strategies have transformed the customer experience, omni-channel delivery, and cross-functional corporate data systems, effectively auditing a company's capacity to reconfigure its virtual business models continuously.

Critical Evaluation of Model Weaknesses and Resource-Constraint Limitations

While contemporary literature predominantly highlights the benchmarking efficacy and architectural strengths of established Industry 4.0 assessment models, a rigorous framework selection requires an objective, dialectical interrogation of their inherent operational and structural weaknesses. A primary theoretical contribution of this study lies in exposing the evaluative friction and systemic mismatches that occur when sophisticated, high-fidelity frameworks are epistemologically forced onto resource-constrained organizations—a prevalent structural reality within the Indonesian economic topography.

Operational Roadblocks and Diagnostic Lock-In in SIRI Implementation

The Smart Industry Readiness Index (SIRI) relies on an internationally validated, mathematically rigid matrix designed for high-maturity industrial ecosystems. However, its core structural limitation stems from an ontological over-reliance on pre-existing Information Technology and Operational Technology (IT/OT) convergence. For middle-tier manufacturing enterprises in emerging economies like Indonesia, which face acute capital constraints and legacy infrastructure, the deployment of SIRI induces a severe "diagnostic lock-in." Because the architecture demands formal, highly capital-intensive certified external auditors and exhaustive engineering hours to satisfy its data-granularity requirements, resource-constrained firms risk diverting critical capital from actual technological upskilling or hardware procurement toward diagnostic overhead. Consequently, the assessment becomes counterproductive, mapping existing gaps without provisioning a viable, cost-effective evolutionary pathway.

Self-Assessment Methodologies and Social Desirability Bias in INDI 4.0

The Indonesia Industry 4.0 Readiness Index (INDI 4.0) offers robust macro-policy alignment with the national *Making Indonesia 4.0* strategic roadmap. Nevertheless, its fundamental methodological vulnerability originates from its self-assessment operational design. In institutional environments where readiness scores are tied to the acquisition of government incentives, digital tax reliefs, or state-backed subsidies, this non-blinded diagnostic approach introduces significant subjective leniency and social desirability bias. In the absence of multi-layered technical audits or independent empirical validation, participating organizations frequently over-report their shop-floor capabilities. This measurement error generates inflated readiness scores that mask underlying operational vulnerabilities, thereby compromising the statistical reliability and policy utility of the resulting aggregate data.

Socio-Technical Blindspots of the Digital Maturity Model (DMM)

The Digital Maturity Model (DMM) exhibits exceptional diagnostic performance when applied to virtual asset architectures, data-driven ecosystems, and tertiary industries such as fintech and telecommunications. Its structural blindspot, however, is the complete omission of physical assembly line dynamics, cyber-physical machine-to-machine (M2M) telemetry, and complex shop-floor logistical loops.When applied indiscriminately to industrial manufacturing configurations, the DMM generates a severe evaluative bias; it disproportionately measures corporate administrative agility, customer-centric omni-channel capabilities, and front-end digital adoptions while completely ignoring the raw material transformation and physical production performance that define industrial enterprises.

Discussion of Research Findings

Digital transformation readiness and maturity assessment models cannot be generalized across all types of organizations because each framework has a distinct assessment orientation, measurement architecture, and operational application context. Therefore, the interpretation of model suitability in this study is based on the alignment among each model's main focus, measured dimensions, sectoral characteristics, and the organization's stage of digital transformation. The findings indicate that no single assessment model is universally suitable for all industrial sectors in Indonesia. Instead, each framework provides value under different sectoral and organizational conditions. To summarize these differences, Table 4 presents the sectoral positioning and recommended application of the five assessment models.

Table 4. Sectoral Positioning and Recommended Application of Digital Assessment Models

Model	Dominant Orientation	Most Suitable Sector	Usage Stage	Recommended Position
SIRI	Readiness toward smart manufacturing	Manufacturing and production industries	Before or during Industry 4.0 transformation	Comprehensive smart manufacturing assessment and global benchmarking
INDI 4.0	Readiness toward Industry 4.0	Indonesian manufacturing priority sectors	Initial stages of Industry 4.0 implementation	Manufacturing assessment aligned with national industrial policies
acatech	Post-adoption digital maturity	Digitalized complex manufacturing lines	After foundational digital layers are operational	Mapping gradual maturity increments for cyber-physical data value
DMM	General capability maturity	Fintech, telecom, retail, and digital services	After digital initiatives are deployed	Evaluating functional digital integration across service ecosystems
Digital Transformation Readiness Model	Pre-investment organizational readiness	Public sector, services, health, and MSMEs	Before large-scale capital or tech expenditure	Diagnostic baseline of socio-cultural and change management readiness

Source: Processed Data, 2026

The first major finding is that no assessment framework can be considered universally appropriate for all companies. Differences in model architecture create differences in application suitability. Models that emphasize factory operations, machine connectivity, process integration, and automation are naturally more relevant to manufacturing companies. In contrast, models that emphasize leadership, organizational culture, data governance, workforce capability, and change management are more appropriate for service-based and public-sector organizations. Therefore, framework selection should begin with an understanding of the organization's dominant operational characteristics rather than with the popularity of a particular model.

Secondly, the study reveals that the suitability of a model is contingent upon two primary contextual factors: the specific characteristics of the industrial sector and the overarching objective of the assessment. Within the manufacturing realm, the Smart Industry Readiness Index (SIRI) and INDI 4.0 emerge as the most pertinent frameworks due to their comprehensive evaluation of factory operations, production workflows, industrial technologies, organizational readiness, and Industry 4.0 execution. However, rather than viewing these two models as direct competitors, they should be understood as serving complementary evaluation purposes. SIRI delivers a holistic smart manufacturing architecture by synthesizing process, technology, and organizational dimensions. This structural configuration makes SIRI exceptionally suited for manufacturing enterprises seeking a systematic appraisal of shop-floor automation, digital connectivity, intelligence, horizontal/vertical integration, and governance. Consequently, SIRI is highly recommended when the strategic goal involves international benchmarking and global readiness comparisons.

INDI 4.0, on the other hand, offers a stronger contextual alignment with Indonesia’s national industrial environment. It was developed to support the Making Indonesia 4.0 agenda and incorporates dimensions that reflect the characteristics and policy priorities of domestic manufacturing industries. Consequently, INDI 4.0 is particularly suitable when the primary objective is to evaluate readiness in accordance with national regulations, policy initiatives, and priority manufacturing sectors. The selection between SIRI and INDI 4.0 should therefore depend on the assessment objective. SIRI is more appropriate for internationally comparable smart manufacturing assessment, whereas INDI 4.0 is more suitable for national policy alignment and contextual relevance within Indonesia.

For non-manufacturing sectors, including finance, telecommunications, education, healthcare, retail, government, and MSMEs, the Digital Transformation Readiness Model is more appropriate because its measurement scope is not dependent on physical factory operations. These organizations rely more heavily on intangible resources, data-driven services, organizational capabilities, customer interaction, and internal governance. Accordingly, the Digital Transformation Readiness Model evaluates relevant dimensions such as digital strategy, leadership, organizational culture, workforce capability, business processes, technology infrastructure, data readiness, governance, and change management. However, this model is less suitable for evaluating manufacturing-specific capabilities such as shop-floor automation, machine connectivity, and horizontal or vertical production integration.

The Digital Maturity Model and acatech Industrie 4.0 Maturity Index occupy a different assessment position because they are more strongly oriented toward maturity than initial readiness. The acatech model is particularly relevant for manufacturing and complex industrial organizations that have established basic digital foundations and seek to progress through structured maturity stages, from computerization and connectivity to predictive capability and adaptability. Meanwhile, the Digital Maturity Model is more flexible across sectors and is suitable for organizations seeking to evaluate how extensively digital strategy, customer experience, operations, data, culture, and technology have been integrated into organizational activities.

To bridge the gap between conceptual suitability mapping and empirical reality, this study cross-references its theoretical taxonomy with localized case evidence across two highly divergent state-owned enterprises (BUMN) in Bandung, Indonesia:

Case 1: Capital-Intensive Cyber-Physical Industry (The Vaccine Manufacturing Domain)

During pilot digital transformations involving complex biological manufacturing platforms (such as Electronic Batch Record [EBR] system deployment and cyber-physical standard validation), attempts to utilize generic digital maturity frameworks resulted in major strategic ambiguity. The diagnostic tools failed to evaluate specialized computerized system validations (CSV), clean-room data integrity, or real-time process analytics. This empirical gap validates our framework's assertion: complex chemical and pharmaceutical domains require a combined implementation of SIRI (for shop-floor vertical data integration) and acatech (for evolutionary post-adoption data predictability tracking) rather than cross-sectoral models.

Case 2: Intangible Asset, Bureaucracy-Heavy Domain

Conversely, empirical observations within domestic service administrative units show that failures are almost exclusively triggered by paternalistic top-down management, bureaucratic inertia, and a lack of digital leadership. When technocentric checklists were forced onto these teams, the workforce showed intense psychological resistance. This empirical reality supports our model's positioning: for public governance, services, and small businesses facing extreme resource constraints, the Digital Transformation Readiness Model must be utilized first to secure a socio-cultural and change management baseline before any hardware capital expenditure is authorized.

Overall, the findings demonstrate that digital assessment model selection should be based on sectoral characteristics, assessment objectives, and the organization's transformation stage. SIRI and INDI 4.0 are most appropriate for manufacturing companies, but their use depends on whether international benchmarking or national policy alignment is prioritized. The Digital Transformation Readiness Model is more suitable for assessing initial organizational readiness in non-manufacturing sectors, whereas acatech and the Digital Maturity Model are more appropriate for organizations that seek to evaluate digital maturity after implementation. Therefore, the value of each framework lies not in its universal superiority, but in its alignment with the specific context in which the assessment is conducted.

CONCLUSION

This study concludes that no single digital transformation assessment model is universally suitable for all industrial sectors in Indonesia. The suitability of each model depends on its assessment orientation, measurement dimensions, sectoral characteristics, and the organization's stage of digital transformation. SIRI and INDI 4.0 are most suitable for manufacturing companies because of their strong emphasis on factory operations, production integration, automation, technology, and organizational readiness. SIRI is particularly appropriate when internationally comparable smart manufacturing assessment is required, whereas INDI 4.0 provides stronger alignment with Indonesia's national industrial policies.

For non-manufacturing sectors and organizations seeking to evaluate their initial organizational readiness, the Digital Transformation Readiness Model is more appropriate. Meanwhile, the Digital Maturity Model is suitable for cross-sector organizations that have implemented digital initiatives, while the acatech Industrie 4.0 Maturity Index is particularly relevant for manufacturing companies seeking to advance through structured stages of digital maturity. Therefore, model selection should be based on sectoral fit and assessment purpose rather than on the assumption that one model can be applied universally.

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