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Identification and Evaluation of Agile Criteria in the Iranian Telecom Industry Based on Digital Transformation Trends

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A B S T R A C T

Objective: The objective of this study is to identify and analyze the agility criteria within Iran's telecom industry based on digital transformation trends.

Methodology: The research employs a mixed-method approach, combining both qualitative and quantitative techniques. Initially, the Fuzzy Delphi Method was used to screen and rank the identified agility criteria through expert surveys. The Fuzzy DEMATEL Method was then applied to explore the causal relationships between the criteria, using pairwise comparisons to analyze the influence and susceptibility of each criterion. The study utilized a five-level fuzzy scale for data collection and analysis, with the final results being defuzzified for clearer interpretation.

Findings: The study identified four key agility criteria: (1) Flexible and Dynamic Organizational Structure, (2) Skilled and Multi-Functional Workforce, (3) Data-Driven and Fast Decision-Making, and (4) Adoption of Advanced Technologies. The Flexible and Dynamic Organizational Structure was found to be the most influential criterion, while Data-Driven Decision-Making had the highest simultaneous influence and susceptibility. The research also highlighted the importance of skilled human resources and the adoption of advanced technologies as critical factors driving organizational agility.

Conclusion: The findings emphasize the necessity for telecom companies to prioritize agility as a core element in their digital transformation strategies. By focusing on the identified key criteria, telecom companies can better navigate the challenges of a rapidly changing environment, improve their responsiveness to market demands, and enhance overall organizational performance. The study provides actionable insights for industry leaders to incorporate agility into their organizational culture and strategic planning, ensuring sustained competitiveness in the digital era.

Keywords: *Agility criteria, telecom industry, digital strategies, digital transformation*.

1 Introduction

The term "agility," now frequently used in managerial literature, reflects the increasing need for organizations to swiftly respond to changes in both internal and external environments. Organizational agility emphasizes the awareness of managers and the organization's preparedness to flexibly and effectively align strategies and activities with the changes occurring in the business environment (Nosrati Kordkandi, 2017). In other words, agility can be defined as the ability to succeed in an unpredictable and variable environment or the capability of a company to quickly adapt to market changes.

As Jeff Bezos, the owner of Amazon—the world's largest retailer—states, "In times of instability, agility is the only enduring competitive advantage that cannot be replicated." Bezos's firm belief in agility has ensured Amazon's unparalleled global impact. It is this agility that has granted Amazon an unrivaled competitive capacity, enabling it to rapidly respond to market changes and achieve remarkable success by leveraging digital technologies (Isaacson & Bezos, 2020).

The McKinsey Institute, recognized as a leader in business development worldwide, defines agility as "an organization's ability to renew itself, adapt, change quickly, and succeed in a constantly changing, turbulent, and ambiguous environment." The more flexible a company is and the faster it can adapt to the inevitable changes in the industry, the better prepared it will be to gain a larger market share, improve organizational efficiency and effectiveness, and increase customer satisfaction and loyalty. In essence, the core of agility lies in an appropriate response to changes (Salo et al., 2017). McKinsey highlights two components, speed and stability, as the backbone of organizational agility, asserting that these can serve as a springboard for the organization. In the digital age, agility involves making the most of transformative business trends and the imposed conditions on industries and competitive markets. Agility can be considered one of the most critical characteristics of a digital organization, as digital technologies play a significant role in transforming organizational processes, particularly in enhancing their agility. The competition between startups and technology giants has led to increased customer expectations and the emergence of new innovations. Organizations, by adopting new technologies and moving towards digitalization of their processes, must first become agile (Smet et al., 2018).

Many leaders of leading companies believe that digitalization and agility can reinforce each other and facilitate the organization's efforts to achieve digital goals. Therefore, to succeed in these conditions, organizations and businesses must apply a more agile approach to empower their human resources (Boudelayi et al., 2021). In the telecom industry, which has witnessed numerous transformations, particularly in the digital era, possessing agility capabilities is considered a vital business criterion. Telecom companies with greater flexibility and the adoption of new technologies will be able to quickly respond to market changes and meet the updated needs of customers. Agile transformation is not the ultimate goal, but rather the advantage of agility is that it helps organizations swiftly react to changes and focus on their strategic decisions. Therefore, agility can be considered a key element in the success of digital transformation strategies in the industry. Telecom companies will only be able to respond to the changing conditions in the competitive market and customer needs through an agile approach and by incorporating prominent agile methodologies in the industry, such as developing cloud infrastructures and automating processes. Sometimes, a misguided approach to agility can bring new challenges for the organization, especially if managers' efforts toward agility at the core of the company are weak or immature, without considering the organization's maturity level and the impact of these criteria on employees, processes, and current technologies. This issue itself can lead to problems such as adopting incorrect business strategies or implementing costly technical solutions for the organization (Westcott, 2023). In fact, to succeed in today's variable and competitive conditions, telecom companies must leverage an agile approach. This approach helps them rapidly respond to market changes and meet customer needs by being more flexible and utilizing modern technologies. Additionally, agility is a key element in the successful realization of digital transformation strategies in this industry.

Numerous studies have shown that the agility criterion plays a critical role in the resilience and adaptability of companies in industries with high rates of technological turnover. However, in the country's telecom industry, due to the lack of practical content and the absence of an agile transformation model, a comprehensive study on this topic was necessary. This research was conducted with the aim of answering two fundamental questions:

What are the digital transformation trends impacting the agility of the Iranian telecom industry?

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What is the significance of these criteria, and how are they related?

2 Methods and Materials

This study aimed to analyze digital transformation criteria with an agile approach in the country's telecom industry; therefore, it is applied in nature and exploratory in its attempt to gain a deep understanding of the concept of agility in a specific industry. Additionally, given that neither quantitative nor qualitative data alone can answer the posed questions, the research combines both methods and employs a mixed-method approach. In the first step, through library research and targeted searches in electronic sources using appropriate and combined keywords in search engines, the criteria impacting organizational agility, especially in the telecom industry, were identified, thereby forming the research's content framework. Subsequently, the identified criteria were categorized without any presuppositions and discussed in semi-structured interviews with 10 experts who were knowledgeable in digital transformation and had experience in the country's telecom industry; these experts validated the criteria and ensured their relevance. Additionally, criteria not identified in the first step were extracted from the interviews.

3 Findings and Results

First Stage: Criteria Screening Using the Fuzzy Delphi Method

In this stage, the Fuzzy Delphi Method was employed to screen and rank the identified agility criteria. This method is suitable when the knowledge domain is new and imprecise, and there is an intent to explore newer dimensions of the subject. In the Fuzzy Delphi Method, researcher-made questionnaires are used to collect expert opinions. Given the uncertainty in the responses, fuzzy techniques are utilized to consolidate and analyze the data. In this study, a five-level fuzzy scale was used as shown in Table 1.

Table 1

Fuzzy Scale Used in the First Stage of the Research (Fuzzy Delphi Method)

Verbal Expressions	Triangular Fuzzy Numbers	Crisp Equivalent
No Impact (No)	(0.25, 0, 0)	0
Very Low Impact (VL)	(0.5, 0.25, 0)	1
Low Impact (L)	(0.75, 0.5, 0.25)	2
High Impact (H)	(1, 0.75, 0.5)	3
Very High Impact (VH)	(1, 1, 0.75)	4

After the second round of questionnaire collection and conversion of the responses to their fuzzy equivalents, the fuzzy mean method was used to consolidate the opinions in the data table. Since the output of this mean was a number between 0 and 1, this number was screened and defuzzified by selecting a threshold intensity scale criterion of 0.7. In other words, criteria with a value lower than the threshold (i.e., 0.8) were eliminated, and the output of the screened criteria is presented in Table 2. It is worth noting that this screening was performed in a confirmatory manner in a single step.

Table 2

Screening and Ranking Results of Criteria in the First Stage Using the Fuzzy Delphi Method

Rank	Criteria Code	Main Agility Criteria	Index Score	Result
1	C1	Flexible and Dynamic Structure	0.867	Approved
2	C2	Skilled and Multi-Functional Workforce	0.833	Approved
3	C3	Data-Driven and Fast Decision-Making	0.833	Approved
4	C4	Adoption of Advanced Technologies	0.800	Approved
5	C5	Innovation Enablement	0.783	Rejected
6	C6	Platform and Modular Development	0.783	Rejected
7	C7	Development of Collaborations and Partnerships	0.758	Rejected
8	C8	Organizational Learning	0.750	Rejected
9	C9	Dynamic and Flexible Management	0.742	Rejected
10	C10	Market Monitoring and Forecasting Capability	0.742	Rejected
11	C11	Agile Project Management	0.692	Rejected
12	C12	Lean Production Principles (Cost-Effective and Optimal)	0.542	Rejected

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Stage 2: Explaining the Causal Relationships Between Criteria Using the Fuzzy DEMATEL Method

In the second stage, to explain the pattern of causal relationships between the criteria and to draw the influence and susceptibility diagram of the criteria, the Fuzzy DEMATEL method was used. This method is suitable for identifying the inter-network relationships of criteria and the degree of their connections. At this stage, a researcher-made questionnaire (Questionnaire 3), containing a pairwise comparison table of direct relationships between the criteria (from the previous stage), was distributed among the group of experts, who are the same 10 previous participants. After collecting the data, the initial direct relationship matrix was formed. Given the potential uncertainty in the responses, Fuzzy DEMATEL was used to analyze the data. At this stage, the five-level fuzzy scale shown in Table 3 was used to convert verbal expressions into fuzzy values. The following are the steps involved in the Fuzzy DEMATEL method:

Table 3

Fuzzy Scale Used in the Second Stage (Fuzzy DEMATEL Method)

Verbal Expressions	Triangular Fuzzy Numbers	Crisp Equivalent
No Impact (No)	(1, 1, 1)	1
Very Low Impact (VL)	(4, 3, 2)	2
Low Impact (L)	(6, 5, 4)	3
High Impact (H)	(8, 7, 6)	4
Very High Impact (VH)	(9, 9, 8)	5

Step 1: Formation of the Fuzzy Direct Relationship Matrix Z

In this step, to identify the pattern of relationships among the criteria, a 10x10 matrix was initially formed. In this matrix, the impact of each criterion listed in each row on the other criteria in the columns was recorded as fuzzy numbers according to Table 3. The opinions of 10 experts were utilized for this section. The questionnaire form was sent to each of these experts, and after collection, the numbers were completed in the corresponding matrix. Then, using the arithmetic mean of the experts' opinions, the direct relationship matrix Z was formed. This matrix forms the basis for analyzing the causal relationships among the criteria in the subsequent stages.

Step 2: Normalization of the Fuzzy Direct Relationship Matrix

In this step, the following formula was used to normalize the fuzzy direct relationship matrix:

$$\tilde{x}_{ij} = \frac{\tilde{z}_{ij}}{r} = \left(\frac{l_{ij}}{r}, \frac{m_{ij}}{r}, \frac{u_{ij}}{r}\right)$$

$$r = \max_{i,j}\left\{\max_{i}\sum_{j=1}^{n} u_{ij}, \max_{j}\sum_{i=1}^{n} u_{ij}\right\} \qquad i, j \in \{1,2,3,\dots,n\}$$

Step 3: Calculation of the Complete Fuzzy Relationship Matrix

In this step, to obtain the complete relationship matrix T, the inverse of the normalized matrix was first calculated, then subtracted from the identity matrix I, and finally, the normalized matrix was multiplied by that matrix. Each element of the fuzzy number in the complete relationship matrix, denoted as $\tilde{t}_{ij} = (l''_{ij}, m''_{ij}, u''_{ij})$, was calculated as follows:

$$[l''_{ij}] = x_l \times (I - x_l)^{-1}$$
$$[m''_{ij}] = x_m \times (I - x_m)^{-1}$$
$$[u''_{ij}] = x_u \times (I - x_u)^{-1}$$

Step 4: Defuzzification of the Complete Relationship Matrix Values

For defuzzification, the CFCS method (Zhang & Apirakvic, 2003) was used, with the implementation steps as follows:

$$l_{ij}^{n} = \frac{(l_{ij}^{t} - \min l_{ij}^{t})}{\Delta_{min}^{max}}$$
$$m_{ij}^{n} = \frac{(m_{ij}^{t} - min\ l_{ij}^{t})}{\Delta_{min}^{max}}$$
$$u_{ij}^{n} = \frac{(u_{ij}^{t} - min\ l_{ij}^{t})}{\Delta_{min}^{max}}$$

The output of the CFCS algorithm is a matrix with crisp values, calculated using the normalized crisp values method:

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$$x_{ij} = \frac{[l_{ij}^s(1 - l_{ij}^s) + u_{ij}^s \times u_{ij}^s]}{[1 - l_{ij}^s + u_{ij}^s]}$$

Step 5: Threshold Value Calculation (TS)

At this stage, by calculating the threshold value, all values in the complete relationship matrix that were less than the average of the complete relationship matrix or the threshold value TS were identified and set to zero using the following formula, meaning that the causal relationship was not considered:

$$TS = \frac{\sum_{i=1}^{n}\sum_{j=1}^{m} V_{ij}}{m \times n}$$

$$U_{ij} = \begin{cases} V_{ij} & V_{ij} \geq TS \\ 0 & Others \end{cases}$$

The threshold value (TS) was calculated to be 0.483 using the above formula. Based on this value, Table 4 shows the causal relationships between the criteria after removing values less than the threshold.

Table 4

Complete Relationship Table T after Removing Values Below the Threshold

TS	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
C1	0	0	0	0	0.501	0.511	0	0	0.509	0
C2	0.534	0	0	0	0.564	0.571	0.512	0.536	0.557	0.529
C3	0.506	0	0	0	0.516	0.525	0.489	0.512	0.532	0.52
C4	0.514	0	0	0	0.537	0.558	0.509	0.522	0.546	0.524

Step 6: Final Output and Creating the Causal Relationship Diagram

The final step involves obtaining the sum of the rows and columns of matrix T, where the row sums (D) and column sums (R) were calculated using the following formulas:

Table 5

Complete Relationship Table T after Removing Values Below the Threshold

Telecom Industry Agility Criteria	Criteria Code	R	D	D + R	D - R
Flexible and Dynamic Organizational Structure	C1	4.872	4.578	9.451	-0.294
Skilled and Multi-Functional Workforce	C2	4.345	5.149	9.495	0.804
Data-Driven Decision-Making	C3	4.659	4.89	9.549	0.231
Adoption of Advanced Technologies	C4	4.301	5.032	9.333	0.731

In the final stage, the meaningful relationship patterns among the criteria were represented using the data provided in Table 5. These data were plotted on a coordinate system.

In this model:

- The horizontal axis represents the D + R values.
- The vertical axis represents the D - R values.

The position of each criterion is plotted on this diagram with a circle at the coordinates D + R, D - R.

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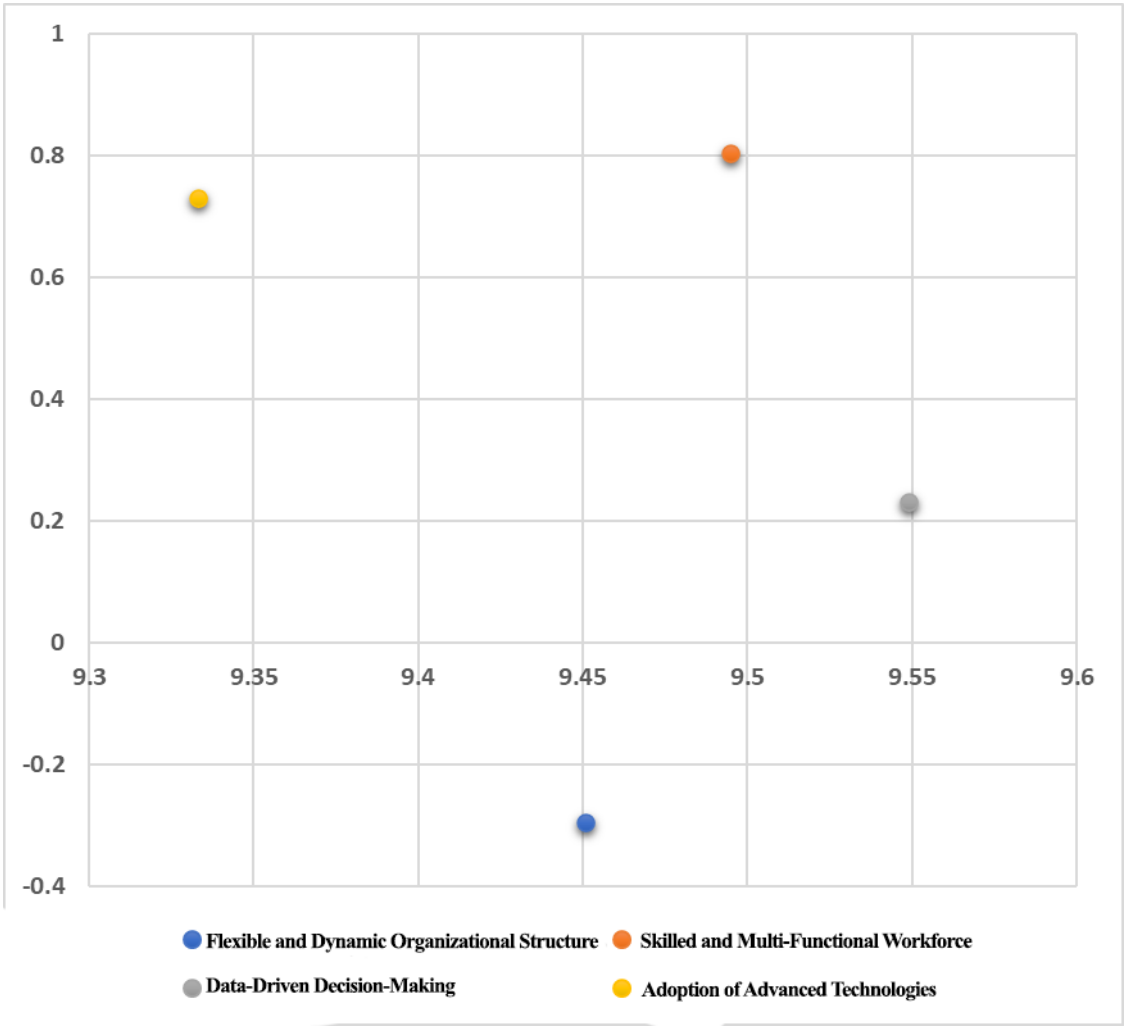
Figure 1

Significant Relationships Among Agility Criteria in Iran's Telecom Industry Based on Digital Transformation Trends



After screening the criteria using the Fuzzy Delphi Method and comparing with the threshold value of 0.8, the most important and effective criteria were identified in the order shown in Table 6.

Table 6

The Most Important Agility Criteria in Iran's Telecom Industry Based on Digital Transformation Trends

Rank	Main Agility Criteria	Score
1	Flexible and Dynamic Structure	0.867
2	Skilled and Multi-Functional Workforce	0.833
3	Data-Driven and Fast Decision-Making	0.833
4	Adoption of Advanced Technologies	0.800

4 Discussion and Conclusion

As highlighted in the 2017 Deloitte report, agility has been introduced as the most important criterion for the success of telecom companies during the digital transformation era. This report states that if telecom companies can institutionalize agility within their organizations, they are more likely to achieve their set goals, such as cost reduction, revenue growth, and customer satisfaction improvement. As a result, agile telecom companies are more inclined toward innovation and offering new products/services.

Key findings from previous studies include:

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- Telecom leaders should first turn agility into part of the organizational culture. This cultural change will be costly, time-consuming, and challenging.
- Agility in Iran's telecom industry refers to companies' ability to quickly adapt to market changes, technologies, and customer demands.
- To measure agility in any company, it is first necessary to identify the factors that influence agility so that steps can be taken to improve these factors.
- With the understanding of telecom leaders regarding these criteria and their significance rankings, these companies will be able to quickly respond to technological changes and customer expectations in the digital transformation era and improve their agility.

The main findings from this study are summarized as follows:

Influence of Criteria:

- The flexible organizational structure has the most influence on other criteria.
- Skilled workforce, data-driven decision-making, and adoption of advanced technologies are next in terms of influence.

Susceptibility of Criteria:

- The flexible and dynamic organizational structure is susceptible to influence from other criteria.
- Simultaneous Influence and Susceptibility (D+R):
- Data-driven decision-making has the highest simultaneous influence and susceptibility.
- Skilled and multi-functional workforce ranks next.

Influence Power (D-R):

- Skilled and multi-functional workforce, data-driven decision-making, and adoption of advanced technologies are among the causal criteria.
- The flexible and dynamic organizational structure is considered an effect criterion.

Thus, the first research question was answered by extracting and screening the agility criteria in Iran's telecom industry based on digital transformation trends using the Fuzzy Delphi Method. For the second question, using the Fuzzy DEMATEL Method, the evaluation of the impact of criteria on each other, their importance ranking, and finally, their relationship patterns were obtained.

The findings from this research assist telecom industry leaders in identifying the priorities of agility criteria to consider in developing their company's digital transformation roadmap. Additionally, by leveraging transformative technologies, they can maximize the benefits of digital transformation opportunities. This research provides company managers with the awareness to correctly understand the nature of these criteria, enabling them to abandon traditional business thinking and adopt new digital transformation strategies, redesigning the main pillars of their presence in the telecom industry, updating their interactions with employees and customers, and preparing to enter international markets.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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