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# Identify the Effective Components on the Resilience of Financial Technology Businesses and Prevent Failure Using Fuzzy ANP Method

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## ABSTRACT

The goal of resilience is to build the capacity to improve a system for survival, from a shock and to face change and instability, to resist the effects of shock by building the capacity to adapt and grow. The purpose of business continuity management is to ensure the uninterrupted availability of all the key resources needed to support business activities in the event of a disruption, as well as to accelerate the return to normalcy. The present study is a survey and is of an applied type. The statistical population of this research is experts familiar with financial technology businesses in Tehran, of which 10 experts were identified and considered as the statistical population of the research. The data collection tool is an expert questionnaire and pairwise comparisons. According to the studies, the resilience parameters for the time before the occurrence of failure are 1- probability of failure 2- tolerance threshold and 3- intensity of possible failure. Parameters related to the occurrence of failure also include: 1- recovery time 2- recovery quality and 3- recovery cost. Therefore, according to the research findings, it can be concluded that among the parameters before and after the failure, the most influential factors are the severity of failure, recovery cost and the probability of failure have the greatest impact on the resilience of financial technology businesses and failure prevention. have been.

**Keywords:** Resilience, financial technology businesses, failure prevention, fuzzy ANP method

## 1. Introduction

Today, the world is changing at a breakneck speed. Intense global competition, ever-increasing customer demand, rapid changes in technology, economic uncertainty, and the recent financial crash have combined to create one of the most difficult business conditions in recent decades (Demer et al., 2011). Organizations must adapt to changes in order to survive in this environment. Therefore, organizations need to improve their performance in order to achieve excellence. In other words, competition and trying to survive in today's fast-paced business world has become more and more difficult (Pal et al., 2014).

Currently, the global view of (natural and social) risks has changed from focusing on reducing vulnerability to increasing resilience. As a result, the application of the concept of resilient societies and the ways to create and strengthen them have been more widely used (Kater et al., 2008). Due to its dynamic and forward-looking nature, economic resilience can be more effective in increasing the ability of the economy to adapt to risks.

In the current conditions of the country's economy, including sanctions, pandemic, COVID-19, etc., resilience must be implemented at all the mentioned levels; But an economy as a whole is resilient when it implemented from the lower levels. Radovic-Markovic et al. (2017) believe that the concept of resilience shows why and how the national economy is able to return to its previous level based on this concept. However, they state that the economic resilience of a country cannot be achieved unless small and medium-sized enterprises (SMEs) also show resistance against negative effects. Since avoiding bankruptcy is a fundamental strategy whose is to guarantee business activities and continuity in technological businesses related to financial systems, the predicting profitability and assessing the continuity of SMEs has attracted researchers. At the beginning of the 21st century, devastating events have occurred in the world. In addition to natural and unnatural events, including war and the resulting damages, business crises, and successive partial and chain financial crises in recent years in different countries, has affected the organization and has brought many of these institutions and businesses to the point of destruction and they have faced a crisis in the continuity of their business (Rostami et al., 2017). Business continuity management is one of the latest risk management frameworks, which enables organizations to improve their capabilities by addressing known risks. The focus of the business continuity management system is on maintaining and continuing the key activities and success indicators of the organization, after the crisis, until the organization is restored to a normal state. Business continuity planning is a document that describes in detail how to continue key organizational activities (even in an alternative location) during and after a crisis and prevent failure. The evaluation of the business continuity management system and recovery of the organization enables the organization to by continuously improving its plans in the event of a crisis deal with maximum preparation and as soon as possible (John and et al., 2016). In such a turbulent environment, where the severe US sanctions have been added, economic activities will be associated with high risks, and finding solutions to avoid the country from falling into economic problems as well as getting out of the existing problems, is intended for politicians, economists and decision makers. Although usually, in theory, favorable plans have been formulated for this matter and to overcome the problems, but in practice, these plans, especially the development plans and the vision, have never been properly implemented. Therefore, the issue of not paying attention to the development plans and vision of the Islamic Republic of Iran is also one of the factors that can cause the economy to face many problems.

With the advent of the Internet and the revolution of information technology in recent decades, innovative businesses can create new business opportunities around innovative ideas. Since these businesses are tied to the field of technology, they have become a driving engine in the economy of countries. But their high failure rate shows that the failure of a part of their innovative ecosystem is inevitable and due to limited resources and time, a failed project can put them out of business. According to recent researches, most innovative financial businesses are more vulnerable in the early stages of their life cycle, and examining the factors affecting the resilience of financial institutions and banks during their life cycle can reduce their failure rate. A problem that businesses are seriously facing in today's chaotic conditions. It requires preparing to deal with the crisis and its problems and trying to survive (Ray Marti et al., 2015).

Resilient organizations have more competitive power in times when business is in normal conditions. Although many researches have been conducted in Iran regarding the resilience literature, but so far, no comprehensive research has been conducted on the presentation of the financial technological business resilience and failure prevention model, so the aim of the research is to provide the business resilience model. It is financial technology. But the main point is how to carry out the resilience process of the financial technological business so that it has the necessary effectiveness against possible failures? How to manage the risk of failures caused by financial technological business resilience?

## Theoretical Foundations

Resilience plays an important role in returning to the initial balance or reaching a higher-level balance, and hence, provides positive and successful adaptation in life. In recent years, the concept of resilience has been used in management literature. In simpler terms, it is the resistance against extended shocks and disasters combined with the ability to recover and return to the initial conditions.

Resilience in the corporate concept means the ability to resist crises and disturbances, which has become a key word in recent years, this concept is associated with the activities of launching and establishing, risk and crisis management and Business planning and strategic management and help businesses to continue operating in any situation (Pal et al., 2013). The company's resilience capacity improves the organization's ability to face special situations and accelerates the implementation of transformative actions when unexpected and important events occur, which helps the long-term survival of the organization (Lengnick-Hall & Beck, 2009). Resilience has also been conceptualized in different ways in the business world. Some are focused on the characteristics of the company, which is the performance of resilience through understanding its function and how to maintain it by applying proactive behavior (Wick and Sutcliffe, 2007); Some with the aim of developing the concept in the field of supply chain management and design (Falasca et al., 2008) and some researchers have adopted the approach based on customer perspectives (Gulati, 2010).

### Resilience in small and medium-sized enterprises (SMEs)

Small and medium-sized enterprises(SMEs) are the backbone of the economy in many countries and often make up more than 90% of all these enterprises or businesses in some countries, and the importance of such businesses in terms of exports, economic growth, job creation and other things are not hidden from anyone. Most definitions of small and medium-sized enterprises are based on quantitative criteria such as the number of employees or financial turnover rate (Ebrahimi et al., 2017). The European Union has called businesses and institutions with less than 250 people "medium", and less than 50 people "small" and less than 10 people "micro" (Sultani et al., 2013). Examining the factors affecting the resilience of small and medium enterprises requires knowledge and understanding of the characteristics of this type of enterprises. Small and medium enterprises have common characteristics such as lack of resources that distinguish them from larger companies (Stokes, 2002). The lack of resources and facilities is considered a key issue for small and medium enterprises and is related to resilience (Herbane, 2010). The research results show that these types of businesses suffer from limited resources in the financial, technological and human fields and are directly and indirectly affected by severe events and are vulnerable. They are highly sensitive to fluctuations and environmental changes such as changes in labor laws, changes in technology, the collapse of the national financial system, or changes in customer demand and requirements (Bhamra and Dani, 2011). Another important difference is that large businesses have planned for almost all possibilities, while small and medium-sized enterprises do not have a plan to face environmental threats, and for this reason, they occur in the very early stages. the event is inappropriately affected (Sullivan and Branicki, 2011). The conducted research shows that such institutions have their own behavioral patterns that can be considered in order to check resilience: lack of long-term strategic planning and short-term orientation, a passive approach to solving everyday problems, focusing more on operational and technical issues, culture of control and command, tacit knowledge and informal decision-making, poor management skills and a tendency towards entrepreneurship are the most important characteristics of small and medium

enterprises (Ates and Bititci, 2011). Considering that the stability of small and medium enterprises is important for the health of the economy (Gunasekaran et al., 2011), its managers concluded that they must use mechanisms to respond to environmental changes and disturbances and to adapt to the new market in order to achieve stability. also in making this type of resilient industries play an important role. Resilience is the capacity of an organization to survive, adapt and maintain business in the face of changes and disturbances (Ates and Bititci, 2011). Usually, small and medium-sized enterprises try to achieve resilience through their strengths such as adaptability, flexibility and creation of knowledge and innovation (Sullivan and Branicki, 2011). The resilience of small and medium enterprises requires the preservation and application of knowledge through a flexible workforce, strategic thinking and the support of top management (Levy et al., 2003). Factors such as internal factors (management characteristics, organizational behavior, quality), external factors (globalization) and enabling factors (use of technology, supply chain integration, capital production and marketing) affect the resilience of this institutions. (Gonase-karan et al., 2011). With an emphasis on innovation, in order to create or form resilience in small and medium enterprises, two main steps must be taken (Demer et al., 2003): the first step is laying the foundation for renovation (including: breaking the dependence on the status quo, supporting the manager Senior from innovation, strengthening internal and external knowledge networks, moving towards an organic structure, implementing strategic planning with a focus on entrepreneurship) and the second step, implementing modernization (including: modernization with optimization, positioning In the value chain of customers, identifying new opportunities, externalizing innovation with actions such as strategic alliances, investing in human resources in order to create innovation, supporting a set of strategic projects). Other important factors such as assets and resources, dynamic competitiveness and learning and culture are also needed to strengthen and cultivate resilience in businesses (Pal et al., 2014).

## Resilience in financial businesses

The resilience of financial management refers to the management of company resources and expenses in an efficient and effective manner. Financial system includes financial planning, monitoring, control of financial obligations of customers, accounts receivable and financial obligations to suppliers, control of operating budget and income-expense statement. The financial sector is one of the most important sectors of the economy of any country, and the occurrence of a crisis in it can have destructive effects on other economic sectors of the country. Due to its special characteristics, the nature of the financial management profession is always susceptible to instability, risks and, in higher degrees, crises (Eftakhari Mahabadi; Panahi and Talebi, 2017). The role of financial managers and financial institutions in equipping and allocating financial resources is very important. This is more evident in Iran's bank-oriented economy. In this regard, in addition to its duties, the developed financial system must also have high strength and be able to deal with various internal and external shocks (Jahangerd et al., 2017). On the other hand, Iran's financial system is struggling with various internal and external challenges and crises, and therefore, the issue of the resilience of technological financial institutions and their business continuity has become an important and serious issue. Is. In the period of financial crises, intelligent financial management can guarantee survival. Financial crises cause a decrease in demand and as a result decrease in the sales of many businesses, therefore, in such a situation, the cash flow on which the life of businesses depends has faced a problem, in this case, it is necessary to focus on financial management and financial discipline.

To optimize financial resources in businesses, the following are suitable:

- Managing cash flow and ensuring financial discipline.
- Reducing unnecessary expenses and adopting a strict approach in spending
- Preparation of the schedule for settling the company's debt and obligations.
- Examining the options of getting loans and financing.
- Examining financial and non-financial obligations of the company in emergency conditions.
- Stopping long-term and less essential projects.
- Prioritizing the implementation of the company's development plans.

- Examining crowdfunding solutions and quick credit facilities.
- Using a delayed approach in repaying debts and accounts payable, if possible, with the aim of maintaining liquidity.

## Resilience Factors

Resilience along with other variables such as optimism, hope and self-efficacy constitute the psychological capital of the organization. Psychological capitals are considered as a source of competitive advantage of organizations, which leads to the improvement of the value of human capital (knowledge and skills of people) and social capital (network of relationships between them) in the organization (Avey et al., 2006). Today's businesses show more demand for resilience due to facing the chaotic environment of organizations. These factors include: perceptual states, coherence in the field, strategic capacity, and strategic activity, whose relationship with organizational resilience is shown in Figure 1. This relationship has focused on the integration and combination of different factors, which is aimed at strengthening organizational resilience. At the same time, if the organization is improved in terms of resilience, when a negative disturbance occurs in the normal functioning of the organization, the resilient organization can improve its situation by adapting to the changes and reconstructing the damaged cases (Kantur & İşeri-Say, 2012).

If a system can maintain its functions, processes and components when a disturbance or chaos occurs, it will have high resilience. Most complex systems are able to maintain some components, processes and functions (but not all of them) after any given disturbance (As long as it's not catastrophic). In other words, resilience in real world systems is usually dependent on the type of disturbance and specific components, processes and functions of the systems. Figure 2 shows the expression of resilience and the metaphor of a ball in a pond.

Resilience is often seen as a good field. If an ecosystem is resilient, or if human society is resilient, then they will be fully able to withstand the perturbations ahead. Any system cannot experience any disturbance beyond its resilience capacity to maintain any specific situation. Therefore, resilience, like carrying capacity, is more concretely related to sustainability. This is the reason that we see efforts to increase the resilience of groups such as group resilience.

Therefore, in this research, after introducing the effective factors in the failure of technological businesses, solutions and factors to prevent failure will be suggested that have the necessary efficiency in the planning of technological and financial institutions.

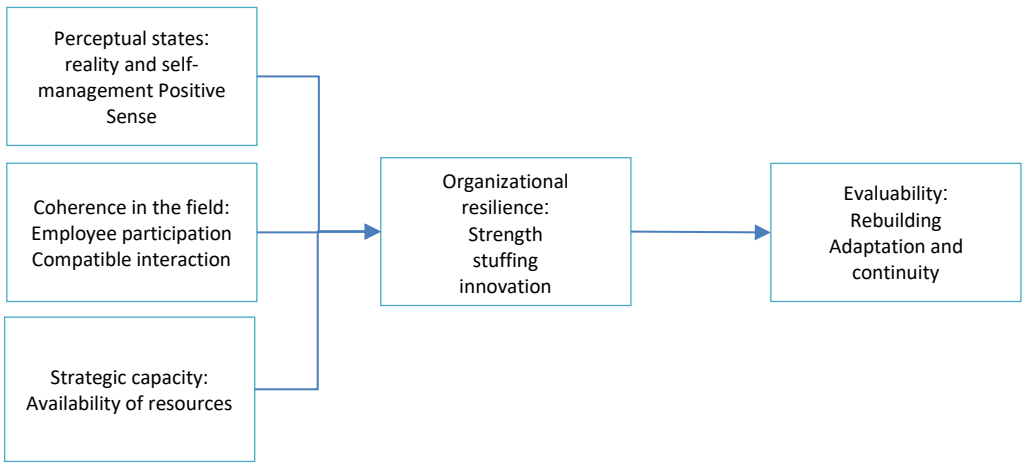


**Figure 1: Factors affecting organizational resilience**


**Figure 2: Resilience and its metaphorical states**

**Table No. 1: Background of domestic and foreign researches**

| Researcher | year | Components |
|---|---|---|
| Ghasemi and Arabic Mazar | 2019 | Economic resilience refers to the ability to deal with various economic shocks and the rate of recovery after a crisis |
| Rahimi et al | 2019 | Improving security systems is recognized as an independent action that can be .taken seriously and implemented at any time |
| Amiri et al | 2018 | Four aspects of macroeconomic stability, including microeconomic market efficiency, governance and social development, and Iran's economic resilience .and vulnerability index were investigated in the period of 2015-2016 |
| Behzadi et al | 2019 | Optimal risk management strategies lead to making skillful decisions regarding .the supply chain and cover damages |
| Kamalahmadi & Parast | 2016 | Flexibility in the capacity of suppliers and their reliability are the main factors in .reducing the effects of supply chain disturbances |
| Sahu & Mahapatra | 2016 | Resilience indicators included the amount of investment in the capacity of buffers, responsiveness, and the capacity to maintain strategic stock reserves for .use in critical situations |

## Research methodology

In this research, due to the novelty of the research topic and with use of 10 experts, the fuzzy ANP method has been used so that reliable results can be obtained. Since experts have different characteristics, they also have different mentalities, and if the options are answered based on different mentalities, the analysis of variables will be worthless. In this way, by defining the range of qualitative variables, experts will answer the questions with the same mentality. Therefore, in this section, the qualitative variables are defined in the form of trapezoidal fuzzy numbers (Figure 3). According to the two stages of questionnaire distribution among experts and the selection of 12 questionnaires among the questionnaires distributed among expert members, the obtained results are shown in the tables below.

Table (3) average difference of experts' opinions in the first and second stages of completing the questionnaire

According to the results obtained from the fuzzy Delphi qualitative analysis in the majority of the above table, in the measurement and evaluation of the averages obtained from the calculation of the fuzzy values resulting from the distribution of the questionnaire among experts, the components with a final average difference of less than or equal to 0.2 will be confirmed. Therefore, according to the measurement of the final average difference column, it is clear that only the first sub-component is the main indicator of failure in resilience, among all the studied sub-components, which is the sub-component of the probability of occurrence. The failure has not had enough validity and validity from the point of view of the studied experts. Therefore, in summarizing the rest of the research components and their qualitative analysis, we have reached a suitable and good consensus.

| Components | Fuzzy average of experts' opinion (first questionnaire) | | Fuzzy average of experts' opinion (the second questionnaire) | | Final mean difference | |
|---|---|---|---|---|---|---|
| **The probability of failure** | 2 | 1 | 2 | 1 | 2 | 1 |
| | 5/5،7/3،9/3،9/5 | 5/5،7/3،9/3،9/5 | 6،8،10،10 | 4/8.6/3،7/8،8/2 | 0.2 | ۰/۳۵ |
| | 4 | 3 | 4 | 3 | 4 | 3 |
| | 4/8.6/3،7/8،8/2 | 6،8،10،10 | 5/3،7،9،9/3 | 6،8،10،10 | 0.1 | 0 |
| **Tolerance threshold** | 2 | 1 | 2 | 1 | 2 | 1 |
| | 6،8،10،10 | 4/8.6/3،7/8،8/2 | 6،8،10،10 | 5/8،7/7،9/7،9/8 | 0 | 0.14 |
| | 4 | 3 | 4 | 3 | 4 | 3 |
| | - | 4/8.6/3،7/8،8/2 | - | 5/3،7،9،9/3 | - | 0.1 |
| **Severity of failure** | 2 | 1 | 2 | 1 | 2 | 1 |
| | 5/5،7/3،9/3،9/5 | 5/8،7/7،9/7،9/8 | 5/5،7/3،9/3،9/5 | 5/8،7/7،9/7،9/8 | 0 | 0 |
| | 4 | 3 | 4 | 3 | 4 | 3 |
| | - | 5/5،7/3،9/3،9/5 | - | 6،8،10،10 | - | 0.2 |
| **Quality and recovery time** | 2 | 1 | 2 | 1 | 2 | 1 |
| | 5/8،7/7،9/7،9/8 | 5/5،7/3،9/3،9/5 | 5/8،7/7،9/7،9/8 | 6،8،10،10 | 0 | 0.2 |
| | 4 | 3 | 4 | 3 | 4 | 3 |
| | - | (5/5،7/3،9/3،9/5) | - | 6،8،10،10 | - | 0.2 |
| **Recovery cost** | 2 | 1 | 2 | 1 | 2 | 1 |
| | 6،8،10،10 | 4/8.6/3،7/8،8/2 | 6،8،10،10 | 5/8،7/7،9/7،9/8 | 0 | 0.14 |
| | 4 | 3 | 4 | 3 | 4 | 3 |
| | 5/8،7/7،9/7،9/8 | 5/5،7/3،9/3،9/5 | 5/8،7/7،9/7،9/8 | 6،8،10،10 | 0 | 0.2 |

## Findings and data analysis

The fundamentals of the quantitative analysis of the present model in this article are based on the interpretation and analysis of the data collected from the experts, in the form of quantitative and qualitative analytical statistics. So that the data related to each of these variables was obtained in 2 steps, they are analyzed based on the principles of quantitative research method and fuzzy network analysis (ANP) method.

## Fuzzy Network Analysis (ANP)

In the fuzzy ANP method, the geometric mean of experts' evaluation will be calculated first. Then, using the Gogos and Butcher method, the consistency of the matrices will be calculated at the level of each relationship between each component and its sub-components. For this purpose, according to the standard of the network analysis method, in order to achieve the goal of the present quantitative method, pairwise comparison questionnaires based on the proposed and confirmed model in the mentioned qualitative method were designed and distributed among experts. According to the fuzzy approach in this research, verbal expressions and fuzzy numbers listed in the table below have been used.

In table number 6, in the first step, the main components affecting the resilience of financial technology businesses have been examined and analyzed. According to the standard of the fuzzy network analysis method, the fuzzy geometric mean of these components has been calculated.

**Table (4) Qualitative words and their corresponding fuzzy numbers in fuzzy network analysis method (FANP)**

| verbal expressions | Fuzzy number |
|---|---|
| Equal importance | (1,1,1) |
| Equal to weak importance | (1,1.5,1.5) |
| Weak significance | (1,2,2) |
| Weak to strong significance | (3,3.5,4) |
| Strong significance | (3,4,4.5) |
| Strong to very strong significance | (3,4,5,5) |
| Very strong importance | (5,5,5,6) |
| Very strong to absolute significance | (5,6,7) |
| Absolute importance | (5,7,9) |

(Sukli et al., 2012)

Table (5) studied components and sub-components

| no | component | | Sub-component | symbol |
|---|---|---|---|---|
| ۱ | **The probability of failure** | **A** | Establish strong internal control systems | a1 |
| ۲ | | | Developing effective communication and networking | a2 |
| ۳ | | | Training and empowerment of human capital | a3 |
| ۴ | | | Coherence and integration with successful businesses in the field of financial technology | a4 |
| ۵ | **Tolerance threshold** | **B** | Involvement of employees in the profit or loss of the company | b1 |
| ٦ | | | Cultivation of non-profit management among employees | b2 |
| ۷ | | | Development of optimal flow of information | b3 |
| ۸ | **Severity of failure** | **C** | Creating a risk management committee and developing its charter | c1 |
| ۹ | | | Creating an optimal infrastructure of information capital | c2 |
| ۱۰ | | | Performance evaluation and reward | c3 |
| ۱۱ | **Quality and recovery time** | **D** | Quality (attention to management of communication with key stakeholders; use of knowledge management system in capacity development and error reduction) | d1 |
| ۱۲ | | | Time (active participation of employees in organizational decisions; failure of traditional structures and future research) | d2 |
| ۱۳ | | | Time (encouraging employees to learn and improve skills; paying attention to financial trends and drivers in different eras) | d3 |
| ۱۴ | Recovery cost | **E** | Paying attention to the economic added-value of resources and income | e1 |
| ۱۵ | | | use of financial engineering; Attention to information security in financial information systems | e2 |

**Table (6) average pairwise comparisons of the main criteria affecting the resilience of financial technology businesses**

| Criteria | A | | | B | | | C | | | | D | | E | | | Geometric mean | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | l | m | u | l | m | u | L | m | u | l | m | u | L | m | u | l | m | u |
| A | 1 | 1 | 1 | 0.9 | 1.1 | 1.1 | 0.5 | 0.5 | 0.6 | 2.3 | 0.68 | 3.32 | 3.4 | 4.24 | 3.4 | 1.2672 | 1.08848 | 1.477 |
| B | 0.9 | 1 | 1.09 | 1 | 1 | 1 | 0.4 | 0.4 | 2.2 | 2.3 | 0.87 | 3.22 | 2.1 | 1.54 | 3.2 | 1.0921 | 0.87322 | 1.907 |
| C | 1.85 | 2.1 | 2.2 | 2.2 | 2.6 | 2.8 | 1 | 1 | 1 | 3.2 | 0.57 | 4.66 | 3.4 | 5.65 | 0.8 | 2.1497 | 1.77259 | 1.902 |
| D | 0.3 | 0.3 | 0.44 | 0.3 | 0.3 | 0.4 | 0.2 | 0.2 | 3.3 | 1 | 1 | 1 | 2.0 | 3.33 | 2.5 | 0.5261 | 0.61507 | 1.104 |
| E | 2.41 | 2.9 | 3.1 | 2.2 | 2.8 | 3 | 1.2 | 1.3 | 2.8 | 2.3 | 1.21 | 4.41 | 1 | 1 | 1 | 1.7115 | 1.66801 | 2.584 |
| Total | | | | | | | | | | | | | | | | 6.7467 | 6.01739 | 8.976 |
| | $CR^m$ =0.025 $CR^g$ =0.069 Compatible | | | | | | | | | | | | | | | | | |

Now, in the form of Table 7, the average comparisons in measuring the identified sub-criteria are discussed:

**Table (7): Average pairwise comparisons of components and sub-components affecting the resilience of financial technology businesses.**

| component | Sub-component | symbol | Geometric mean | | | Compatibility rate | Compatibility status |
|---|---|---|---|---|---|---|---|
| | | | l | m | U | | |
| The probability of failure(A) | Establish strong internal control systems | a1 | 1.24187 | 1.42655 | 1.56086 | $CR^m$ =0.010 $CR^g$ =0.019 | Compatible |
| | Developing effective communication and networking | a2 | 1.29986 | 1.61835 | 2.13092 | | |
| | Training and empowerment of human capital | a3 | 1.16818 | 2.37278 | 2.52291 | | |
| | Coherence and integration with successful businesses in the field of financial technology | a4 | 1.31125 | 1.97692 | 1.89823 | | |
| | Financial planning and capital budgeting | A | 11.4635 | 11.1790 | 12.4858 | | |
| Tolerance threshold (B) | Involvement of employees in the profit or loss of the company | b1 | 1.12065 | 0.93140 | 1.44802 | $CR^m$ =0.012 $CR^g$ =0.033 | Compatible |
| | Cultivation of non-profit management among employees | b2 | 1.20235 | 1.01912 | 2.02821 | | |
| | Development of optimal flow of information | b3 | 1.98606 | 1.47530 | 2.36785 | | |
| | Stability for damping against time | B | 8.69328 | 8.05480 | 10.5177 | | |
| Severity of failure(C) | Creating a risk management committee and developing its charter | c1 | 1.12065 | 0.93140 | 1.44802 | $CR^m$ =0.001 $CR^g$ =0.017 | Compatible |
| | Creating an optimal infrastructure of information capital | c2 | 1.20235 | 1.01912 | 2.02821 | | |
| | Performance evaluation and reward | c3 | 1.98606 | 1.47530 | 2.36785 | | |
| | Creating a quick and operational response system | C | 8.69328 | 8.05480 | 10.5177 | | |
| Quality and recovery time(D) | Quality (attention to management of communication with key stakeholders; use of knowledge management system in capacity development and error reduction) | d1 | 2.14759 | 2.21316 | 1.53438 | $CR^m$ =0.008 $CR^g$ =0.055 | Compatible |
| | Time (active participation of employees in organizational decisions; failure of traditional structures and future research) | d2 | 2.35967 | 2.07718 | 2.16871 | | |
| | Encouraging employees to learn and improve skills | d3 | 1.89013 | 2.14740 | 2.52786 | | |
| | Attention to financial trends and drivers in different eras | D | 12.7796 | 15.3835 | 13.3889 | | |
| Recovery cost(E) | Paying attention to the economic added-value of resources and income | e1 | 1.13398 | 0.94039 | 1.39881 | $CR^m$ =0.010 $CR^g$ =0.023 | Compatible |
| | use of financial engineering; Attention to information security in financial information systems | e2 | 1.16156 | 0.86425 | 1.40787 | | |
| | Total | E | 7.46229 | 7.61306 | 8.15275 | | |

In the third step, the geometric means calculated in the previous step are normalized. In this step, the values obtained from the second step are normalized. The $\tilde{Z}_i$ values for each matrix are normalized with the $\tilde{Z}_i$ sum.

$$\tilde{r}_{ij} = \tilde{W}_i = \frac{\tilde{z}_i}{\sum_{i=1}^{n} \tilde{z}_i}$$

If these normalized weights are related to the comparison of options (the weight of the $\tilde{r}_{ij}$ I'th option in relation to the j'th criterion) and if it is related to the comparison of criteria, it is called $\tilde{w}_i$ .Table 8 shows these normalized values in the measurement of the 5 main components.

**Table 8 The normalized geometric mean of the main criteria**

| Metrics | symbol | Normalized geometric mean | | |
|---|---|---|---|---|
| | | l | M | u |
| The probability of failure | A | 0.187835 | 0.18089 | 0.164538 |
| Failure tolerance threshold | B | 0.161872 | 0.145117 | 0.212523 |
| Severity of failure | C | 0.318631 | 0.294578 | 0.211967 |
| Quality and recovery time | D | 0.077979 | 0.102216 | 0.12309 |
| Recovery cost | E | 0.253683 | 0.2772 | 0.287881 |

Stage 4:De-phasing. In this step, the obtained fuzzy weights will be de-phased according to the following relationship.

$$\boldsymbol{Crisp(\widetilde{U}) = \frac{(u_l + 2 \times u_m + u_r)}{4}}$$

In this regard, $\widetilde{U} = (u_l, u_m, u_r)$ and $Crisp(\widetilde{U})$ it is di-phased to$\widetilde{U}$. By performing these calculations, the final weights will be obtained respectively. Therefore, according to the results of de-phasing the output of the third stage in the calculation of the fuzzy network analysis method (FANP), it is possible to prioritize the main components and related sub-components according to the table 9.

**Table 9- Matrix of final weights of criteria**

| Sub-component | | component | Rank |
|---|---|---|---|
| Severity of failure | **C** | **0.279939** | ۱ |
| Recovery cost | **E** | **0.273991** | ۲ |
| The probability of failure | **A** | **0.178538** | ۳ |
| Failure tolerance threshold | **B** | **0.166157** | ٤ |
| Quality and recovery time | **D** | **0.101375** | ٥ |

Table 9 shows the final weight matrix of the main criteria. According to the results, the prioritization of these criteria can be shown as follows (in order from the highest priority to the lowest): 1. Severity of failure, 2. Recovery Cost, 3. The Probability of failure, 4. Failure tolerance threshold and 5. Quality and recovery time. After the final weights of the main criteria of the research have been determined, final weights of the sub-criteria related to each of these 5 components will measure and evaluate the (Table 10).

**Table 10- The final weight sub-criteria of the main components**

| criterion | abbreviation | sub-components | Final weights de- Fuzzy | The final internal ranking of the subcomponents |
|---|---|---|---|---|
| **The probability of failure(A)** | A1 | Establish strong internal control systems | 0.122141 | ٤ |
| | A2 | Developing effective communication and networking | 0.143398 | ۳ |
| | A3 | Training and empowerment of human capital | 0.182118 | ۱ |
| | A4 | Coherence and integration with successful businesses in the field of financial technology | 0.155025 | ۲ |
| **Tolerance threshold (B)** | B1 | Involvement of employees in the profit or loss of the company | 0.124463 | ۲ |
| | B2 | Cultivation of non-profit management among employees | 0.146048 | ۱ |
| | B3 | Development of optimal flow of information | 0.204977 | ۳ |
| Severity of failure(C) | C1 | Creating a risk management committee and developing its charter | 0.124463 | ۳ |
| | C2 | Creating an optimal infrastructure of information capital | 0.146048 | ۲ |
| | C3 | Performance evaluation and reward | 0.204977 | ۱ |
| **Quality and recovery time(D)** | D1 | Quality (attention to management of communication with key stakeholders; use of knowledge management system in capacity development and error reduction) | 0.142595 | ۳ |
| | D2 | Time (active participation of employees in organizational decisions; failure of traditional structures and future research) | 0.154169 | ۱ |

| criterion | abbreviation | sub-components | Final weights de- Fuzzy | The final internal ranking of the subcomponents |
|---|---|---|---|---|
| | D3 | Encouraging employees to learn and improve skills | 0.153972 | ۲ |
| Recovery cost(E) | E1 | Paying attention to the economic added-value of resources and income | 0.142646 | ۱ |
| | E2 | use of financial engineering; Attention to information security in financial information systems | 0.138848 | ۲ |

As shown in Figure 3 of the research model, the six components before and after the failure in the majority of the five main factors of resilience, including failure severity, recovery cost, failure probability, failure tolerance threshold, and quality and recovery time on financial technology businesses. From the point of view of the selected experts in this research, each of these factors also includes several sub-components whose impact has been determined in the previous discussions.

In the field of severity of failure, shaping and creating strong internal control systems to make businesses resilient in order to develop effective communication and system networking and training and empowering employees leads to integration and integration with successful businesses in the field. Technology is financilized and any of the factors of failure may be financilized to disorder and disorder in technological businesses. Therefore, strategies must be determined to prevent failure. Two parameters of the company's resilience, i.e. "reducing the probability of failure" and "raising the tolerance threshold for failure" have a direct impact on the occurrence of failure. But if these two parameters cannot prevent failure, failure will occur with certain "failure intensity".

In the field of recovery costs, so that organizations during the recovery period (which is very important and vital after a disaster) can solve the costs and financial problems for the survival of the organization and reduce the disruptions caused by the disaster. The cultural change management factor among employees is very important. In this case, in order to revive and finance the recovery costs, by involving the employees in the profit or loss of the company and optimally developing the flow of information and increasing the recovery capacity within the system and business, return to production and reach the normal level and Reducing the cost, and analyzing to what extent the subsystems at their disposal have the capability and ability to alleviate, adapt and recover against the shocks and tensions that have arisen, should be considered. Among the factors that lead to reducing the probability of failure and increasing the resilience of financial technology businesses, creating strong internal control systems, training and empowering human capital, developing a strategic plan, sharing information, standardizing and developing integration capabilities. Information systems, the development of effective communication and networking, and integration with successful businesses in the field of financial technology are respectively among the factors affecting the reduction of the probability of failure, and the factors of financial planning and capital budgeting are integrated. Developing human resource management strategy and company strategy, information technology management planning, applying new service quality management approaches and ensuring financial stability in technological businesses are effective factors in resilience. Therefore, if the companies that are active in the field of financial technology businesses want to increase their resilience by reducing the probability of failure, they should pay enough attention to the important effective strategies stated.

The technique used in this research is the fuzzy ANP method, and since the priority of these factors has already been investigated and identified, financial technological businesses and policy-making institutions in the field of risk management in order to prevent failure and increase the resilience of business construction should implement their policies according to the specified priority and importance. Also, considering the comprehensive impact of the components in this model, the accuracy of the identified dimensions and components is reliable and can be optimal solutions for the resilience of financial technology businesses in the future.

## Discussion and conclusion

Resilience in financial technological businesses has been considered as the most important factor for survival in the organization. Existing empirical analyzes have shown a significant volume of problems created in businesses and their resilience, which has been reported through investment and the amount of risk available around the world. This topic has focused on the fundamental dependencies in different parts of business resilience. In this research, the resilience processes of financial technological businesses were studied in order to prevent failure. In addition, the analysis of the factors of failure and recovery from failure and resilience in the effect of the changes that occurred in financial technological businesses and its understanding and finally the management of the resulting risk were among the topics of interest in this research. Also, the impact of resilience on resistance to failure in financial technology businesses has been investigated. Studies have shown that the resilience goals of avoiding bankruptcy is a fundamental strategy whose purpose is to guarantee existing business and commercial activities. These goals have changed from removing and liquidating the company to the goals of resistance and staying in business. More specifically, when businesses face one of the factors of failure in themselves, they suffer decay and confusion and major changes, and they face problems in advancing their goals. By creating a resilience approach, companies try to stay and resist in their business.

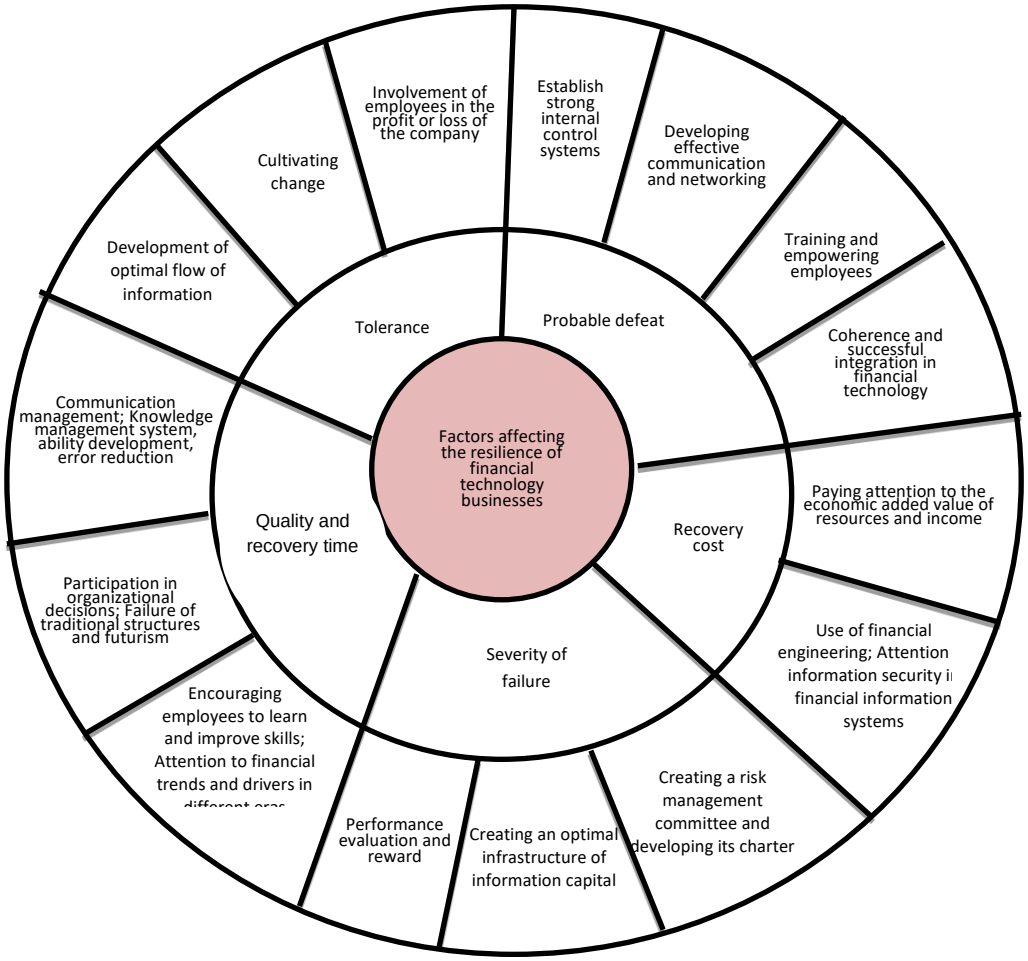


**Figure 3: Research model**

The main goal of this research was to investigate and identify the factors affecting resilience in financial technology businesses, and according to the results of fuzzy network analysis calculations and the output obtained, the priority of these criteria in influencing resilience It showed financial technological businesses as follows (in order from the highest priority to the lowest): 1) failure severity 2) recovery cost 3) probability of failure 4) failure tolerance threshold and 5) recovery quality and time.

Resilience in financial technology businesses is an efficient and effective concept, but to achieve it, the main principles and rules must be implemented correctly. According to the surveys, the successful countries in this field have been able to base the resilience structure of their subgroups based on this thinking to the ideal extent. For this reason, in the current research, the researcher introduces the application of financial technological business resilience solutions based on the risk management approach as a requirement for resilience research in applying professional principles and preventing failure and survival of one's business.

In this model, in addition to special emphasis on factors such as; Dimension of probability of failure (Myers et al., 2006; Bogataj and Borgata, 2007; Soni et al., 2014), Dimension of tolerance threshold (Trabi et al. (2015), Carvalho, (2012), Vogrin et al. (2011)), Dimension The severity of the failure (in line with the research findings of Carvalho (2012), Kraigd et al. (2007) and Panamaro and Holcombe (2009)), quality dimensions and recovery time (Carvalho (2012) and Vogrin et al. (2011)), cost factor Recovery (as mentioned by thinkers such as Carvalho and Cruz Machado (2011) and Rezazadeh in 2017. It is necessary to consider the framework and structure of resilience of institutions and companies based on the considered parameters and the correct management of resilience principles in order to We can provide better situations for organizational and corporate success.

Also, considering that business resilience thinking in the risk management department and high levels of the organization has increased the managerial ability and strengthened the organizational resilience departments, risk management prevents failure and resists it as much as possible. empowers According to the context of the research and the results obtained from it and the views of the experts, it is suggested that the institutions in charge of resilience in financial technology businesses and other companies should adapt the proposed model of this research in their organization and Preparation of control checklists of the effective components, a kind of self-audit of their resilience against failure and business survival against unfortunate accidents and natural and unnatural crises. Application proposals are announced as follows for financial technology businesses:

Considering that one of the important aspects influencing the development of resilience of financial technological businesses is reducing the probability of failure for these institutions, and on the other hand, the results of the analysis of the quantitative part of the research showed that the strategies of creating strong internal control systems, training and Empowerment of human capital, formulation of strategic plan, sharing of information, standardization and development of information systems integration capability, development of effective communication and networking, integration and integration with successful businesses in the field of financial technology, respectively, are among the effective strategies to reduce There is a possibility of failure, therefore, if the companies that are active in the field of financial technology businesses want to increase their resilience by reducing the probability of failure, they should pay sufficient and proper attention to the important effective strategies stated above. For example, developing strategic planning with the approach of developing resilience can, in addition to analyzing the weaknesses and strengths, environmental threats and opportunities, propose operational solutions and practical goals to increase resilience and reduce the possibility of uncertainties.

By developing the optimal flow of information and involving employees in the profit or loss of the company, it is possible to increase the tolerance threshold of financial technological businesses and, as a result, their resilience. Therefore, by designing ERP, CRM, etc. systems that are in line with the interests of employees, it can be a useful method for developing the transparency of organizational information and the optimal flow of information. On the other hand, the

transfer of part of the company's shares to the company's key employees and financial technology business specialists, in addition to retaining these people, leads to an increase in work motivation and individual and organizational resilience.

Another important activity to develop and increase resilience is to use the process of creativity and innovation, encouraging employees to learn and improve their skills. Of course, it should be noted that keeping in mind the process of progress or regression of businesses during different periods can somewhat predict their functional future and prevent or at least delay possible failure.

Taking advantage of the knowledge and experience of expert employees, as well as paying attention to the importance of the expectations and demands of customers and key organizational stakeholders, are among the effective strategies for increasing the quality of restoring businesses to their original state. Therefore, creating a service desk unit or managing relations with Customers can be helpful. Also, the development of the after-sales service process and the formulation of guidelines for the use of possible commercialized products and services of these businesses can increase the organizational resilience.

The use of the financial engineering approach in reducing risk and financing the costs of financial technological businesses and paying attention to the added economic value of the resources and the resulting incomes are among the effective proposed solutions in increasing the speed of recovery. The use of financial engineering techniques and its promotion in related to finance Process, can reduce financing costs and lead to risk reduction and increase organizational productivity.

One of the requirements of the Securities and Exchange Organization for member companies of this organization is to establish a risk management committee in the organization and develop its charter, which can be a suitable tool for predicting and controlling possible risks facing financial technology businesses.

In order to plan and develop fundamental solutions in the fields of financial technology and increase effective communication with key stakeholders in the fields of financing and technology promotion, effective planning, flexible and alternative financial software, should be developed. Finally, paying attention to the three-dimensional triangle of persons, organization and environment can improve resilience in businesses.

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