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Identification and Ranking of Effective Factors to Improve Customer Experience in the use of Artificial Intelligence in Banking by Fuzzy Delphi and Fuzzy Aras Method

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ABSTRACT

Customer experience is a key tool for achieving competitive advantage in all industries. In fact, customer experience is an interactive process that is facilitated through cognitive and emotional cues and will be adjusted by the customer and background characteristics and lead to a unique and enjoyable or unpleasant experience. One of the challenges in this field is that customer experience is fundamentally a qualitative type that varies from person to another person. On the other hand, the interest in the field of customer experience, based on Google's site trend analysis, is increasing strongly, which shows the importance and challenge of this field. From another point of view, the emergence of chatbots, wearable devices, smart speakers, and technologies and machine learning have greatly changed our lives, so it is expected that the impact of these technologies in the banking industry and customer experience will also be significant, unlike traditional banking, banking based data and artificial intelligence follows the customer's behavior pattern and answers his daily economic needs in real time. This research tries to identify and rank the effective factors to improve the customer experience in using artificial intelligence in banking by Fuzzy Delphi and Fuzzy Aras methods.

Keywords: banking, artificial intelligence, customer experience, Delphi-Fari method, Fuzzy Aras

Introduction

Basically, there is no more news of customer queues and restrictions on bank working hours in new strategy of banks, and the customer experiences a frictionless experience in different channels; In fact, increasing in the importance of data in recent years is the main factor for changing the strategy of businesses but it can be said that the outbreak of the pandemic emphasizes and accelerates the need for banks to move in this direction. Therefore, many organizations have planned to focus on digitizing their channels and interactions with customers, but at the same time they believe that adopting artificial intelligence and machine learning is the main priority to become a data-driven business. A report published by an Algorithmi in 2021 showed that 76% of organizations prioritized artificial intelligence and machine learning over other areas of information technology[1], also this report emphasized that 43% of the respondents acknowledged the use and benefits of these technologies and declared that these technologies are more important than they thought at first. The same upward trend is seen in the number of data professionals in organizations, with 29 percent of respondents having more than 100 data professionals on their teams, that has increased 17 percent from the year before this report. These statistics show that banks need to develop strong and intelligent platforms to process online payment data, transfer money, check account balances, process consumer loan requests and answer questions [2]. For example, chatbots can provide a personalized experience to customers, help streamline operational services, and allow employees to focus on more complex tasks that require their knowledge.

Theoretical research literature review

Artificial intelligence

Artificial intelligence in banking

According to the research of the Global Customer Experience Network in 2023, responding managers from all over the world believed that the main obstacles in implementing a successful customer experience in the organization are as described in the following table:

Table 1. Obstacles on implementing a successful customer experience

obstacles	Percentage
Silo data and lack of integrated system	64
Limited understanding of the customer and his behavior and needs	36
Lack of immediate ability to respond to customer needs	31
Lack of personalization and personalization of customer interactions	39
Conflicting customer experiences across channels	43

This statistic shows that the potential of artificial intelligence to improve the customer experience has not been used sufficiently and the data-driven customer experience has not been formed as a strategy in the minds of senior managers. Also, based on lack of researches conducted in the field of artificial intelligence, the main questions of the research were determined as follows:

1- What are the factors affecting the improvement of customer experience in the use of artificial intelligence in banking?

2- What challenges are there in the use of artificial intelligence in the banking industry, especially in the field of customer experience?

Customer experience

Customer experience is the customer's subjective response to service elements that emerges during purchase and use, or through imagination or memory. Customer experience has emerged as one of the important dimensions in today's marketing and is in the challenge to create a unique, memorable and enjoyable experience for customers. In other researches, there has been more focus on the dimensions of experience.[2] For example, customer experience is defined as cognitive, emotional, physical, sensory and social responses that are provoked by a set of market actors, or in studies such as customer experience from the set of customer interactions with a product, a service, an organization or a part of an organization arises, which is the driver of customer behavior. One of the most important definitions in the field of customer experience is the customer journey, which refers to all customer interactions before, during and after the purchase.

Figure 1. Customer interactions with banks

One of the most comprehensive frameworks related to customer experience, which examines the theoretical foundations of the last 30 years regarding customer experience;[3,4] From the review of articles in this field, two general themes can be found in the research: the first theme is related to the process of implementation and management of customer experience and the second theme is the organization's ability to support good customer experiences. In the second theme analysis, things like strategy, leadership, organizational design, culture and systems, technology and processes, and in the first theme, customer understanding, experience, design experience implementation and experience measurement have been discussed [4]. The details of each step are shown in figure 2. According to the process of designing and implementing customer experience in this way, improving each block of customer understanding, designing customer experience, measuring customer experience and implementing customer experience change by applying artificial intelligence will create value.

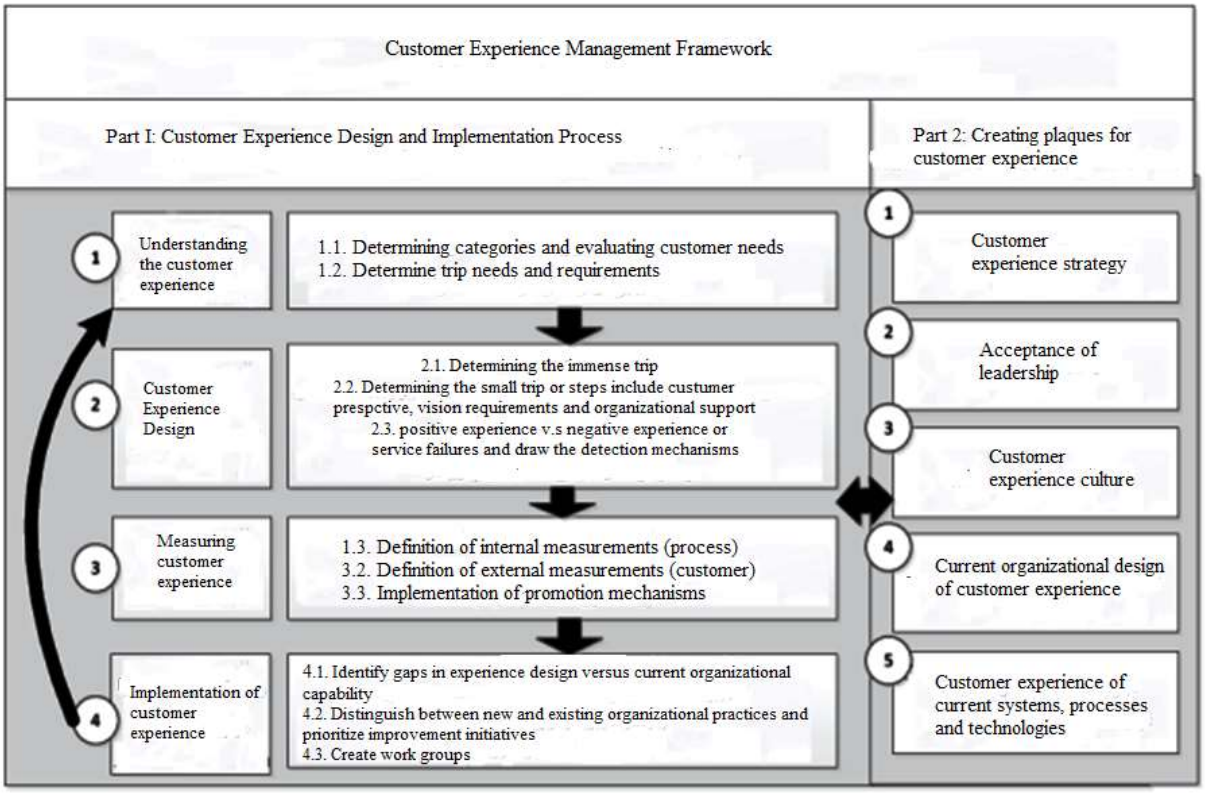

Figure 2. Customer experience framework

Research method

Fuzzy Delphi method

The fuzzy Delphi method was invented in the 1980s by Kaufman and Gupta. Nordhaben (1995) found that using the fuzzy Delphi method for group decisions can lead to a common understanding of experts' opinions.

Also, the decisions taken by the experts are based on their individual competence and are highly subjective. Therefore, it is better to display the data with fuzzy numbers instead of definite numbers. The implementation steps of the fuzzy Delphi method are actually a combination of implementing the Delphi method and performing analyzes on information using the theoretical definitions of fuzzy sets. In this research, a method is used in which only one round of the questionnaire is present.

Therefore, the diversity of experts opinions is maintained more. Although using of this method has been done in a more limited way, almost most of those who use another fuzzy method along with Fuzzy Delphi, and their research includes Fuzzy Delphi in the first stage, have used this method.

Its purpose is to use Fuzzy Delphi to remain among the multitude of variables or factors that have more impact; In other words, the Fuzzy Delphi keeps the key and main variables and other variables are removed. The implementation steps of the Fuzzy Delphi method are actually a combination of implementing the Delphi method and performing analysis on the information using the definitions of Fuzzy set theory. The fuzzy Delphi process is as follows:

1. Collecting the opinions of the decision group (experts): for this purpose, a range of five options of linguistic variables was used. This range was ranked from the least effective option to the most effective option.

2. Converting verbal variables into fuzzy triangular numbers: the method provided by Habibi et al. (2015) was used. Since the different characteristics of people affect their subjective interpretations of qualitative variables, by defining the scope of qualitative variables, experts have answered the questions with the same mentality. According to Table 2, these variables are defined in the form of triangular fuzzy numbers.[2]

Lingual expressions	Triangular fuzzy numbers
Very low	(0, 0, 0.25)
Low	(0, 0.25, 0.5)
Medium	(0.25, 0.5, 0.75)

High	(0.5, 0.75, 1)
Very high	(0.75, 1, 1)

Aras technique

The Aras method was presented by Zavadskas and Treskis in 2010 in an article entitled "A new method for evaluating the incremental rate in multi-criteria decision making". Aras method is used as one of the newest, most effective and at the same time simplest methods in multi-criteria decision making. The mentioned method is used to solve various decision-making problems (Zavadskas and Terskis, 2011). This technique is a powerful method in providing the performance rate and the degree of desirability of different options compared to the optimal situation, which is relatively easy to use. The capabilities of this technique in the studies of Zavadskas and Torsky (2010) and the selection of the best work room with the most pleasant climate, Kresoulin and Torsky (2011) for ranking and choosing an architect, Krosoulin and Torsky (2014) in choosing the appropriate chief accountant, Zavadskas et al. (2015) has been confirmed in the selection of the deep water port of the Eastern Baltic Sea.[2,4]

Review and discussion

Technologies affecting the customer experience

Studies show that organization strategies can be implemented by integrating information technology to improve and personalize the customer experience. Among the technologies that are used in personalizing the experience, the following can be mentioned:

Internet of objects

In recent years, Internet of objects technology has been applied in the financial field, and the data generated, such as real-time mortgage monitoring data with GPS, sensors, network cameras, mobile devices, and has been used to improve credit risk management of bank loans. It should be noted that due to the increase in data, the use of just traditional statistical models and neural networks is not the solution, and the use of artificial intelligence in combination with the Internet of objects is necessary. For example, in a research entitled " Back PSO neural network data mining approach for financial risk management with Internet of objects, it deals with the design of data mining solution for propagation based on classification and prediction". The proposed approach can distinguish the default sample and predict the financial risk with high accuracy and capacity.[5,6].

Blockchain

Blockchain technologies are another technology in the banking industry, which, of course, we did not see any special action in Iran, but due to its advantages such as transparency, security, efficiency, traceability, immutability, etc., it has received the attention of the academic and executive fields in the world. Blockchain applications in the banking industry include international payments and individual remittances. Traditionally, international payments can be slow and expensive, often involving multiple intermediaries and high fees. However, with blockchain technology, international payments can be processed faster, in real time, and potentially at a lower cost. This method can be especially useful for individuals and businesses that rely on cross-border payments. Another potential use case for blockchain technology in banking is the identity verification field. Currently, banks rely on various methods to verify the identity of their customers, including manual verification and using biometric technology. However, with blockchain technology, authentication can become simpler and more secure. Blockchain-based authentication systems can provide a secure and virtually tamper-free way to verify the identity of customers, which can reduce the risk of fraud and identity theft [7].

Artificial intelligence

Artificial intelligence is the ability of a machine to simulate human thought patterns and make predictions based on data. This definition of generative artificial intelligence is completed as follows: the ability of a machine to create new content, rather than repeating what it has been trained to do. Artificial intelligence refers to the theory and development of computer systems to enable the performance of tasks that require human intelligence, such as visual perception, speech recognition, decision making, and translation between languages. Artificial intelligence has ushered in a new era, transforming businesses and improving people's lives in unprecedented ways. Artificial intelligence-based text and image algorithms such as e-Dall and Fusion Stable can generate images based on text commands, and finally, artificial intelligence-based LLM models such as ChatGPT can do coding. A personal assistant in the economic field named Erica, which Bank of America considers a personal economy manager, is one of the examples of the use of artificial intelligence in the banking industry, but the use of artificial intelligence and productive intelligence in the banking industry is still very low [8]. ,9] According to a 2019 study by Accenture, more than 50% of respondents expected to be able to switch between human and digital channels. According to this study, which has been conducted regarding banks and insurance, 5 key points have been identified:

- Customers need integrated offers that solve the main needs.

- Customers are increasingly demanding a completely personalized offer from banks.

- Customers are willing to share data with their providers in exchange for better advice and more attractive deals.

- Customers want more integration in physical and digital channels.

- Customers' trust in financial institutions is high and increasing.

In conversational banking, it is emphasized that banks should interact intelligently with their customers and use text messages and visual interaction tools, which are facilitated by using artificial intelligence and machine learning techniques. Examples of conversational banking applications include automatic customer support, voice bots in call centers, real-time customer assistance, and image-based customer interactions. The attractiveness of financial institutions based on artificial intelligence is lower operating costs, better customer recognition, higher revenues and innovation in financial products and services [9, 10].

Based on the systematic review of the articles in this field, the main categories were identified and the factors effective in improving the customer experience in the use of artificial intelligence were ranked. The first category is related to the applications of artificial intelligence in improving the banking customer experience field, the second category is technical algorithms for implementing applications, and the third category is the challenges of implementing and using artificial intelligence in banking industry.

Table 3. key factors affecting customer experience with the fuzzy Delphi method

Key factors influencing customer experience using artificial intelligence	Information bar	Importance factor
Translation between different languages to answer customer questions	0.82224	0.12767
Analyzing the customer feedback program - moving towards a customer-centric strategy and led-Customer	0.48777	0.08787
Reducing costs with intelligent agents in call centers	0.47654	0.13467
Using chatbot in investment proposal and service support	0.46678	0.08789
Customer authentication	0.13767	0.16767
Increasing the efficiency of branches by automating banking operations	0.89876	0.27678
Segmenting customers to provide a better experience through product design	0.68789	0.08897
Link analysis	0.56578	0.08789
Increasing personalized digital services	0.66767	0.07889
Provide personalized content	0.28789	0.08893
Fraud detection in financial field using artificial intelligence	0.87689	0.06768
Using virtual reality	0.47876	0.02783
Investigating customer feelings when using the service and brand loyalty	0.67689	0.08973
Suggesting new products and services through smart messages through robots	0.56789	0.02763
Changing the marketing strategy based on customer communication at different touch points and its data	0.46768	0.06376
Understanding the level of customer loyalty to the text processing bank brand	0.48289	0.06376

Table 4. key factors affecting customer experience with Aras method

Key factors influencing customer experience using artificial intelligence	Information bar	Importance factor
Changing the marketing strategy based on customer communication at different touch points and its data	0.0767	0.0723
Suggesting new products and services through smart messages through robots	0.0657	0.0567
Using virtual reality	0.0356	0.0345
Translation between different languages to answer customer questions	0.1546	0.0789
Analyzing the customer feedback program - moving towards a customer-centric strategy and led-Customer	0.0356	0.0378
Using chatbot in investment proposal and service support	0.0376	0.0347
Increasing personalized digital services	0.0767	0.0657

Among the announced applications, the most repetition was related to the chatbot. Compared to the call center, chatbots equipped with artificial intelligence provide fast and reliable information to bank customers, and the findings also show that the most references are in the field of experience. The banking client was also related to the chatbot. In a study conducted through a questionnaire and with generation Z, there was a direct relationship between the use of chatbots and interest in the brand [11].

The challenges of using artificial intelligence in banks

In addition to the various benefits of using artificial intelligence has for the organization, thre is also challenges. For example, in an article aimed at examining the challenges of using artificial intelligence assistants in retail stores, 7 main obstacles are mentioned in the implementation and using intelligent assistants, these challenges include: customer-related obstacles such as privacy concerns private, stress related to new technology, obstacles related to marketing, technical obstacles, cultural obstacles, organizational obstacles, economic obstacles and operational obstacles [11].

Figure 3. Obstacles related to the implementation and using artificial intelligence

User authentication

Smartening banking systems and of course crises such as the Covid-19 pandemic and the increase in remote work are not without risks. Mackenzie announced in 2020 that banks should immediately include following two measures in their business strategy: First, securing the connection with the bank network, as well as the integration, confidentiality and availability of online services. Another challenge that became more necessary with the increase in online services is the issue of user authentication, which, of course, has been helped by smartness in this area. The most widely used solutions for authentication include checking a person's digital activity on social networks, device analysis to identify possible fraudulent activities based on device settings, evaluation based on email, mobile number, IP, facial biometrics, and voice recognition [11,12].

Data modeling

Another challenge in this field is data modeling. In fact, this challenge deals with the issue that the use of artificial intelligence is not just collecting data and entering it into data analysis algorithms, and it requires sufficient knowledge and expertise in this field. Finally, one of the basic challenges of this field is the dehumanization of customer experience, one of the elements of interest in the design of experience and empathy service is that due to the focus of organizations and banks on data-oriented processes, customer experience has become a dehumanizing process.[13].

Dehumanization of processes

Organizations will increasingly replace human interactions and relationships with automated processes and algorithms. This can have negative consequences for both service providers and customers, such as loss of trust, empathy, satisfaction and loyalty. Artificial intelligence systems can dehumanize the customer experience by eliminating human interactions and personalization that lead to customer loyalty and satisfaction.

Non-acceptance of technology

There is a recurring concern that artificial intelligence will displace people and their roles. Several articles have addressed the issue of artificial intelligence acceptance from different dimensions such as customers, employees and technology. For example, in the article "The Impact of Artificial Intelligence on Organizational Employees: A Review of Literature", the authors have examined the factors influencing the adoption of artificial intelligence technology by employees in various industries. This article examines the impact of artificial intelligence on four main areas: human-computer collaboration, work performance, employee psychology and emotions. In the report on the state of artificial intelligence qualities, the latest statistics show that 81% of customer experience professionals believe that artificial intelligence will benefit their team by reducing the workload or providing a tool to identify and respond to customer issues more quickly [13,14].

Lack of experts in artificial intelligence field

Such banking applications include machine and programming languages. As a result, the exploitation of these services requires expertise and knowledge, and banks often face problems due to the unavailability of expertise. Lack of technological skills affects the user experience.

Lack of information technology infrastructure in banks

The large and diverse data of banks requires the use of appropriate information technology infrastructures for the possibility of collecting and processing information, the storage of data in a silo form and the duplication of some customer data in the organization and incorrect data archiving strategies, infrastructure estimation suitable and costs have faced problems.

Conclusion

According to the review of valid articles in this field, the areas where artificial intelligence can be used to improve the customer experience were identified, and the algorithms that can be used along with the challenges of using artificial intelligence were explained. It is expected that the output of the current research will help bank executives in reviewing artificial intelligence and customer experience strategies and facilitating the preparation of prerequisites and implementation of projects in this field. Given that customer experience is also a qualitative issue, it is necessary to pay attention to the following points in reviewing how to implement and design a data-driven customer experience strategy. Balancing quantitative and qualitative customer insights and putting this data into a banking context to deliver a seamless customer experience in real time and across the customer lifecycle, connecting customers to the right actors with access to the right insights, at the right time to create meaningful experiences and creating a sense of loyalty and based on trust, the need to fill the gap in customer expectations and the concerns of using artificial intelligence-based services, training employees in the areas of customer science, designing customer journey maps and data science, and closer cooperation of banking business areas with data science experts.

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