

The Global State of Digital Transformation Across Organisations: Evidence from a Large-Scale Survey

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Abstract: Digital transformation is widely recognised as a key driver of innovation and competitiveness, yet systematic empirical insights into its implementation across organisations remain limited. Existing studies are often fragmented, based on limited samples or focused on specific sectors, technologies or organisational contexts. This paper addresses this gap by analysing the status quo of digital transformation based on 2,024 valid organisational responses collected between June 2020 and March 2026 through the Digital Transformation Assessment (DTA). The DTA is a scientifically grounded and empirically validated self-assessment instrument that conceptualises digital transformation as a holistic organisational phenomenon across seven dimensions: Corporate Strategy, Leadership and Corporate Culture, Organisation and Processes, Employees and Competences, Technology, Products and Services, and Supply Chain and Networks. The analysis combines descriptive, comparative and benchmark-oriented methods to examine maturity patterns across dimensions, items and contextual variables. Results show a globally moderate digital transformation maturity of $\bar{D} 3.12$. Technology is the strongest dimension, whereas Employees and Competences is consistently the weakest dimension across regions, industries, organisational sizes and management levels. The findings suggest that the main bottleneck of digital transformation is increasingly human and organisational rather than purely technological. The paper contributes large-scale empirical evidence on digital transformation maturity and provides implications for research and managerial practice.

Keywords: Digital Transformation, Maturity Assessment, Benchmarking, Organisations

1. Introduction

Digital transformation has emerged as one of the most significant challenges facing organisations today. Driven by advances in information and communication technologies, data analytics, artificial intelligence, cloud computing, automation and digital platforms, it reshapes how organisations create value, compete, interact with stakeholders and organise work. In contrast to earlier waves of IT-enabled organisational change, digital transformation is increasingly understood as a strategic and organisational phenomenon affecting value propositions, business models, organisational identity, dynamic capabilities and long-term competitiveness (Bharadwaj et al., 2013; Vial, 2019; Warner and Wäger, 2019; Wessel et al., 2021). It therefore extends beyond technology adoption and process automation, requiring coordinated change across strategy, leadership, culture, processes, employees, products and services, customer interfaces and external value networks (Bockschecker et al., 2018; Matt et al., 2015; Kidschun et al., 2021).

To support the management and evaluation of organisational digital transformation, numerous digital maturity models have emerged in both research and practice. These models seek to capture the extent to which organisations have developed the capabilities required for digital transformation and often provide structured roadmaps for future development. Despite their popularity, however, digital maturity models face important conceptual and methodological challenges. Many assume a normative and linear progression toward an idealised future state, while empirical evidence validating the relationship between maturity levels, organisational capabilities, and performance outcomes remains limited (Thordsen and Bick, 2023; Hórtoványi et al., 2023). Moreover, self-assessment instruments primarily capture respondents' perceptions rather than objectively verified organisational conditions, making results susceptible to calibration differences and social desirability biases. These limitations do not invalidate maturity assessments as diagnostic tools, but they underline the need for large-scale empirical studies that examine whether observed maturity patterns remain robust across diverse organisational contexts.

Although empirical research on digital transformation has grown, systematic large-scale evidence on digital maturity across heterogeneous organisational contexts remains limited. Reviews point to fragmentation in the field and to limited empirical validation for many maturity models. Teichert (2019), for example, identified 24 relevant studies and 22 digital maturity models, illustrating the diversity of approaches but also the limited consolidation of the field. Thordsen and Bick (2023) similarly argue that the value of digital maturity models remains contested, partly because of limited empirical evidence on the assumed relationships between

maturity, organisational capabilities and performance. Hórtoványi et al. (2023) further note that capability maturity models for digital transformation often lack empirical validation despite their practical relevance.

Existing empirical studies provide important insights but are often limited in scope. Giotopoulos et al. (2017) analyse ICT adoption based on 3,500 SMEs in Greece but focus on ICT penetration rather than holistic digital transformation maturity. Berghaus and Back (2016) derive maturity stages from 547 individuals representing 417 organisations in Switzerland and Germany. Petzolt et al. (2022) develop and apply a maturity model for SME business model transformation based on 310 organisations. Hórtoványi et al. (2023) examine digital maturity in 302 manufacturing firms, while Ladu et al. (2024) analyse digital maturity in the conformity assessment industry using data from 1,447 organisations across 15 countries. These studies advance empirical understanding, but are typically focused on ICT adoption, specific countries, SMEs, manufacturing/B2B firms or single industries. A research gap therefore remains regarding large-scale empirical studies that apply a consistent, holistic digital maturity assessment across diverse industries, regions, organisational sizes and management levels.

In response to this need, researchers at Fraunhofer IPK developed the Digital Transformation Assessment (DTA), a self-assessment instrument for evaluating digital transformation maturity across seven organisational dimensions: Corporate Strategy, Leadership and Corporate Culture, Organisation and Processes, Employees and Competences, Technology, Products and Services, and Supply Chain and Networks (Kidschun et al., 2021). This paper uses the DTA dataset to analyse digital transformation maturity based on 2,024 valid organisational responses collected between June 2020 and March 2026. By leveraging the multidimensional structure of the instrument and contextual variables such as industry sector, organisational size, management level and geographic region, the study provides differentiated insights into how digital transformation unfolds across organisational settings.

The contribution is threefold. First, the paper promotes the understanding of digital transformation as a multidimensional organisational capability rather than a technology-centred implementation challenge. Second, it provides large-scale empirical evidence on global digital transformation maturity. Third, it identifies persistent maturity gaps relevant for research and practice, particularly regarding workforce capabilities, strategic execution and digital value creation.

The remainder of the paper is structured as follows. Section 2 defines the core concepts of digitisation, digitalisation, and digital transformation. Section 3 introduces the DTA. Section 4 describes the dataset and sample. Section 5 presents the empirical findings, including global maturity patterns, top-quartile benchmarks, item-level results and contextual comparisons. Section 6 discusses implications and limitations. Section 7 concludes with key findings and directions for future research.

2. Theoretical Background

Digitisation, digitalisation, and digital transformation are central concepts in the theoretical foundation of this study. Although the terms are often used interchangeably in practice, they describe different levels of digital change and therefore need to be clearly distinguished (Bockschecker et al., 2018; Legner et al., 2017; Gong and Ribiere, 2021; Vial, 2019). This distinction is particularly important for maturity and benchmarking approaches, as unclear terminology complicates the systematic assessment of digital progress.

Digitisation refers to the technical process of converting analogue information into digital formats, such as scanning paper-based documents or transforming analogue media into digital data (Bockschecker et al., 2018; Legner et al., 2017; Freitas Junior et al., 2016). It provides the technical and infrastructural basis for digital information processing, but does not, by itself, imply substantial organisational change (Parviainen et al., 2017).

Digitalisation goes beyond this technical conversion and describes the use of digital technologies to improve, automate and connect existing business processes (Bockschecker et al., 2018). Examples include ERP, CRM or workflow systems that increase efficiency, transparency and process quality. While digitalisation may already have strategic implications, it typically remains focused on optimising existing organisational structures and processes rather than fundamentally changing the business model.

Digital transformation represents the most comprehensive form of digital change. It describes a long-term process of strategic, organisational, cultural and technological change driven by digital technologies (Bharadwaj et al., 2013; Matt et al., 2015; Vial, 2019). In contrast to digitisation and digitalisation, digital transformation affects the organisation as a whole, including strategy, structures, culture, employee competencies, products, services, customer interactions and business models (Haffke et al., 2016; Hess et al., 2020). Its objective is to enable new forms of value creation and secure long-term competitiveness (Bharadwaj et al., 2013; Li, 2020).

In summary, digitisation provides the technical foundation, digitalisation applies digital technologies to optimise existing processes, and digital transformation refers to holistic strategic change at the organisational and business model level. This study focuses on digital transformation, as it captures the broader organisational adaptation process required to respond to digital challenges and opportunities.

3. Digital Transformation Assessment

The Digital Transformation Assessment (DTA), developed by Kidschun et al. (2021), is a reference-model-based and empirically validated instrument for assessing organisational digital transformation maturity. It conceptualises digital transformation as a holistic organisational change process integrating strategic, cultural, structural, process-related, technological and market-oriented dimensions.

The development of the DTA followed an exploratory multi-stage research design. First, a systematic literature review and an analysis of 25 maturity models – using binary coding of the conceptual elements present in each – and frameworks were conducted. Recurring model elements were consolidated and complemented through a structured expert process. In subsequent workshops, more than 300 aspects of digital transformation were collected, prioritised and transferred into a reference model consisting of seven dimensions: Corporate Strategy, Leadership and Corporate Culture, Organisation and Processes, Employees and Competences, Technology, Products and Services, and Supply Chain and Networks. This combination of literature-grounded construct development and two-stage expert review establishes the content validity of the DTA.

The DTA is operationalised as a standardised online self-assessment comprising 33 items distributed across the seven dimensions. Each item is formulated as a precise statement and evaluated on a five-point Likert scale. Concrete best-practice examples support respondents in assessing their organisation realistically and consistently.

Table 1: Overview of the seven DTA dimensions and assessment items

Dimension	Assessment Items
1. Corporate Strategy	1.1 Digitalisation and corporate strategy; 1.2 Roles and responsibilities; 1.3 Measurable goals; 1.4 Monitoring
2. Leadership and Corporate Culture	2.1 Top management commitment; 2.2 Middle management commitment; 2.3 Openness to change; 2.4 Participatory culture; 2.5 Internal communication
3. Organisation and Processes	3.1 Innovative forms of work; 3.2 Interdisciplinary cooperation; 3.3 Process analysis and continuous improvement; 3.4 Digital process models
4. Employees and Competences	4.1 Professional and methodological competencies; 4.2 Social-communicative competencies; 4.3 Personal competencies; 4.4 Evaluation of employee competencies; 4.5 Education and qualification in digital technologies (digital expertise); 4.6 Digital technologies in human resource management
5. Technology	5.1 Investment in digital technologies; 5.2 Updating the IT infrastructure; 5.3 IT-Security; 5.4 Data integration; 5.5 Collaboration technologies
6. Products and Services	6.1 Analysis of market potentials (business model development); 6.2 Analysis of usage data; 6.3 Stakeholder integration for product and service development (open innovation); 6.4 Diversification through digital product/service innovations
7. Supply Chain and Networks	7.1 Customer Management; 7.2 Digital customer interfaces; 7.3 Supplier management; 7.4 Digital supplier interfaces; 7.5 Network of experts

After completion, participants receive an automatically generated, organisation-specific maturity profile. The results show the maturity level across the seven dimensions as well as an aggregated overall maturity score. This enables organisations to identify initial strengths and development areas. In addition, the assessment supports benchmarking by allowing organisations to compare their maturity profile with relevant peer groups.

The DTA therefore serves not only as a diagnostic instrument, but also as a basis for strategic prioritisation and transformation roadmap development. Overall, the DTA combines a theory-driven and evidence-based model architecture with a structured, best-practice-supported item design and a statistically validated measurement logic. It therefore provides a holistic and methodologically robust instrument for assessing, comparing and strategically steering digital transformation in organisations.

4. Empirical Dataset and Sample Characteristics

This chapter presents the empirical basis of the study and describes the composition of the analysed DTA dataset. It first explains the data collection process, inclusion criteria and methodological limitations of the dataset. It then summarises the sample structure in terms of geography, industry sector, organisational size and management level, which forms the basis for the subsequent results analysis.

4.1 Data Collection and Inclusion Criteria

The empirical analysis is based on data collected through the DTA online self-assessment platform. The platform has continuously collected organisational responses since June 2020 and enables respondents to assess the digital transformation maturity of their organisation across the seven DTA dimensions. All responses are stored in anonymised form in compliance with Art. 4 EU-GDPR.

The dataset analysed in this paper comprises 2,024 valid organisational responses, derived from 2,275 complete submissions received between June 2020 and March 2026. Responses were included if respondents had answered at least 50% of the items in each DTA dimension. This threshold ensures sufficient data for calculating dimension-level maturity scores while preserving the breadth of the sample. A total of 251 submissions, corresponding to 11.0% of all complete submissions, did not meet this criterion and were excluded from the analysis. For included responses, dimension scores were computed from the available items within each dimension (available-case analysis); no imputation of missing values was applied.

The final dataset covers organisations from 105 countries across all major world regions. However, the dataset should not be interpreted as a longitudinal panel of unique organisations. Participation was voluntary and anonymous; therefore, multiple individuals from the same organisation may have participated, and individual respondents may have completed the assessment in more than one year. Due to the anonymised design, organisational-level deduplication is not possible. In addition, the self-selected nature of participation may introduce an upward bias in maturity scores, as the sample likely overrepresents organisations actively engaged with digital transformation. The findings should therefore be interpreted as reflecting the perceptions of digitally engaged respondents across the observation period, rather than statistically representative organisational-level maturity distributions.

4.2 Sample Characteristics

The analysed dataset comprises 2,024 valid responses from organisations in 105 countries. Europe constitutes the largest regional group ($n = 966$; 47.7%), followed by South America ($n = 400$; 19.8%), Asia ($n = 296$; 14.6%) and North America ($n = 205$; 10.1%). The remaining responses originate from the Middle East, Africa and Oceania. The five countries with the highest response counts are Germany, Brazil, the United States, Taiwan and Ireland.

The sample covers a broad cross-section of sectors classified according to NACE. Manufacturing is the largest named sector ($n = 641$; 31.7%), followed by Information and Communication ($n = 200$; 9.9%) and Other Service Activities ($n = 166$; 8.2%). With respect to organisational size, 60.8% of respondents are SMEs, defined as organisations with up to 500 employees, while 39.2% are large organisations. Top, Middle and Lower Management together account for 77.7% of the sample. Employees without managerial responsibility account for 7.9%, while 14.4% provided no management-level information. Figure 1 summarises the sample distribution.

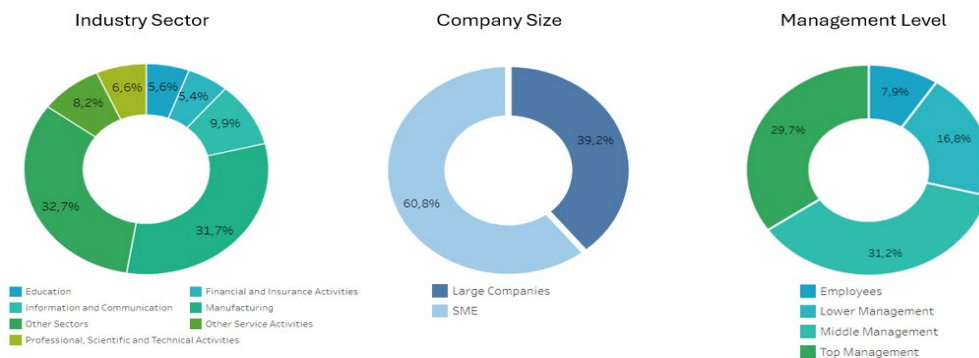


Figure 1: Sample composition – industry sector, organisational size, and management level distributions (N = 2,024)

5. Results Summary

This section presents the main empirical findings of the DTA global results analysis. It focuses on robust patterns across the dataset rather than reporting all subgroup analyses in detail. The results are organised into three parts: global maturity profile and top-quartile benchmark, item-level maturity patterns, and contextual comparisons.

5.1 Analytical Approach

The analysis combines descriptive, comparative and benchmark-oriented methods. Dimension-level maturity scores are calculated as unweighted means of the respective assessment items. The overall maturity score is calculated as the unweighted mean across all seven DTA dimensions. Three maturity bands are applied: Weak (1.0–2.99), Moderate (3.0–3.99) and Strong (4.0–5.0). Unweighted aggregation was chosen for transparency and comparability across dimensions; no differential item or dimension weighting was applied.

The empirical analysis examines global maturity levels at dimension and item level, the distribution of responses across maturity bands and differences between the global sample and the top quartile of respondents. The top quartile is defined by the 75th percentile of the overall maturity score. Contextual comparisons are conducted across geographic regions, organisational size, industry sector and management level. Temporal developments between 2020 and 2026 are reported only briefly and interpreted cautiously, as annual samples differ in composition and do not represent a longitudinal panel of identical organisations.

All subgroup comparisons are descriptive: differences are reported as observed mean differences and were not subjected to inferential significance testing, consistent with the exploratory, non-probabilistic nature of the sample.

5.2 Global Dimension Overview and Top-Quartile Benchmark

The global dimension overview provides the central maturity profile of the dataset. Figure 2 shows the distribution of Weak, Moderate and Strong responses by dimension and compares the global mean score with the average score of the top-quartile respondents.

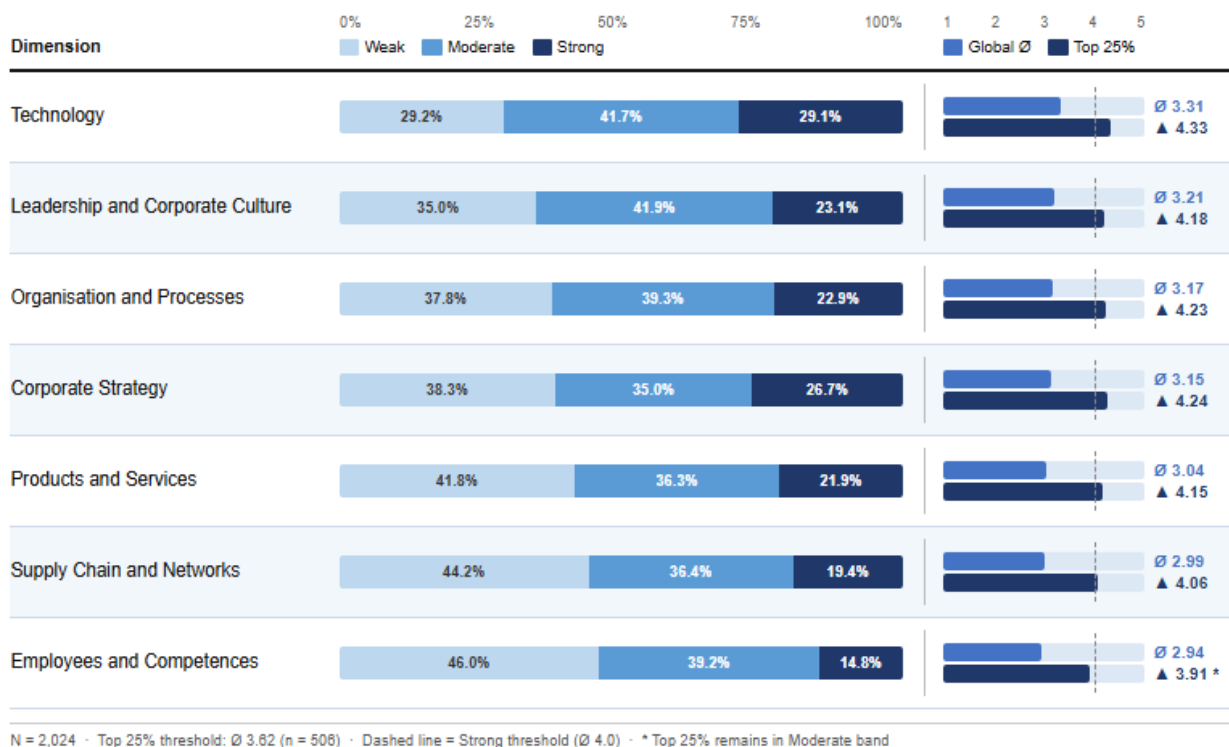


Figure 2: Dimension overview – distribution of Weak, Moderate, and Strong responses with global mean score and top-quartile average per dimension (right panel); dashed line = Strong threshold (Ø 4.0); N = 2,024; top 25% threshold Ø 3.62 (n = 506).

The results indicate a globally moderate level of digital transformation maturity, with an overall mean score of $\bar{x}$ 3.12. All seven dimensions fall within the Moderate band; none reaches the Strong threshold. Technology is the strongest dimension ($\bar{x}$ 3.31), with 29.1% of responses classified as Strong. Leadership and Corporate Culture ($\bar{x}$ 3.21), Organisation and Processes ($\bar{x}$ 3.17) and Corporate Strategy ($\bar{x}$ 3.15) follow. Products and Services ($\bar{x}$ 3.04) and Supply Chain and Networks ($\bar{x}$ 2.99) score lower, indicating that maturity is less advanced where digital transformation requires broader value creation and ecosystem integration. Employees and Competences is the weakest dimension ($\bar{x}$ 2.94), with the highest share of Weak responses (46.0%) and the lowest share of Strong responses (14.8%). Workforce capability development, therefore, represents the most pronounced maturity gap in the global sample.

The top-quartile benchmark reinforces this interpretation. The top 25% of respondents reach a mean overall maturity of $\bar{x}$ 4.16, which is 1.04 scale points above the global mean. The largest gaps between the global average and the top quartile occur in Products and Services (+1.11), Corporate Strategy (+1.09) and Organisation and Processes (+1.06). This suggests that digitally mature organisations differentiate themselves particularly through digital value creation, strategic execution and process maturity. Notably, Employees and Competences is the only dimension in which even the top-quartile average remains below the Strong threshold ($\bar{x}$ 3.91), confirming workforce capability development as a persistent bottleneck.

5.3 Item-Level Analysis

The item-level analysis provides a more granular view of the organisational practices underlying the dimension scores. The highest-scoring items are Top Management Commitment ($\bar{x}$ 3.65), IT Security ($\bar{x}$ 3.64) and Digitalisation and Corporate Strategy ($\bar{x}$ 3.64), indicating that many organisations have established strategic awareness, leadership commitment and technological safeguards.

At the same time, the weakest items reveal implementation gaps. The lowest-scoring item is the systematic evaluation of digital competences ($\bar{x}$ 2.50), followed by Digital Technologies in Human Resource Management ($\bar{x}$ 2.86). Both belong to Employees and Competences, confirming that organisations struggle less with recognising the relevance of digital transformation than with systematically developing and managing the workforce capabilities required to implement it.

A further pattern is the gap between strategic intention and execution. Within Corporate Strategy, Digitalisation in Strategy scores comparatively high ($\bar{x}$ 3.64), whereas Monitoring of Goal Achievement scores substantially lower ($\bar{x}$ 2.80). A similar pattern appears in Employees and Competences: general social-communicative competences reach a moderate maturity level ($\bar{x}$ 3.16), while the systematic evaluation of digital competences remains the weakest item ($\bar{x}$ 2.50). Overall, the item-level findings suggest that many organisations have established strategic and technological foundations but still lack governance and capability-management mechanisms for consistent transformation progress.

5.4 Contextual Comparisons

The following contextual analysis examines whether maturity patterns differ across regions, organisational sizes, industry sectors and management levels.

The regional comparison (Figure 3) shows that Europe records the highest overall maturity score ($\bar{x}$ 3.24), followed by Asia ($\bar{x}$ 3.19), the Middle East ($\bar{x}$ 3.03) and North America ($\bar{x}$ 3.03). Africa ($\bar{x}$ 2.92) and South America ($\bar{x}$ 2.86) score below the global mean. Europe demonstrates strength in Technology and Corporate Strategy, while Asia scores comparatively high in Leadership and Corporate Culture. Despite these differences, one pattern is consistent across regions: Employees and Competences is among the weakest dimensions in every regional profile. This confirms that workforce capability development is not a region-specific issue, but a global challenge.

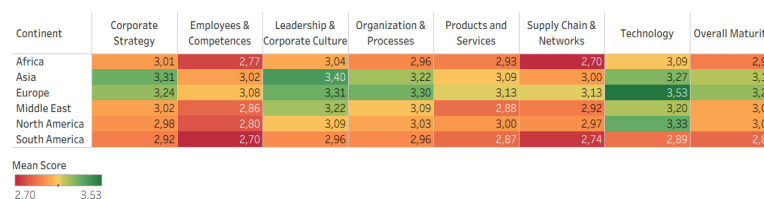


Figure 3: Regional comparison – mean dimension scores by continent (n=2024, regions with fewer than 40 responses excluded)

Organisational size also influences maturity levels. Large organisations ($n = 793$; $\bar{\phi} 3.29$) outperform SMEs ($n = 1,231$; $\bar{\phi} 3.00$) across all seven dimensions. The largest gaps appear in Technology and Corporate Strategy, suggesting that larger organisations benefit from greater resources for infrastructure investment and formal governance. Industry differences are also visible: Information and Communication companies achieve the highest overall maturity ($\bar{\phi} 3.40$), while Other Service Activities records the lowest maturity ($\bar{\phi} 2.90$). Manufacturing, the largest named sector in the dataset ($n = 641$), scores slightly below the global mean ($\bar{\phi} 3.05$), with relative weaknesses in Products and Services and Supply Chain and Networks.

The analysis by management level reveals a notable perception gap. Employees ($\bar{\phi} 3.22$) and Lower Management ($\bar{\phi} 3.18$) report higher maturity levels than Top Management ($\bar{\phi} 3.09$) and Middle Management ($\bar{\phi} 3.07$). One interpretation is that top managers assess transformation maturity against broader strategic ambitions and dependencies, while employees evaluate implemented tools and local process improvements more directly. Across all management levels, Employees and Competences remains the weakest dimension.

6. Discussion

Across regions, industries, organisational sizes, and management levels, Employees and Competences is the weakest dimension. The systematic evaluation of digital competences is the weakest item in the assessment ($\bar{\phi} 2.50$), indicating that the main bottleneck of digital transformation is not technology, but the structured development, measurement and management of workforce capabilities.

Viewed through an innovation lens, this pattern suggests that digital technologies act as innovation enablers only when matched by the workforce capabilities required to absorb and recombine them; the persistent Employees and Competences gap therefore constitutes a latent constraint on organisations' innovation and entrepreneurial capacity, not merely a training shortfall.

The globally moderate overall maturity score ($\bar{\phi} 3.12$) confirms that most organisations remain in an active but incomplete state of digital transformation. This is consistent with prior digital maturity research, which describes digital transformation as a multidimensional and ongoing organisational development process rather than a one-time technology implementation effort. The fact that no dimension reaches the Strong threshold reinforces the view that digital transformation maturity requires balanced progress across strategy, technology, organisation, people and external value creation.

A second important finding is the strategy-to-execution gap. While many organisations report relatively high maturity in digital strategy formulation and top management commitment, they score considerably lower on monitoring, goal achievement and competence governance. The findings show that digital transformation strategies require not only strategic intent, but also governance structures capable of coordinating and monitoring transformation progress.

The top-quartile benchmark shows that more digitally mature organisations differentiate themselves through Products and Services, Corporate Strategy, and Organisation and Processes. This indicates that advanced maturity is associated with digital value creation, strategic execution and process maturity. However, even among top-quartile organisations, Employees and Competences remains below the Strong threshold, confirming that workforce capability development is a persistent bottleneck across maturity levels.

The management-level comparison highlights the interpretive complexity of self-assessment data. Employees and Lower Management report higher maturity levels than Top and Middle Management. One possible explanation is that senior managers assess transformation maturity against broader strategic ambitions and systemic dependencies, while employees evaluate implemented tools and local process improvements more directly. This underlines the importance of considering the respondent perspective when interpreting self-assessment results.

Several limitations must be acknowledged. First, the DTA captures perceived maturity rather than externally verified performance, which may introduce social desirability bias, calibration differences and role-specific perception effects. Second, the sample is voluntary and non-probabilistic, limiting population-level generalisation. Third, organisational-level uniqueness cannot be guaranteed due to anonymised participation. Finally, regional and sectoral comparisons may be influenced by uneven sample distributions. Nevertheless, the consistency of the core findings, particularly the weakness of Employees and Competences, across all contextual subgroups strengthens confidence in their directional robustness.

Beyond these study-specific constraints, self-assessment validity in digital transformation research warrants explicit attention. Respondents assess maturity without external reference points: one who has never encountered a digitally advanced competitor may calibrate responses differently from one in a highly competitive environment. This context-dependent variance introduces calibration bias that aggregate scoring cannot fully control, and it is particularly consequential when comparing across industries and size classes where the operational meaning of the scale anchors may differ. This is not unique to the DTA but a structural challenge for the field. The consistency of the core findings, especially the universality of the Employees and Competences gap, across all subgroups nonetheless strengthens confidence in their directional robustness, even where precise measurement remains an open challenge.

7. Conclusion

This paper provides a large-scale empirical analysis of digital transformation maturity based on 2,024 organisational self-assessments across 105 countries. The findings show that global digital transformation maturity remains moderate and incomplete, with an overall maturity score of $\bar{X}$ 3.12 and no dimension reaching the Strong threshold.

Three central conclusions can be drawn. First, Employees and Competences represents the most persistent maturity gap and is the weakest dimension across all regions, industries, organisational sizes and management levels. Second, digitally more mature organisations differentiate themselves primarily through digital value creation, strategic execution and process maturity. Third, the gap between strategic ambition and operational implementation remains a key barrier: many organisations have recognised digital transformation strategically, but have not yet established sufficient mechanisms for monitoring, capability development and implementation control.

For practitioners, the results suggest three priorities: systematically assess and develop digital competences, strengthen governance mechanisms linking digital strategy to measurable targets, and pay greater attention to digital value creation in products, services and external networks. For researchers, the study highlights the need for longitudinal panel designs, multi-respondent assessments, context-specific benchmarking and the integration of objective performance data with subjective maturity ratings.

Overall, the findings confirm that digital transformation cannot be reduced to technology adoption. While technological foundations are comparatively advanced, sustainable digital transformation depends on the integrated development of strategy, organisation, people and value creation capabilities.

Ethics Declaration

The research draws exclusively on anonymised self-assessment data collected in compliance with Art. 4 EU-GDPR. No external ethical clearance was required.

AI Declaration

AI-assisted tools were used for automated data processing, transformation, and quality validation of the raw survey dataset. All analytical decisions, interpretations, and written content were developed and reviewed by the authors.

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