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Designing a digital transformation model of banking services and improving customer experience and satisfaction through the development of business ecosystems (Case study: Bank Mellat)

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Abstract

Recent research in the banking field points to the importance of digital technology penetration, changing traditional paradigms, a complete study of the customer's roadmap and digital experience and their needs, as well as how the digital bank operates in an ecosystem of partners. Therefore, the necessity of aligning the performance of banks according to the dynamic digital environment to maintain survival is felt more than ever. This research has been done to identify the actors and factors affecting the digital banking business ecosystem and ultimately its effect on improving the experience and satisfaction of customers in two quantitative-qualitative parts. In the qualitative part, the required data and information were extracted through in-depth interviews with 15 banking experts using the snowball sampling method and through three stages using the content analysis method, and finally the components of the digital transformation of banking services and the improvement of customer experience and satisfaction. has been Then coding is done and finally the final research model is presented. In the quantitative part, descriptive surveillance and correlational research methods are applied. Using a questionnaire of the opinions of 200 selected banking experts, and using structural equation modelling and 3smart pls software, the degree of connection between the components was determined, and according to the results, the number of 8 domestic actors and 9 foreign actors was determined. 100 key indicators of the ecosystem were identified and it was determined that the digital transformation of banking services with the mediating role of the business ecosystem has a positive and significant effect on improving the customer experience and customer satisfaction.

Keywords: digital transformation, digital banking services, digital customer experience, customer satisfaction, business ecosystem
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1 Introduction

The penetration of digital technology into the banking field has created a paradigm shift in banking, what is known as digital banking today [12]. Digital transformation through a complete study of customer experience anal-

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ysis of existing needs and identification of new needs. is obtained and these are the consumers of banking services who are the driving force of the innovative development of banks and are considered the most important aspect of digital banking. Reduce operating costs by taking advantage of new digital banking channels such as ATMs, internet banking, mobile banking, and digital banking kiosks [21] and in the digital business ecosystem, which is a social and technical environment consisting of people, organizations and Digital technologies create value by creating cooperative and competitive relationships with other actors in the chain and network [22]. This ecosystem not only includes the value chain of a business but also other components such as manufacturers of complementary products or equipment, and outsourcing companies, It includes regulatory organizations, financial institutions, research institutions, media, universities and even competitors. Improving the digital experience of customers with the help of information technology experts, designing digital products based on the understanding of the digital needs of customers and providing them to customers through the networks in the business ecosystem. Digital with rapid prototyping, short product development cycles, early test marketing, compensation based on options, and venture capital increase the amount of access of customers to new digital services. By using the Internet, technology, artificial intelligence, big data analysis and credit scoring algorithms, by creating a chain of cooperation with other components of the business ecosystem such as landtechs, they provide quick and smart credits to applicants. It includes three main components, including the use of digital channels, the use of digital data, and focusing on the experience and interaction with the customer, and it affects the way of providing banking services [20]. Therefore, developments such as the digital revolution, the increase in the penetration rate of the Internet, smartphones, the entry of venture capitalists and accelerators into the development of digital business, as well as the development of digital banking business ecosystems in recent years have greatly affected the way digital services are provided. Banks must operate in the business ecosystem to be able to survive in a digital world, meet the increasing expectations of customers and also to develop their products and services, if banks do not react to new conditions, they risk losing Communication with customers will face a decrease in bank brand support and a decrease in profitability. Despite the mentioned necessities, we see that many banks are facing numerous political and legal, economic, technological, social and cultural obstacles in the digital banking business ecosystem. Also, despite the compilation of a limited theoretical background in the field of development of digital banking business ecosystems, despite the scattered views in this field and the placement of previous studies in the initial stages, a consensus regarding the development model of digital businesses and how to relate its dimensions has not been achieved among researchers and experts. As a result, each researcher has investigated several dimensions and limited factors in his own opinion, and research that provides a comprehensive look at digital banking in a comprehensive business ecosystem identifies the key players and factors affecting this ecosystem, and finally, the impact of the role The mediation of the business ecosystem on increasing the satisfaction and improving the digital experience of customers has not been considered. As a result of this research, it examines the existing gaps and to achieve the main goal of the research, it tries to answer the following questions:

1. Who are the actors of the digital banking business ecosystem?
2. What are the key factors affecting the digital banking business ecosystem by players?
3. What are the key factors affecting the improvement of customer experience and satisfaction in digital transformation models?
4. Does the digital transformation of banking services with the mediating role of the business ecosystem affect the improvement of customer experience and satisfaction?

2 The basics of research

2.1 Theoretical foundations of research

Digital transformation includes the digitization of sales and communication channels, which provides new ways to interact with customers, and the digitization of a company's offerings (products and services) replaces physical supply [13]. It uses digital tools to make existing resources and processes more efficient and effective, and this approach can reduce costs and increase agility [8].

Digital banking is the transformation of all traditional banking activities and services into a digital environment. Digital banking technology includes innovation in financial services for customers and business customers in the field of mobile, digital, artificial intelligence and payment strategies, reg technology, data, blockchain, API, distribution channels and technology [23].

The business ecosystem is beyond the types of industries. Companies develop their capabilities around innovation. In fact, they work collaboratively and competitively to support new products, satisfy customer needs, and finally incorporate the next round of innovations [14]. Digital business ecosystem refers to the two main levels of digital

ecosystem and business ecosystem [24]. Digital ecosystem refers to a virtual environment created by digital entities such as software applications, hardware and processes are filled [22]. The digital business ecosystem acts as a peer-to-peer distributed technology infrastructure that creates, distributes and connects digital services over the Internet [22].

2.2 Empirical bases of research

In a 2017 research, Dapp [7] emphasized the importance of modern online banking and added that modern online banking is significantly more personal, simpler, intuitive and convenient for the customer. The customers themselves are at the heart of the digital banking ecosystem with their secure online accounts. seen in action. Solution ecosystems, which coordinate different participants to create or provide a product or service, and exchange ecosystems, connect participants in a two-way market through a (digital) platform [18].

In 2019, in their research, Arsanjani et al. pointed to seven areas of Delcastro's strategies, such as user experience, infrastructure strategy, content strategy, business process strategy, mobile and social network strategy, data analysis strategy as influential components in the implementation of digital banking [4].

In 2019, Galazova and Magomaeva emphasized the importance of fintechs, blockchains, the role of legislators and laws, as well as the impact of new financial technologies in the effective networking of the digital banking ecosystem in their research entitled Transition from traditional banking to digital banking [10]. Perlman stated in a research in 2017 that digital financial services ecosystems include four main actors: market users, market service providers, ITC infrastructure and the government [17]. According to the result of Gary Perlman in 2017, Adam in a supplementary study in 2021 pointed out the factors affecting each of the actors mentioned in the previous studies [2]. Digital banking in 2020 has pointed to the connection between the ecosystem of fintechs and digital banking through B2B participation in providing digital services.

In 2021, Anggraeni, Hapsari, and Muslim published research results under the title of factors affecting the customer in using digital banking, in which factors such as habit, price value, performance expectation, social impact, and employment behaviour from the customer's perspective were mentioned [3]. Ramezani et al. in a research in 2022 under the title of digital business ecosystem emphasized the background of the subject and its shortcomings such as creating a comprehensive framework that shows the combination of various components in the heart of the comprehensive set [19]. Torres and Godinho's ideas in 2022 are equally important. These authors argue that "Cultural and informal institutions", "market conditions", "networking and support" and "creating and disseminating knowledge" have a significant impact on the quality of entrepreneurial activity in entrepreneurial ecosystems [25].

Werth and his colleagues, in a research titled Factors Affecting Digital Transformation in the Financial Services Sector in 2020, identified the factors influencing digital transformation in the financial services sector based on Post and Porter's Five Forces Model, including political factors, economic factors, and social factors, technological factors, bargaining power of suppliers, bargaining power of buyers, threat of substitute products, competition between existing competitors, threat of new entrants. Among the limitations of the above research is focusing on the German market, providing solutions to improve the performance of employees, and the correct understanding of the dynamics by the interviewees [26].

Matkovskaya, Vechkinzova and Biryukov [15] in research called Banking Ecosystems: Identifying Latent Innovation Opportunities to Increase Their Long-Term Competitiveness Based on the Technology Enhancement Model in 2022 concluded that ecosystem organization by the bank due to the greater number of innovative technologies and the possibility of disposing of ownership Spirituality creates opportunities for the formation of new profit centers and provides competencies and new opportunities and perspectives for growth. It has addressed innovative perspectives in business ecosystems and has paid attention to the problem of learning in organizations [27].

In the research entitled Digital transformation in the manufacturing industry under the optics of digital platforms and ecosystems, which was published by Okano, Antunes and Fernandes in [16], they pointed out the importance of perspective in the business ecosystems of the banking sector. They examine the process of digital transformation of manufacturing companies and They consider five cases that differ in the degree and depth of the connection of companies in the digital reality [16]. According to the theoretical and experimental background of the subject, it can be said that despite the necessity of aligning banks with global digital trends, comprehensive research on digital banking business ecosystems that all examine the actors and factors affecting each one and its impact on improving the experience and satisfaction of the customer has not been considered. Therefore, by answering the questions raised, this research can make a significant impact in identifying the components and indicators of improving digital banking business ecosystems and improving customer experience and satisfaction, and also lead to the development of scientific fields.

3 Research method

The research method in this research is of an applied type, and in terms of the goal, it is of an analytical type, and in terms of the process, it is a mixed (qualitative-quantitative) research. The method of collecting the required data in the research group is a combination of exploratory research, which was carried out in the following two consecutive stages.

3.1 Research method in the qualitative part

To improve the qualitative part of the research, two library methods and a semi-structured in-depth interview with a snowball sampling method were used and the interviews continued until theoretical saturation was realized. Interviews were conducted with 15 experts and experts who have academic knowledge or activity experience in the field of digital banking and business ecosystems related to it. Validity and reliability in this phase based on the criteria of credibility or believability, review by members (interviewees), triangulation of data sources, analysis of negative cases and transferability have been done. The above criteria are considered as reliability to replace the validity and reliability of qualitative research. The analysis of the interview texts was done in open, central and selective coding stages. The theme analysis is based on the theoretical foundations of the process of going back and forth in which the movement back and forth between the stages of the method in this research was carried out as follows over time: Stage 1. Getting to know the data, Stage 2. Creating small Topics, step 3. Finding themes, step 4. Revising themes, step 5. Defining and naming themes, step 6. Preparing a report. The results of the demographic survey of the experts are as follows:

Table 1: Frequency distribution of the statistical sample of the qualitative section according to demographics

Percent	Abundance	Variable levels	Variable	Percent	Abundance	Variable levels	Variable
20.0	3	Masters	education	33.3	5	Female	gender
80.0	12	Masters and Ph.D.		66.7	10	Man	
100.0	15	total		100	15	total	
47.0	7	32-42 years	Age	47.0	7	11-15 years	Years of service
20.0	3	43-54 years		33.0	5	16-20 years	
33.0	5	Over 54 years old		20.0	3	More than 21 years	
100	15	total		100	15	total	

3.2 Research method in the quantitative part

The research is descriptive in terms of practical purpose and in terms of collecting survey data, and among the types of survey research, the statistical population of the research includes all active employees of Mellat Bank in the field of service design and digital banking and ecosystem development. There are 420 related companies in Tehran. For sampling, available sampling method and Cochran's formula were used, the sample size was calculated to be 200 people.

$$n = \frac{\frac{z^2 pq}{d^2}}{1 + \frac{1}{N}\left(\frac{z^2 pq}{d^2} - 1\right)} \tag{3.1}$$

First, based on the findings of the theoretical foundations and background of the research, he designed a questionnaire, and then to obtain the reliability of the questionnaire, an initial random sample of 30 people was selected and using Cronbach's alpha test (calculated as 0.96), the reliability of the questionnaire Made by a researcher, it has been measured. Cronbach's alpha was generally calculated using the following equation.

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} S_i^2}{\sigma^2}\right) \tag{3.2}$$

In these relationships, k is the number of questions, the variance of the i-th question, the variance of the total number of questions, the average variance between the questions, and the average variance of the questions.

After confirming the reliability and validity of the questionnaire, it has been distributed among the entire sample population. Considering the maximum variance (success and failure equal to 0.05) and the limit error of 0.05, the number of 200 people has been estimated as a statistical sample. To measure the validity of the researcher's questionnaire, the opinions of academic experts have been used. Their shared opinion on the items was based on the validity of the target measure.

3.3 Quality Control

For the researcher to be able to use the qualitative findings in the analysis, he must code them.

Inter-coder reliability is a widely used term that refers to the degree of agreement that independent coders obtain when evaluating the features of a message or text. The specific term for consistency in content analysis is "agreement between coders". Determining validity and reliability is a critical step in the qualitative data analysis process.

The Kappa method is one of the statistical decision-making tools that examines the amount of agreement and coordination between two individuals, phenomena, or sources of decision-making, each of which is measured separately.

Kappa coefficient is a numerical measure between -1 and +1, the closer to +1 indicates the presence of proportional and direct agreement, the closer to -1 indicates the presence of inverse agreement, and the opposite and values closer to zero indicate the opposite of agreement.

$$k = \frac{p_o - p_e}{1 - p_e} \tag{3.3}$$

in this regard, p_o is equal to the ratio of the units about which there is an agreement, p_e is also the ratio of units that are likely to be a random agreement.

3.4 Interpretive structural method

The interpretive structural modelling method is an interactive learning process. In this technique, a set of different elements is structured in the form of a comprehensive systematic model. Such a model that is formed, draws the structure of a complex issue or a problem in the form of a carefully designed pattern in the form of a diagram. This method is an interpretive model in which a group of experts decide whether and how the elements are related, and it is a structural model in that it extracts complex components based on the relationship of the structure and specific relationships through the modelling method. and explains the overall structure as a diagram model. This method is a tool to create order in the complexity of relationships between variables and is a suitable option for dealing with complex issues, especially when using systematic and logical thinking.

The various steps involved in the ISM technique are shown in the figure above. These steps ultimately lead to the creation of an ISM model, which is explained in the following steps:

Step 1) Identification of variables related to the problem: The ISM method begins with the identification of variables that are related to the problem or topic under discussion. These variables are obtained through the study of the subject literature, past studies, through receiving the opinions of experts or through questionnaires.

Step 2) Formation of the structural matrix of internal relations of variables (SSIM): This matrix (structural self-interaction matrix) is a matrix with the dimensions of the variables, in which the variables are mentioned in the first row and column respectively. To determine the type of relationship, use the symbols in the table below.

Step 3) Create the achievement matrix (RM) or the received matrix: by converting the symbols of the SSIM matrix to the numbers zero and one, the achievement matrix can be reached. By following these rules, the initial acquisition matrix is prepared. These rules are as follows:

Step 4) Adapt the achievement matrix: After the initial achievement matrix is obtained, its internal consistency should be established. For example, if variable 1 leads to variable 2 and variable 2 leads to variable 3, then variable 1 should also lead to variable 3, and if this state was not established in the initial achievement matrix, the matrix should be modified and the relationships that were missed be replaced.

If we have n criteria as described in $c_1, c_2, ..., c_n$ and their pairwise comparison matrix is as follows:

$$A = [a_{ij}], \quad i, j = 1, 2, ..., n \tag{3.4}$$

where a_{ij} shows the preference of element c_i over c_j, if we have in this matrix:

$$a_{ik} \times a_{kj} = aij, \quad i, j, k = 1, 2, 3, ..., n \tag{3.5}$$

Then we say that the matrix A is consistent.

In this part, we want to know that if the matrix of pairwise comparison is inconsistent, what is the amount of inconsistency of the matrix and how do we measure it. Before stating the inconsistency measurement criterion, some important issues about each pairwise comparison matrix are mentioned:

Theorem 3.1. If $\lambda_1, \lambda_2, ..., \lambda_n$ are eigenvalues of the pairwise comparison matrix A, the sum of its values is equal to n:

$$i = \sum \lambda_n \tag{3.6}$$

Theorem 3.2. The largest of this special value ($\lambda_{\max}$) is always greater than or equal to n, in this case some λ's will be negative.

$$n \geq \lambda_{\max} \tag{3.7}$$

Theorem 3.3. If the elements of the matrix deviate a little from the compatible state, its eigenvalues will also deviate a little from their compatible state.

$$A \times w = w.\lambda \tag{3.8}$$

where λ and w are the eigenvalue and eigenvector of matrix A, respectively. In the case that matrix A is consistent, one eigenvalue is equal to n (greater than eigenvalue) and the rest are equal to zero. Therefore, in this case it can be written:

$$A \times w = n \times w \tag{3.9}$$

In the case that the pairwise comparison matrix A is inconsistent, according to Theorem 3.3, $\lambda_{\max}$ is slightly different from n, which can be written:

$$\lambda_{\max} \times w = A \times W \tag{3.10}$$

The reason for using $\lambda_{\max}$ according to theorem 3.3 is that it will have the smallest distance from n. Since $\lambda_{\max}$ is always greater than or equal to n, and if the matrix deviates from the compatibility mode, $\lambda_{\max}$ will deviate from n, so the difference between $\lambda_{\max}$ and n

$(n - \lambda_{\max})$ depends on the value of n, and to solve this dependence, the scale can be defined as follows, which we call the inconsistency index (I.I.).

$$\lambda_{\max} - n/n - 1 = I.I. \tag{3.11}$$

For each matrix, the result of dividing the inconsistency index (I.I.) by the inconsistency index of the random matrix (IIR.) is then a suitable criterion for judging the inconsistency, which we call the inconsistency rate (I.R.). If this number is smaller than 0.1, the compatibility of the system is acceptable, otherwise you should reconsider your judgments.

To calculate the inconsistency rate:

Step 1. Calculation of the weighted sum vector: Multiply the matrix of pairwise comparisons by the "relative weight" column vector. Call the new vector that you get in this way, the weighted sum vector (Weighted sum Vector=WSV).

Step 2. Calculation of compatibility vector: Divide the elements of the weighted sum vector by the relative priority vector. The resulting vector is called compatibility vector (Consistency Index = CI).

Step 3. Obtaining $\lambda_{\max}$ gives the average of the elements of the compatibility vector $\lambda_{\max}$.

Step 4. The formula for calculating the compatibility index: The compatibility index is defined as follows:

$$CI = \frac{\lambda_{\max} - n}{n - 1} \tag{3.12}$$

n is the number of options in the problem.

Step 5. Compatibility ratio calculation formula: The compatibility ratio (Random Index = RI) is obtained by dividing the compatibility index by the random index.

$$CR = \frac{CI}{CR} \tag{3.13}$$

A compatibility ratio of 0.1 or less indicates compatibility in comparisons [5].

Step 5) Determining the level and priority of variables: In this step, using the final achievement matrix, the set of output and input for each variable is obtained. To determine the level and priority of the variables, the achievement set (output) and the prerequisite set (input) are determined for each variable.

Step 6) Drawing the model: after determining the relationships and level of the variables, they can be drawn in the form of a model. For this purpose, first, the variables are adjusted according to their level from top to bottom. At this stage, according to the levels obtained from the variables and the final matrix, an initial model is drawn and the final model is obtained by removing transferability in the initial model. The relationship between the variables and the direction of the arrow is determined from the final matrix.

Step 7) Analysis of penetration power and degree of dependence (MICMAC): MICMAC or the mutual influence of matrix multiplication applied for classification; The purpose of this analysis is to identify and analyze the power of penetration and the dependence of the variables. At this stage, by summing the entries of ((1)) in each row, the power of penetration and also the sum of the entries of ((1)) in each column, the amount The dependence of the variables is obtained.

4 Qualitative research findings

In the qualitative phase of the research, in order to answer questions such as and identify the internal and external actors of the business ecosystem of the digital transformation of banking services and the key factors affecting each of them, as well as the factors affecting the experience and satisfaction of customers, in the first step, a review of the literature and background A theory was made and in the next step, in order to complete the qualitative phase, semi-structured interviews were used and continued until theoretical saturation was reached. The analysis of interview texts has been done in open, central and selective coding stages, the stages of which have been mentioned before. According to the results of the business ecosystem around the digital transformation of banking services, the core of the business ecosystem center (including: bank), 8 internal actors of the business ecosystem (including: customers, support centers, alternative channel providers, business partners, start-ups and fintechs, insurance organizations, affiliated companies of data providers, advertising agencies) and 9 external actors of the ecosystem (including: financial institutions It includes government institutions, infrastructure providers, developers of emerging digital technologies, research and educational centers, competitors, shareholders, policy-making government institutions, investors). Also, 100 indicators affecting the digital transformation model of banking services and improving customer experience and satisfaction through the development of business ecosystems in Bank Mellat were extracted. The final results of the coding steps of the interview texts are as follows:

Table 2: Identified components and indicators for designing the digital transformation model of banking services, improving customer experience and satisfaction through business ecosystems (case study: Bank Mellat) as a result of coding the themes of semi-structured interviews

Code of interviewees	Indicators	Components
M.2, M.5, M.7, M.10, M.11, M.14, M.15	Digital management and leadership (1), digital business processes (2), digital transformation technology capabilities (3), digital customer experience (4), personalization of digital services (5), digital platform design capabilities (6), management Digital service risk (7), collaboration with ecosystem actors (8), digital networking capability (9), digital knowledge management (10), digital innovation management (11), ability to continuously monitor competitors' digital services (12), digital experience employees (13), organizational digital maturity level (14), improving internal communication of research and development units and service design and marketing (15), providing the possibility of outsourcing alternative services (16), agility and flexibility of the organization (17), attracting Expert manpower (18), cyber security and digital automation (19), focus on open and innovative banking (20), protection of intellectual property and digital rules and standards (21), marketing methods and sales of digital services (22), Culture And Skill Digital Organizational (23)	Bank
M.1, M.3, M.8, M.9, M.12, M.13	Security and traceability (24), customers' digital skills (25), privacy protection (26), ease of use (27), perceived risk (28), customers' income level (29), multiple usability (30), cost Using services (31), customer loyalty to the organization (32), achieving goals (33), access to information and documentation (34), digital service innovation (35), customer support (36), functional quality (37), Speed Services (38)	Customers/Users
M.5, M.3, M.7, M.13, M.6, M.14	Employment channel Hi novel communication (39), Presentation Services 24 × 7 support (40), speed responsiveness (41) transparent making Gap Hi Services Digital (42), Management connections effective With Customers Network Digital (43), commitment And Responsibility adaptability the force Human (44)	Customer support centers
Grade 14, Grade 10, Grade 4, Grade 6, Grade 2, Grade 11, Grade 8	Support System Central the unit Hi queue resources and Expenses branches Agent (45), promotion Ability Hi device ATMs and pos And vpos Store (46), presentation Services Bank At bed Hi Along Bank and Internet bank (47)	Alternative channel providers
M.12, M.7, M.8, M.1, M.13	Price put competitive Share products (48), Partners commercial At Market Goal (49), access To the Web service Hi Informational digital (50)	Business Partners

M.1, M.3, M.12, M.8, M.2, M.6	Delete Supervision Tariff E (51), evaluation And Management Risk Digital (52), ability compensation Damage Insurance The candidates Network Services digital (53)	Insurance organizations
M.4, M.5, M.7, M.8, M.11, M.15	Protection Managers senior From Evolution Digital (54), ability Hi technologically Evolution Digital (55), management Environment competitive Services digital (56)	Affiliated companies of data providers
M.10, M.11, M.13, M.15, M.6	Strategies Promotional Digital (57), digital management Marketing (58)	Advertising agencies
M.3, M.7, M.13, M.10, M.1, M.8, M.12, M.5	rate Fund put Digital (59), ability analysis needs and Market Hi Digital (60), ability Cooperation effective With other Actors Ecosystem (61), management creation Value at Network Digital (62)	Startups and fintechs
M.4, M.6, M.2, M.14, M.15	Development finding Rules related To policies money laundering And a fight With Terrorism (63), development finding Rules related To policies Financial And money (64), development finding Rules And regulation supervisory On Number And Volume transactions Ecosystem (65), development finding Rules related To Control rate Interest Services Digital (66), development finding Rules related To Record electronic And get documents Contracts Facilities Banking (67)	Financial institutions
M.1, M.2, M.11, M.5, M.10	Volume Trades Digital (68), quality And Variety Platform Hi Digital (69), scale the reception Technology Digital (70), Activity Hi Media Oh you And Network Social (71), transaction security channel Hi Digital (72), cost Hi Employment channel Hi transactional Digital (73)	Digital market
M.7, M.3, M.5, M.9, M.10	Development width Bond To exchange Information between Actors Ecosystem (74), development Under Constructions Technology Hi Evolution Digital (75)	Infrastructure providers
M.5, M.8, M.7, M.12, M.15, M.14	cycle life Technology Hi Digital (76), native making Platform Hi Digital (77)	Developers of emerging digital technology
M.1, M.10, M.9, M.7, M.12	the future writing and Assessment Technology Hi Digital (78), ability Creation Relationship effective With Development givers Technology Digital (79), ability Presentation solutions native making Technology Hi Digital (80)	Research and educational centers and institutions
M.3, M.7, M.13, M.10, M.6	References technologically Evolution Digital Organization (81), share Services Digital Organization at Market target (82) ,Size Organization (83), power conformity adaptability Organization With changes Digital (84), management And Strategy Hi Digital Organization (85)	Shareholders
M.8, M.7, M.12, M.15, M.1	Development finding Rules related To solve And castle Differences (86), development finding Rules related To Rights ownership Maani (87), development finding politics Hi supportive From Research And Development And Fund put Domestic (88), development finding Rules related With politics Hi supportive acquisition And works of Digital (89), Move To Side Government digital (90), Development the Web service Hi Informational digital (91)	Policy-making government body
M.13, M.12, M.15, M.2, M.4	Volume Fund put At Development Technology Hi Digital (92), rate coming back Capital (93), Changes Conditions Economic And Political (94), analysis Markets digital (95)	Investors
M.7, M.12, M.15, M.14, M.1	The ability to design and supply digital services (96), marketing and sales methods of digital services (97), the share of competing organizations in the digital services market (98), managing the experience of digital network customers (99), skilled human resources (100)	Competitors

5 Quantitative research findings

In the quantitative part of the research, a number of 200 completed and perfect questionnaires were collected from the sample, the frequency distribution of the statistical sample of the quantitative part according to demographics is shown in Table 3, also in order to check the validity of the questionnaire from confirmatory factor analysis and in order to check The structural equation modeling method (SEM) was used in the research with the help of SmartPLS 3 software.

Table 3: Frequency distribution of the statistical sample of the quantitative part according to demographics

Percent	Abundance	Variable levels	Variable	Percent	Abundance	Variable levels	Variable
22.5	45	Masters	education	34.0	68	Female	gender
77.5	155	Masters and Ph.D.		66.0	132	Man	
100.0	200	total		100	200	total	
12.0	24	Less than 30 years	Age	23.5	47	3 to 10 years	Years of service
30.5	61	31 to 40 years		40.5	81	11 to 20 years	
34.5	69	41 to 50 years		33.5	67	21 to 30 years	
100	200	total		100	200	total	

Non-normality of the studied variables. If the significance level is greater than 0.05%, the variable is normal. Otherwise, the data is non-normal. Therefore, according to Table 4, all the variables are abnormal. On the other

Table 4: The results of the Kolmogorov-Smirnov test to check the normal or non-normal distribution of the data

P-value	Statistics test	Sample size	Variables
0.000	0.166	200	Bank
0.000	0.090	200	Business ecosystem
0.000	0.130	200	External actors of the ecosystem
0.000	0.311	200	Internal actors of the ecosystem
0.000	0.207	200	Customer satisfaction
0.000	0.198	200	Enhance customer experience

hand, according to Table 5, the criteria for the structure in question is higher than 0.7, which indicates the appropriate reliability of the model. Considering the higher combined reliability coefficient of the variables in the table below, it shows the appropriateness and acceptable fit of the measurement models.

Table 5: Cronbach's alpha coefficient and composite reliability and average variance extracted

Mean variance extracted	Composite reliability	Cronbach's alpha	Number	Variables
0.611	0.970	0.969	200	Bank
0.652	0.949	0.948	200	Business ecosystem
0.637	0.803	0.801	200	Customer satisfaction
0.649	0.935	0.933	200	Improve customer experience
–	–	0.972	–	Total reliability

As it is clear from Table 6 taken from the method of Fornell and Larcker [9], the root value of the AVE of the variables in the present study, which are located in the main diameter of the matrix, from the correlation value between them, which is in the lower and left houses. The main diameter is arranged more. Therefore, it can be stated that the existing variables in the model interact more with their indicators than with other constructs and the model's divergent validity is at a reasonable level.

Table 6: Fornell and Locker method

4	3	2	1	Variables
			0.578	Bank
		0.576	0.575	Business ecosystem
	0.570	0.560	0.573	Customer satisfaction
0.562	0.549	0.551	0.561	Enhance customer experience

In Table 7, the values of the factor loadings along with the t-statistics for the questionnaire are presented. According to the table 7, which shows the results of the factor analysis of the questionnaire items, since the factor loading of all the items is more than 0.4, also the value of t statistic is more than 1.96, so the questionnaire has good validity.

Coefficient of determining R^2 (R Squares): The R^2 measure determines the impact of an exogenous variable on an endogenous variable. Three values of 0.19, 0.33 and 0.67 have been considered as criteria for weak, medium and strong values of the fit of the structural part of the model by the R^2 criterion. Also, the criterion of predictive quality (Q^2) determines the predictive power of the model. Three values of 0.02, 0.15 and 0.35 are given to show the weak, medium and strong predictive power of the structure or related exogenous structures. It is important to mention that this value is calculated only for the endogenous structures of the model whose indices are reflective.

General model fit (GOF): three values of 0.01, 0.25 and 0.36 have been introduced as weak, medium and strong values for this criterion.

$$GOF = \sqrt{\overline{Communality} \times \overline{R^2}} = \sqrt{0.533 \times 0.881} = 0.68 \tag{5.1}$$

According to the above results, it can be said that the model has a strong fit. Since the mediating role of variables is also examined in this research, it should be noted that, in examining the relationships between variables, despite the role of the mediating variable, direct and indirect effects should be examined.

To determine the indirect paths (digital transformation of banking services with the mediating role of the business ecosystem on customer satisfaction and also the digital transformation of banking services with the mediating role of the business ecosystem on improving the customer experience) using the bootstrap method in the macro program Haffke et al. [11] is used on spss25 software.

Table 7: Values of factor loadings along with t-statistics for the questionnaire

Components	objects	operational burden	The standard deviation	t statistic	Components	objects	operational burden	The standard deviation	t statistic
	1Q	0.793	.05618	10.702	Insurer organization	51Q	0.886	.05617	5.172
	2Q	0.895	.05972	10.237		52Q	0.663	.05907	8.797
	3Q	0.876	.06086	10.228		53Q	0.798	.06815	4.214
	4Q	0.894	.06040	11.762	Company Hi Dependent Presentation data provider	54Q	0.731	.06596	11.556
	5Q	0.908	.06086	11.012		55Q	0.798	.05517	16.932
	6Q	0.756	.07162	9.251		56Q	0.794	.06578	19.320
	7Q	0.585	.05835	7.235	agency Hi Promotional	57Q	0.930	.06261	11.708
	8Q	0.801	.05973	17.919		58Q	0.836	.06889	10.886
	9Q	0.741	.05560	9.053	start up I see And Finn single I see	59Q	0.864	.06694	10.615
	10Q	0.875	.06025	11.599		60Q	0.832	.06954	10.857
	11Q	0.754	.06802	9.397		61Q	0.715	.06710	12.171
Bank	12Q	0.705	.06705	8.439		62Q	0.756	.05564	16.753
	13Q	0.755	.07045	8.066	Institutions Financial	63Q	0.867	.06838	18.729
	14Q	0.792	.06925	10.291		64Q	0.814	.06900	16.805
	15Q	0.726	.05690	9.241		65Q	0.907	.05790	12.885
	16Q	0.869	.06127	10.894		66Q	0.932	.05895	18.233
	17Q	0.706	.06706	12.657		67Q	0.861	.06558	12.899
	18Q	0.552	.05679	9.565	Market Digital	68Q	0.753	.06296	12.534
	19Q	0.682	.06887	12.208		69Q	0.748	.06984	14.730
	20Q	0.834	.05965	10.963		70Q	0.850	.06704	19.542
	21Q	0.840	.06168	10.389		71Q	0.746	.05741	15.061
	22Q	0.781	.05567	9.183		72Q	0.775	.06056	16.729
	23Q	0.612	.05667	8.933		73Q	0.881	.05465	10.126
	24Q	0.771	.07015	9.328	Presentation givers Infrastructure	74Q	0.982	.06702	16.852
	25Q	0.813	.06278	10.063		75Q	0.985	.06797	19.393
	26Q	0.552	.06170	6.460	Development givers Technology Newfound Digital	76Q	0.966	.06676	13.327
	27Q	0.640	.06434	7.852		77Q	0.972	.06751	16.263
	28Q	0.759	.05771	17.750	centers And institutes research And educational	78Q	0.908	.06913	10.720
	29Q	0.654	.06345	12.569		79Q	0.644	.06154	4.865
Customers	30Q	0.624	.05845	8.320		80Q	0.906	.06170	10.187
	31Q	0.463	.06485	3.605	Shareholders	81Q	0.723	.06818	16.759
	32Q	0.450	.05447	3.120		82Q	0.687	.06268	7.677
	33Q	0.961	.06984	9.355		83Q	0.632	.06182	6.230
	34Q	0.966	.06289	16.472		84Q	0.592	.07595	6.461
	35Q	0.919	.05445	11.259		85Q	0.695	.06884	14.263
	36Q	0.943	.06943	13.904	institution Governmental politics transition	86Q	0.721	.06278	10.155
	37Q	0.466	.06005	6.341		87Q	0.777	.05668	10.774
	38Q	0.917	.06449	13.705		88Q	0.707	.05615	9.196
	39Q	0.682	.06690	4.735		89Q	0.787	.06343	15.279
Customer support centers	40Q	0.697	.06289	8.036		90Q	0.464	.06731	4.492
	41Q	0.702	.06828	4.968		91Q	0.659	.06423	8.769
	42Q	0.648	.06766	4.693	Fund The founders	92Q	0.805	.06249	10.001
	43Q	0.635	.06591	7.230		93Q	0.696	.06407	12.373
	44Q	0.675	.06435	7.731		94Q	0.829	.06710	10.882
Alternative channel providers	45Q	0.768	.06320	9.889		95Q	0.674	.06261	11.922
	46Q	0.743	.06858	9.766	Competitors	96Q	0.950	.06352	17.292
	47Q	0.604	.06596	8.087		97Q	0.855	.06284	10.149
Business Partners	48Q	0.715	.05660	11.405		98Q	0.867	.06565	16.456
	49Q	0.643	.06227	7.039		99Q	0.961	.06316	17.224
	50Q	0.876	.05936	10.216		100Q	0.919	.06542	13.247

Table 8: Determination coefficient and prediction quality

Q^2	R^2	**The dependent variable**
0.529	0.845	Satisfaction Customer
0.537	0.918	Promotion Experience Customer
0.533	0.881	Average

According to Table 10, the upper and lower limits of the confidence interval for the digital transformation of banking services with the mediating role of the business ecosystem on customer satisfaction, as well as the digital transformation of banking services with the mediating role of the business ecosystem on improving customer experience,

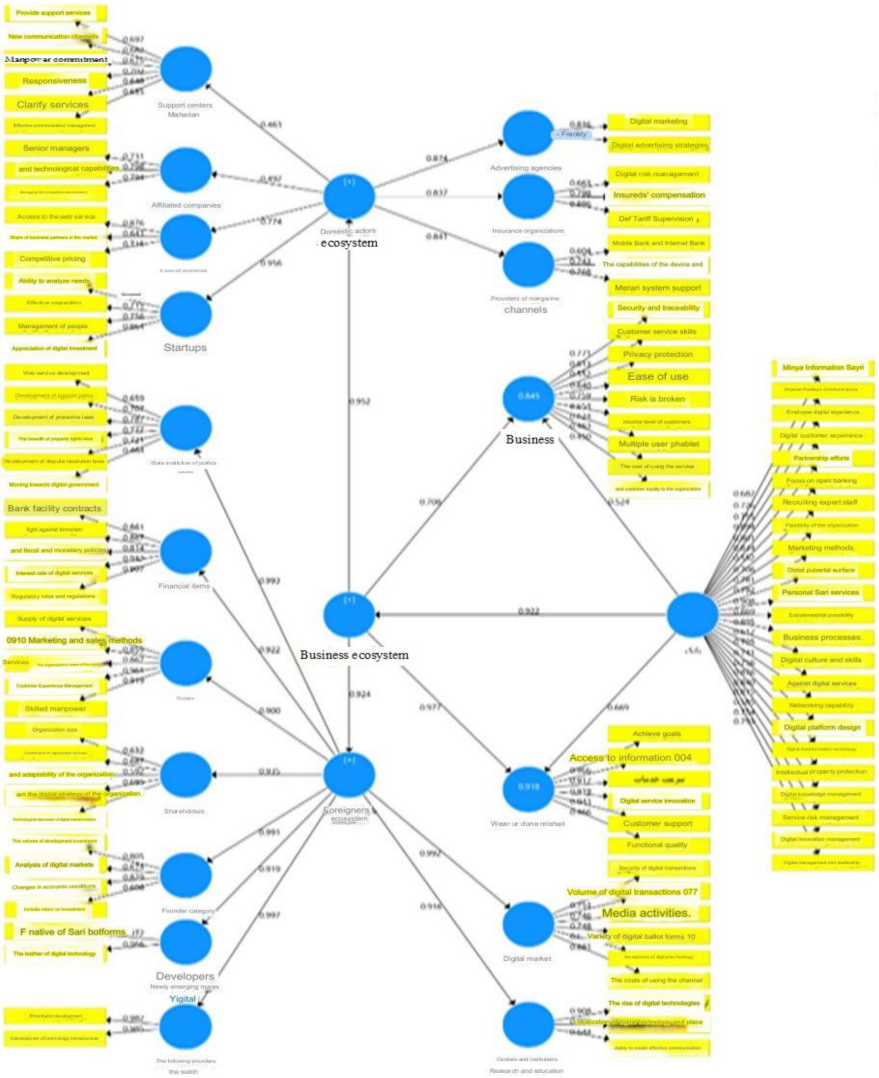

Figure 1: path coefficient in the conceptual model

Table 9: Seville test results

Result	Z	standard error related to the second route	Standard error of the first path	Standard estimation coefficient of the second route	The non-standard estimation coefficient of the first path	hypothesis
confirmation	6.06	0.067	0.068	0.67	0.68	Evolution Digital Services Bank With Role mediation ecosystem acquisition And Work On satisfaction The customer has a positive and meaningful impact
confirmation	6.08	0.069	0.071	0.69	0.71	Evolution Digital Services Bank With Role mediation ecosystem acquisition And Work On Enhance the experience Customer the effect Positive And Meaningful has it

Table 10: Seville test results

upper line	the lower limit	standard error	bias	boot	Data	Direction
0.3889	0.1279	0.061747	0.0001	0.2018	0.2019	Evolution Digital Services Bank With Role mediation ecosystem acquisition And Work On satisfaction Customer
0.3297	0.1187	0.063789	0.0003	0.2017	0.2020	Evolution Digital Services Bank With Role mediation ecosystem acquisition And Work On Promotion Experience Customer

do not include zero. The confidence level of this confidence interval is 0.95% and the number of bootstrap resampling is 1000. Considering that zero is outside this interval, the indirect relationship of the variables is significant.

6 Conclusion and suggestions

Banks have not been exempted from the recent developments in the digital field. Digital banking refers to the use of technology to conduct banking transactions and improve the digital experience and the level of customer satisfaction in the context of a unique digital business ecosystem consisting of different entities created by competition and cooperation. They are worth referring to. Therefore, the way banks react to new conditions is important to maintain relationships with customers, increase support for the bank brand and increase profitability. The present study aims to answer questions including who are the actors of the digital banking business ecosystem and the key factors. What is the effect on each of them and whether the digital transformation of banking services with the mediating role of the business ecosystem affects the improvement of customer experience and satisfaction was carried out in two qualitative and quantitative phases. The findings of the qualitative phase indicate that the business ecosystem of Bank-centered digital banking includes 8 internal actors of the ecosystem (customers, support centres, alternative channel providers, business partners, insurance organizations, data providers, advertising agencies, startups and fintech) and 9 external actors of the ecosystem (financial and government institutions, digital market, infrastructure providers, developers of emerging digital technologies, research and educational centers and institutions, competitors, shareholders, investors) and includes a total of 100 influential indicators. The results of this research It is consistent with the studies of Adam [2], Werth et al. [26], and Castro et al. [6]. In the quantitative part, by performing confirmatory factor analysis and structural equation modelling, the structural equation modelling method (SEM) was used to analyze the quantitative data and conceptual model of the research with the help of SmartPLS 3 software. The result of the first hypothesis of the digital transformation of banking services with the mediating role of the business ecosystem has a positive and significant effect on customer satisfaction, according to the path coefficient between the variable of digital transformation of banking services on the business ecosystem, which is 0.922, and the t-statistic is 10.116. It can be said: that the digital transformation of banking services has a positive and significant impact on the business ecosystem. According to the path coefficient between the variable of digital transformation of banking services on customer satisfaction, which is 0.524 and also the t-statistic is 7.491, it can be said: that digital transformation of banking services has a positive and significant effect on customer satisfaction. According to the path coefficient between the variable of business ecosystem and customer satisfaction, which is 0.708 and also the t-statistic is 9.993, it can be said: that business ecosystem has a positive and significant effect on customer satisfaction. Therefore, the digital transformation of banking services with the mediating role of the business ecosystem has a positive and significant effect on customer satisfaction. The results of the findings are consistent with the studies of Anggraeni et al. [3] and the research of Abubakre et al. [1]. The result of the second hypothesis that the digital transformation of banking services with the mediating role of the business ecosystem has a positive and significant effect on improving the customer experience showed that the path coefficient between the variable of digital transformation of banking services on the business ecosystem is 0.922 and the t-statistic is 10.116. is the path coefficient between the variable of digital transformation of banking services on the improvement of customer experience which is 0.669 and also the t-statistic is 9.793. The digital transformation of banking services has a positive and meaningful effect on improving the customer experience with the mediating role of the business ecosystem. The results of the findings of this research are consistent with the studies of Arsanjani et al. [4]. According to the above findings, the suggestions are:

- To achieve the goals of digital banking, it is suggested that the bank aligns its business models, processes and work environment with the new developments in the field of digital banking while using digital technological capabilities, management practices of governance and leadership.
- It is suggested that the bank is preferable to the necessity of working in the digital business ecosystem, and the digital networking between the ecosystem layers, promoting cyber information security and web services.
- To enhance the digital experience and customer satisfaction level, it is recommended that the bank can design digital banking services by improving internal communication between research and development units, marketing and product design, which simultaneously have high levels of innovation and performance quality at least perceived risk. Brought to customers.
- Considering that cooperation with finance and startups is one of the most important internal actors of the ecosystem, it integrates users and overflows of knowledge and sharing information and resources. Therefore, it is suggested that the bank develops its interactions and cooperation with a number of these prominent institutions to enhance customer digital experience, diversify digital banking services, increase profitability, maintain competitive position, as well as increase brand popularity.
- It is suggested that the Bank, using competitive pricing of business partners and digital networking with this

group in cooperation with the context of digital platforms, design and deliver it to its customers to create a unique digital experience for customers in the partner's market. To increase your business.

- Given that one of the most important actors in the business ecosystem of competitors, it is recommended that the bank has consistently monitor competitors' digital services, marketing and sales and customer experience management to identify the gaps in the market. The supply of digital products with a higher performance level.
- It is suggested that the Bank promotes access, and proper management of potential risks in terms of the digital technology life cycle, to localize the technologies and their related platforms according to cultural and social conditions.

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