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Thematic Analysis and Structural Modeling of Digital Maturity and Competence in the Telecom Industry

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ABSTRACT

Digital transformation in the telecom industry plays a vital role in improving organizational performance, enhancing service quality, and increasing customer satisfaction; however, the knowledge gap and lack of organizational readiness hinder the full exploitation of this transformation. The present study aimed to develop a model for digital maturity, competence, and readiness for digital transformation in the telecom industry. A mixed-methods research design (quantitative and qualitative) was employed, and data were collected through in-depth interviews with experts. In the initial analysis, 118 themes were identified and categorized into 22 organizing categories through axial coding. Subsequently, three overarching themes—digital transformation maturity, digital competence, and employee readiness—were determined, and the dimensions of the model were screened using the Delphi method. Dependent and independent variables were identified using the DEMATEL technique, and the final model was designed. The findings revealed that the success of digital transformation requires simultaneous attention to innovation, organizational culture and structure, leadership, investment in technology, continuous training, and responsiveness to customer needs. Model fit and validation indices indicated the adequacy of the proposed model. This research provides a practical and systematic framework to enhance the competence and readiness of organizations in facing digital transformations and offers guidance for policymaking and strategic planning in the telecom industry.

Keywords: Digital transformation, digital maturity, employee competence, organizational readiness, telecom industry.

Introduction

The digital economy has emerged as the dominant paradigm of organizational competitiveness and sustainability, reshaping industries and redefining the sources of value creation across the globe. Among the sectors most profoundly impacted by digitalization is the telecommunications (telecom) industry, which functions as the backbone of digital connectivity and technological infrastructure [1, 2]. The evolution of digital technologies—including big data analytics, artificial intelligence, the Internet of Things (IoT), and 5G—has disrupted traditional telecom business models and accelerated the demand for innovative digital strategies [3-5]. Digital transformation (DT) in telecom goes beyond mere technological adoption; it requires a systemic shift in strategy, processes, human capital, and culture to ensure operational agility and resilience in an intensely competitive and rapidly changing market [6, 7].

Over the past decade, the importance of digital transformation maturity and digital competence has received increasing scholarly and managerial attention [8, 9]. Maturity models serve as structured frameworks to evaluate an organization's readiness and progression across dimensions such as technology, leadership, innovation, and human resources [10, 11]. For telecom companies, these models are crucial for understanding how far they have advanced in integrating digital technologies into their strategic and operational layers [12, 13]. Organizations that fail to develop digital maturity risk falling behind competitors and losing market relevance [14, 15].

Yet, digital transformation success is not solely contingent on technology; it is deeply intertwined with organizational culture and employee competencies [16, 17]. Studies indicate that employee digital competence and experience play a critical mediating role in fostering innovation and ensuring effective adoption of new technologies [18, 19]. Digital competence includes both technical proficiency and the adaptive capacity to learn and innovate in a technology-driven environment [1, 20]. When organizations invest in building a digital mindset among employees and encourage collaboration between humans and intelligent machines, overall productivity and adaptability increase [21].

The telecom industry, while highly technology-driven, faces unique challenges that differentiate it from other sectors undergoing digital transformation [22, 23]. Telecom operators must deal with complex legacy infrastructures, regulatory constraints, and rapidly changing consumer expectations [2, 24]. In addition, the race to deploy and monetize 5G and next-generation networks is pushing companies to explore innovative digital strategies while simultaneously maintaining operational stability and cost efficiency [25, 26]. Consequently, digital maturity assessments in telecom need to account for sector-specific complexities, including integration of emerging technologies, cyber security concerns, customer experience management, and ecosystem-based innovation [27, 28].

Strategic leadership and governance play a pivotal role in shaping digital transformation trajectories [7, 29]. Digital leaders must orchestrate a coherent vision, align investments in technology with organizational goals, and create a culture that embraces continuous learning and change [6, 17]. Leadership that fails to support digital initiatives often results in fragmented projects and wasted resources [4, 5]. Furthermore, intellectual property (IP) protection and digital governance mechanisms are increasingly recognized as enabling conditions for fostering innovation and competitive advantage in digital transformation [30, 31]. Without robust digital governance frameworks, organizations may face risks associated with data privacy, cyber threats, and regulatory non-compliance, all of which can derail transformation efforts.

Employee engagement and organizational learning have also emerged as essential enablers of digital transformation [32, 33]. In environments characterized by fast technological change, organizations must cultivate agile learning capabilities that allow employees to rapidly acquire and apply new skills [34, 35]. Research indicates that a learning-oriented culture can reduce resistance to change and strengthen organizational readiness for transformation [10, 19]. Additionally, frameworks such as the Test Maturity Model integration (TMMi) demonstrate how structured approaches to continuous improvement can be leveraged to enhance quality and reduce risk in digital initiatives [36].

The Iranian telecom sector reflects these global challenges and opportunities but within a distinctive socio-economic and regulatory context [22, 28]. Although Iran has witnessed accelerated digital adoption due to emerging technologies and changing consumer behaviors, gaps remain in digital governance, strategic alignment, and talent capability development [29, 37]. Prior studies have proposed various models and frameworks for digital transformation in Iranian industries [12, 20], but

sector-specific models for telecom remain underdeveloped. Existing models often fail to fully integrate contextual enablers such as innovation ecosystems, dynamic regulatory compliance, and local market characteristics [13, 27].

Moreover, digital transformation maturity assessments frequently overlook the interplay between external market forces and internal organizational factors [8, 38]. External drivers such as market disruption, customer digital expectations, and competitive digital offerings are reshaping strategic priorities for telecom operators [2, 5]. Simultaneously, internal enablers such as governance structures, culture, and employee competence determine the ability to execute transformation effectively [1, 18]. The literature increasingly points to the necessity of a holistic approach that simultaneously evaluates technological, organizational, and human dimensions of digital transformation [16, 39].

Innovation capability has become a central element of this transformation discourse [25, 26]. In telecom organizations, innovation manifests not only in technological advancement but also in service design, customer engagement, and business model evolution [4, 5]. Scholars argue that the degree to which an organization can innovate digitally depends on the maturity of its processes and the digital literacy of its workforce [18, 19]. Advanced maturity is often associated with greater agility, improved customer-centricity, and enhanced competitive advantage [7, 13].

Another important dimension is the alignment of digital strategy with organizational readiness and environmental complexity [12, 37]. When companies implement digital strategies without sufficient readiness in governance, culture, or competencies, transformation efforts frequently stagnate or fail [6, 14]. Scholars highlight the importance of continuous capability building, where maturity frameworks guide staged development while allowing for feedback and adaptation [8, 9]. Similarly, empirical evidence from large enterprises suggests that digital transformation can substantially enhance total factor productivity when coupled with human-machine collaboration and adaptive talent strategies [1, 21].

Despite the growing body of literature, there is still a notable gap in integrated models that capture the specific conditions of the telecom sector, especially in emerging economies [2, 24]. Telecom companies must navigate volatile regulatory environments, capital-intensive infrastructure investments, and rapidly evolving customer demands while maintaining profitability and service reliability [22, 28]. Many existing maturity models remain generic and fail to provide actionable insights for telecom managers who must simultaneously manage legacy systems and deploy new digital platforms [11, 29].

In response to these gaps, recent studies have called for more context-sensitive frameworks that incorporate both global best practices and local market dynamics [17, 20]. The design of robust, industry-specific models is particularly important for Iranian telecom companies striving to compete in a fast-evolving digital ecosystem shaped by globalization and technological convergence [27, 40]. Furthermore, methods such as thematic analysis and meta-synthesis have proven effective in conceptualizing complex transformation processes [10, 41], while advanced analytical tools like SmartPLS and LISREL allow for rigorous validation of conceptual models [9, 25].

This study is motivated by the pressing need to develop a comprehensive and empirically validated model of digital maturity and digital competence tailored to the telecom industry. By systematically integrating insights from global research and regional case studies, and by incorporating organizational, technological, and human factors, the study aims to provide a practical framework for assessing and improving the readiness of telecom organizations for digital transformation.

This research seeks to develop and validate an integrated model of digital maturity and competence for the telecom industry.

Methodology

This study is applied in terms of its objective and descriptive–analytical in nature, using a mixed-methods approach (qualitative–quantitative).

In the qualitative phase, thematic analysis was used to identify indicators and themes related to digital maturity and competence. For this purpose, 20 experts in the field of information technology management and senior managers of the telecom industry were selected using purposive sampling and the snowball technique. The data collection instrument was semi-structured interviews, which continued until theoretical saturation was reached. The collected data were analyzed through open, axial, and selective coding, and a set of organizing and overarching themes was extracted.

In the quantitative phase, aimed at validating the qualitative findings and explaining the relationships among variables, multi-criteria decision-making methods and structural equation modeling (SEM) were employed. First, the identified indicators were screened using the Delphi method. Then, the DEMATEL technique was applied to determine causal relationships among the criteria. Subsequently, to test the final conceptual model and evaluate its fit, SEM was performed using LISREL and SmartPLS software.

The statistical population in the quantitative phase consisted of managers, senior experts, and specialists working in telecommunication companies and mobile operators. The sample size was determined to be 384 individuals based on Cochran's formula and considering the statistical population. Data were collected using a questionnaire. The reliability of the instrument was confirmed using Cronbach's alpha and composite reliability, and construct validity was assessed through confirmatory factor analysis.

Findings and Results

According to the results obtained, 70.5% of the participants were male, and 29.5% of them were male. Moreover, 6.5% of the sample were younger than 30 years. The age of 42% of the sample was between 30 and 40 years, 34% were between 40 and 50 years, and 17.5% were older than 50 years. Also, the educational level of 32% of the sample was bachelor's degree, 61.5% held a master's degree, and 6.5% had a doctoral degree. Moreover, the work experience of 18.5% of the sample was 5 to 10 years. The work experience of 36% was 11 to 15 years, 30.5% had 16 to 20 years of work experience, and 15% had more than 20 years of experience. Before entering the data analysis stage, it is necessary to describe all research variables. In this regard, a descriptive report of the research variables has been provided, and this information is presented in Table 1.

Table 1

Description of Research Variables

Variable	N	Minimum	Maximum	Mean	SD	Skewness	Kurtosis
Innovation	200	1.00	4.60	1.8347	.80698	1.614	3.141
Organizational Culture	200	1.00	5.00	2.0773	.77870	.998	2.089
Budget and Cost Management	200	1.00	4.50	1.9133	.71482	1.329	3.151
Responsiveness to Customer Needs	200	1.00	5.00	1.9833	.83457	1.009	1.716
Leadership and Governance	200	1.00	5.00	2.1422	1.03130	1.393	1.563
Responsiveness to Organizational Needs	200	1.00	4.50	1.9333	.80259	1.069	1.496
External Factors	200	1.00	4.67	2.0444	.75004	.882	1.758
Digital Transformation Maturity Challenges	200	1.50	5.00	4.0622	.72222	-1.066	2.076
Proper Understanding of Digital Transformation Concept and Its Dimensions in the Telecom Industry	200	1.00	5.00	4.1167	.84363	-1.667	3.452
Ability to Design and Implement Digital Transformation Strategy	200	1.00	5.00	4.1111	.92242	-1.575	2.307
Skill in Managing Digital Transformation Projects	200	1.00	5.00	4.1787	.78539	-1.368	3.068
Ability to Create Digital Culture and Skills in the Organization	200	1.25	5.00	4.1389	.72730	-1.495	3.350
Understanding Customer Needs and Delivering Digital Experience	200	1.25	5.00	4.0367	.76967	-1.201	2.257

Digital Strategy Management	200	1.00	5.00	3.9867	.89281	-.954	1.339
Management Commitment and Performance	200	1.00	4.50	1.9724	.85214	1.416	2.521
Employee Competence	200	1.50	5.00	4.0622	.72222	-1.154	2.163
Continuous Training and Development	200	1.00	5.00	4.6325	.97525	-1.216	1.324
Technology Investment	200	1.00	4.57	2.0521	.76549	1.882	3.205
Collaboration and Participation	200	1.00	4.42	3.6969	.85632	.552	1.439

According to the results of this table, the highest mean scores and standard deviations of the variables are shown. Also, the skewness of the variables was calculated. Skewness is a measure of the symmetry of the distribution function. If the observed skewness value of the variables is within the range (-1, 1), the variables are considered normal regarding skewness and the distribution is symmetric. Likewise, if the kurtosis value of the variables is within the range (-1, 1), it indicates that the variables have a normal kurtosis distribution. As the table shows, the dimensions do not follow a normal distribution.

In this section, the research model is validated, and the model fit is examined. As stated earlier, structural equation modeling (SEM) with the partial least squares (PLS) approach was applied, and Smart PLS 2 software was used.

The measurement model defines the relationships between latent variables and measured variables and is tested through confirmatory factor analysis (CFA). CFA is one of the most established and reliable scientific methods for assessing construct validity; it examines the relationships between sets of indicators and their corresponding components and estimates factor loadings. In this analysis, the relationship between latent variables and observed variables (items or indicators) is evaluated. The factor loading represents the correlation of the latent construct with the related indicator; therefore, its interpretation is similar to interpreting a correlation coefficient. Testing the measurement model indicates how precisely the observed variables (questionnaire indicators) measure the intended construct. Standardized factor loadings for each measured variable, besides being statistically significant, should exceed 0.50.

To determine internal construct validity of the questionnaire, the convergent validity index and, for reliability, composite reliability (CR) and Cronbach's alpha coefficient were used. Convergent validity was proposed by Fornell and Larcker (1981) and is measured by the average variance extracted (AVE). According to the recommendation of Magner, Welker, and Campbell (1996), the AVE for each main variable should exceed 0.50 to confirm internal construct validity. To verify the reliability of the measurement instrument, the Cronbach's alpha coefficient for each variable should be greater than 0.70. In addition, to ensure reliability, the CR criterion—proposed by Werts, Linn, and Jöreskog (1974) and calculated based on the correlation of constructs with each other—was also used. The CR should exceed 0.70 to confirm the reliability of the measurement instrument.

Figure 1 shows the factor loadings and path coefficients of the model and the relationships among the research variables. According to the figure, the items have factor loadings greater than 0.50, and the confirmatory factor analysis is acceptable. Based on this model, the t-statistics are greater than 1.96, and the path coefficients are significant at the 95% confidence level, confirming the model.

Figure 1

Model with Factor Loadings

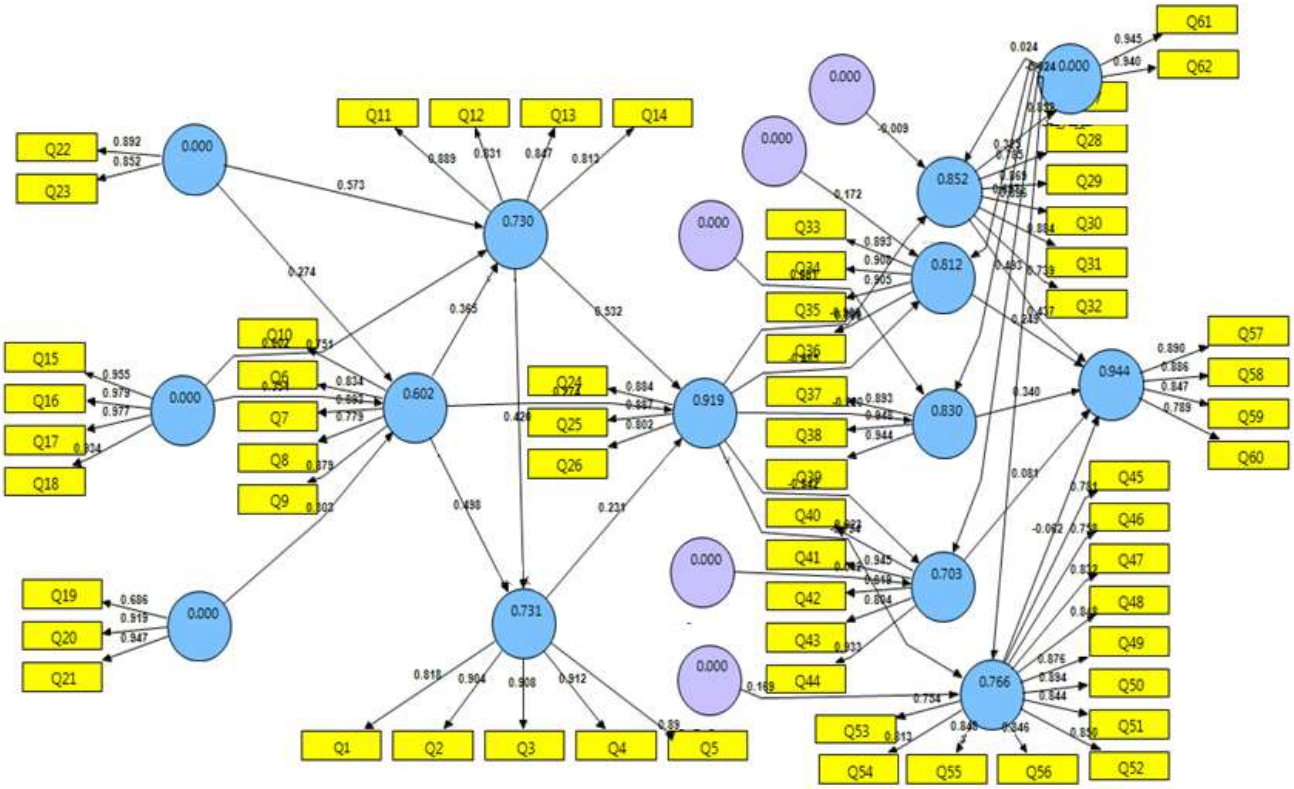

Table 2

Measurement Model: Reliability and Convergent Validity

Dimensions	Average Variance Extracted (AVE)	Composite Reliability (CR)	Cronbach's Alpha
Innovation	0.790	0.949	0.933
Organizational Culture	0.687	0.916	0.885
Budget and Cost Management	0.711	0.908	0.867
Responsiveness to Customer Needs	0.924	0.980	0.973
Leadership and Governance	0.736	0.891	0.816
Responsiveness to Organizational Needs	0.760	0.863	0.686
External Factors	0.737	0.894	0.820
Digital Transformation Maturity Challenges	0.704	0.934	0.915
Proper Understanding of Digital Transformation Concept and Its Dimensions in the Telecom Industry	0.812	0.945	0.923
Ability to Design and Implement Digital Transformation Strategy	0.862	0.949	0.920
Skill in Managing Digital Transformation Projects	0.786	0.948	0.931
Ability to Create Digital Culture and Skills in the Organization	0.688	0.964	0.959
Understanding Customer Needs and Delivering Digital Experience	0.729	0.915	0.875
Digital Strategy Management	0.889	0.941	0.875
Management Commitment and Performance	0.963	0.974	0.928
Employee Competence	0.935	0.980	0.977
Continuous Training and Development	0.952	0.644	0.924
Technology Investment	0.923	0.963	0.941
Collaboration and Participation	0.919	0.937	0.948

The table presents the calculated values for evaluating the indices confirming the model, extracted from Smart PLS. As observed, these conditions are met for all latent variables, indicating satisfactory validity and reliability of the measurement instrument.

The outer (measurement) model specifies the relationship between latent variables and their manifest, observed indicators. To assess the fit of this model, the communality validity check index (CV Com), which evaluates the goodness-of-fit of a measurement model for a block of latent variables, is used.

The inner (structural) model defines the relationships among latent variables themselves. To assess the fit of the structural model, the redundancy validity index (CV Red) is used; this index indicates how well the indicators of endogenous latent variables predict their R^2 values. When both indices (CV Com and CV Red) are positive, they demonstrate the acceptable quality of the measurement and structural models. These fit indices are also used to check the model's predictive relevance.

In this section, the quality of the measurement model is assessed using the cross-validated communality index, and the quality of the structural model is assessed using the cross-validated redundancy index. Table 3 shows the results of the CV Com (communality validity check) and CV Red (redundancy validity check) tests. If these indices for the latent variables are positive and close to 1, the model has an acceptable level of quality. As seen in Table 3, the CV Com and CV Red indices for the model's variables are positive and near 1, indicating good quality of the measurement and structural models.

Table 3

Fit Indices of the Measurement and Structural Models

Variable	CV Com	CV Red
Innovation	0.790	0.380
Organizational Culture	0.687	0.196
Budget and Cost Management	0.711	0.139
Responsiveness to Customer Needs	0.924	–
Leadership and Governance	0.737	–
Responsiveness to Organizational Needs	0.760	–
External Factors	0.737	0.258
Digital Transformation Maturity Challenges	0.704	0.594
Proper Understanding of Digital Transformation Concept and Its Dimensions in the Telecom Industry	0.812	0.490
Ability to Design and Implement Digital Transformation Strategy	0.862	0.279
Skill in Managing Digital Transformation Projects	0.786	0.333
Ability to Create Digital Culture and Skills in the Organization	0.688	0.503
Understanding Customer Needs and Delivering Digital Experience	0.729	-0.082
Digital Strategy Management	0.790	0.380
Management Commitment and Performance	0.687	0.196
Employee Competence	0.711	0.139
Continuous Training and Development	0.812	0.490
Technology Investment	0.862	0.279
Collaboration and Participation	0.889	–

To ensure the overall fit of the conceptual model—especially because the partial least squares (PLS) approach, unlike traditional SEM methods, does not provide global fit indices—a general criterion called the Goodness-of-Fit index (GOF) proposed by Tenenhaus et al. (2004) was used. Although the predictive strength of this index has been challenged by Henseler and Sarstedt (2012), many researchers have continued to use it.

The GOF is calculated as the square root of the product of the average communality (mean AVE of all constructs) and the average R^2 of endogenous constructs, using the following formula:

$$GOF = \sqrt{(\bar{AVE}) \times (\bar{R^2})}$$

According to Wetzels et al. (2009), values of GOF equal to 0.01, 0.25, and 0.36 indicate weak, medium, and strong overall model fit, respectively.

Table 4

AVE and R^2 Indices

Variable	AVE	R^2
Innovation	0.790	0.731
Organizational Culture	0.687	0.602
Budget and Cost Management	0.714	0.730
Responsiveness to Customer Needs	0.924	–
Leadership and Governance	0.737	–
Responsiveness to Organizational Needs	0.760	–
External Factors	0.737	0.919
Digital Transformation Maturity Challenges	0.704	0.852
Proper Understanding of Digital Transformation Concept and Its Dimensions in the Telecom Industry	0.812	0.811
Ability to Design and Implement Digital Transformation Strategy	0.862	0.830
Skill in Managing Digital Transformation Projects	0.786	0.703
Ability to Create Digital Culture and Skills in the Organization	0.688	0.765
Understanding Customer Needs and Delivering Digital Experience	0.729	0.944
Digital Strategy Management	0.760	–
Management Commitment and Performance	0.737	0.919
Employee Competence	0.687	0.602
Continuous Training and Development	0.714	0.730
Technology Investment	0.704	0.852
Collaboration and Participation	0.889	–
Average	0.773	0.774

Based on the results in Table 6, the GOF value was calculated as follows:

$$GOF = \sqrt{(0.773 \times 0.774)} = 0.773$$

Since the obtained value is greater than 0.36, the overall model fit is considered strong.

Discussion and Conclusion

The present study developed and validated an integrated model of digital maturity and competence for the telecom industry by synthesizing qualitative insights with quantitative analysis. The results confirmed that successful digital transformation in telecom depends on a balanced interplay between organizational readiness, digital leadership, technological innovation, and human capability development. Among the key findings, three overarching dimensions—digital transformation maturity, digital competence, and employee readiness—were identified as fundamental to achieving sustainable digital transformation. The final structural model demonstrated a strong fit, as indicated by high factor loadings, robust AVE and CR values, and an overall GOF exceeding the recommended threshold, suggesting both the conceptual soundness and empirical reliability of the proposed framework.

These findings align with the growing literature emphasizing that digital transformation cannot be approached as a purely technological initiative but requires systemic organizational change [4, 6]. The identified role of innovation capability as a driver of digital maturity corroborates the argument that technological adoption must be complemented by a culture that encourages experimentation and agility [5, 14]. Our study found that organizations with greater investment in technology, continuous employee development, and leadership commitment reported higher maturity scores—consistent with research showing that digital leadership and cultural transformation are essential for competitive advantage [7, 17].

A particularly important result is the centrality of human factors. The empirical analysis revealed that employee digital competence—encompassing both technical proficiency and adaptive problem-solving—plays a mediating role between technology investment and digital transformation maturity. This reinforces the notion that human-machine cooperation enhances productivity and adaptability [1]. Similar evidence suggests that when companies invest in digital upskilling, they build resilience and accelerate transformation outcomes [18, 21]. Our findings echo the position that organizational learning and employee engagement are crucial enablers of change [32, 33].

The study also confirmed that innovation and customer-centricity are closely linked to maturity progression. Firms that reported higher capabilities in designing digital strategies and creating digital culture within the organization also scored higher on responsiveness to customer needs. This outcome is supported by prior research on the customer-driven nature of digital business models [2, 24]. Telecom companies, in particular, must anticipate shifting consumer expectations, offering seamless digital experiences while ensuring network reliability [27, 28]. Our data suggest that customer insight and digital service innovation should be prioritized as part of digital maturity roadmaps, confirming arguments that customer-centric strategies are central to transformation success [4, 5].

Another key insight concerns the role of governance and intellectual property (IP) frameworks in enabling transformation. Organizations with formalized digital governance and IP protection mechanisms demonstrated stronger strategic alignment and reduced transformation risk. This is consistent with the assertion that digital governance ensures strategic coherence and regulatory compliance while fostering innovation [30, 31]. For telecom firms, where data security and compliance are paramount, robust governance capabilities can facilitate responsible adoption of emerging technologies and protect competitive advantage [12, 29].

Our model further highlights the influence of external environmental factors—such as market disruption and regulatory pressure—on digital transformation. The study revealed that external pressures can either catalyze or hinder progress depending on the internal maturity of the organization. This observation reinforces frameworks that advocate for dynamic capability development in response to volatile digital environments [8, 38]. In Iran's telecom industry, frequent regulatory changes and infrastructure limitations have historically slowed transformation [22, 37]. However, companies that proactively adapt through innovative strategy and cultural flexibility demonstrate greater resilience [2, 24].

The strong empirical support for the interplay of leadership, culture, and employee readiness also connects with research on digital transformational leadership. Leaders who communicate a clear digital vision and support capability building foster higher employee engagement and readiness [7, 34]. Our results reinforce the idea that leadership commitment acts as a linchpin for aligning strategic objectives with human and technological resources [5, 6]. This finding is especially important for telecom companies with large and complex organizational structures, where alignment is often challenging [11].

The methodological approach of integrating thematic analysis with SEM also adds to the literature on digital maturity modeling. Prior research has emphasized the utility of meta-synthesis and thematic analysis for building conceptual frameworks in digital transformation [10, 41]. Our study's rigorous validation using SmartPLS and LISREL confirms the statistical soundness of these models, encouraging future scholars to adopt similar mixed-method approaches [9, 25]. The high AVE and CR values across constructs and a GOF score exceeding 0.77 indicate that the developed model provides robust explanatory power and predictive reliability.

An important practical implication of this research is the proposed model's ability to guide telecom firms through staged digital maturity. It provides managers with actionable insights on where to invest resources—whether in employee training, governance frameworks, customer experience design, or technology infrastructure. By contextualizing maturity for the telecom sector, the model addresses a long-standing gap in regionally relevant frameworks [13, 19]. The model's emphasis on aligning internal readiness with external pressures supports the call for agile digital strategies that can evolve in fast-changing market and regulatory contexts [8, 40].

Furthermore, our findings reinforce that digital maturity is not static but dynamic, requiring continuous assessment and refinement [3, 39]. Telecom companies can benefit from periodic evaluation of their maturity level using frameworks like the one developed in this study. Regular assessments can identify competency gaps, highlight emerging technological opportunities, and enable faster adaptation to digital disruption [4, 5].

This research, while methodologically rigorous, is subject to several limitations. First, the study focused primarily on the telecom sector in Iran, which limits the generalizability of the findings to other geographic or industry contexts. Although the model integrates global literature, the empirical validation was constrained by local market conditions, regulatory frameworks, and socio-cultural factors. Second, data collection relied on purposive sampling and expert interviews, which may have introduced selection bias despite the effort to reach theoretical saturation. Third, the cross-sectional nature of the study restricts the ability to observe the longitudinal progression of digital maturity over time. The dynamic and evolving nature of digital transformation suggests that future longitudinal tracking could provide deeper insights into how maturity and competence develop and interact under changing conditions. Lastly, although multiple statistical measures were used to validate the model, there may still be unmeasured constructs or environmental contingencies influencing digital transformation success that were not captured.

Future studies should expand the scope of this model to other industries beyond telecom, such as banking, healthcare, and manufacturing, to test its adaptability and refine its dimensions across diverse technological and regulatory settings. Comparative cross-country analyses could reveal how differences in digital infrastructure, cultural attitudes toward technology, and institutional frameworks shape maturity and competence development. Additionally, longitudinal studies are recommended to track digital transformation progression over time and capture how internal and external factors interact dynamically. Researchers could also explore the integration of new indicators such as artificial intelligence readiness, sustainability-driven innovation, and data-driven decision-making to make the model more future-proof. Advanced predictive analytics and machine learning techniques could be employed to enhance the model's ability to forecast digital transformation outcomes and recommend strategic actions.

Telecom executives should adopt the validated model as a diagnostic tool to assess their current digital maturity and identify priority areas for investment. Focusing on strengthening digital leadership and governance, nurturing a culture of innovation and learning, and investing consistently in employee upskilling can accelerate transformation success. Managers should also integrate customer-centric digital strategy into organizational roadmaps, ensuring that technological initiatives translate into superior digital experiences. In parallel, regulatory and policy makers can use the model to evaluate industry-wide digital readiness and support companies with targeted incentives or capacity-building programs. Periodic maturity assessments using this framework can help organizations remain agile, resilient, and competitive in a rapidly evolving digital landscape.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Written consent was obtained from all participants in the study.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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