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# Calculating the equilibrium point in outsourcing the marketing of bank point of sale to PSP companies

Jaafar Golzar[a], Hossein Hakimpour[b,*], Mehdi Mahmoodzadeh Vashan[b], Behrouz Basirt[b]

[a]Department of Business Administration, Birjand Branch, Islamic Azad University, Birjand, Iran
[b]Department of Management, Birjand Branch, Islamic Azad University, Birjand, Iran

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**Abstract**

The purpose of this research is to develop the outsourcing model of the bank's electronic banking services using game theory to identify the equilibrium and win-win strategies between the bank and the applicant companies. For this purpose, an interview was held with bank and company experts. After qualitative data analysis,16 strategies were identified for the parties. According to the compatibility of the identified strategies with the marketing mix, the results were grouped into 4 product groups, price, distribution and promotion. Since the identified strategies did not have the same value for the parties, to identify the weight of the strategies. A pairwise comparison questionnaire was used and the opinions of experts from each side were collected separately. The analytical Hierarchy process was used to obtain the weight of each index and the Inconsistency Ratio index was used to check the reliability of the obtained results. After identifying the weight of the strategies, the game environment was implemented and according to the 16 identified strategies, 65536 scenarios were implemented for each side. After performing calculations, 8 scenarios with the same outcomes were identified as equilibrium scenarios or Nash Equilibrium games. The scenario that had the most consequences for the parties was introduced as the result of the game.

Keywords: outsourcing, marketing mix game theory, Nash equilibrium
2020 MSC: 91-XX

## 1 Introduction

The new business conditions have caused the outsourcing of activities to receive more attention in recent years. Decision making in this field can be considered as one of the most complex decisions that organizations face. Organizations' motivation for outsourcing varies depending on their nature. In the past, outsourcing was done only when organizations were not able to do certain work due to reasons such as lack of ability, lack of capacity, financial pressures or technological limitations. But today, organizations that are quite successful also use this tool to restructure their organizations [4]. Outsourcing means delegating some internal activities of an organization to its supplier outside the organization and delegating the decision-making right to the external supplier based on the contract [2]. The word "outsourcing" is usually used when companies start analyzing activities or vertical analysis. This term was invented and used at the end of the 1980s for subcontracting and management information system. Then, in

*Corresponding author
*Email addresses:* jaafar.golzar@gmail.com (Jaafar Golzar), hhakimpur@iaubir.ac.ir (Hossein Hakimpour), mahmodzaadeh@iaubir.ac.ir (Mehdi Mahmoodzadeh Vashan), behrooz.basirat@iaubir.ac.ir (Behrouz Basirt)

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1989, it was used as a business strategy to explain Kodak's decision to transfer information technology activities to one of IBM's subsidiaries. In the last decade, outsourcing has evolved from traditional to strategic. Outsourcing is considered traditional when an activity is not a key factor for the organization, but strategic outsourcing occurs when organizations outsource everything except their specific activity in which they can achieve a unique competitive position [3]. The areas that bring competitive advantage are placed in the focus of investment. Other work areas are either removed or relied on market suppliers to provide them. Traditional outsourcing has more of a tactical aspect, oversees the operational level, and its main reason is cost reduction, and it focuses on non-core activities. In terms of transformational outsourcing, it has more of a strategic aspect, and its main reasons are value creation, creation of key competencies, and uncertainty management [3].

Banks all over the world, along with various organizations, are increasingly outsourcing their activities. Regardless of non-core activities such as janitorial and maintenance services, security services, property and building maintenance, food preparation, etc., which in some cases have become a requirement, many banks are Outsourcing processes in the field of information technology, administrative affairs and human resources. In addition to outsourcing processes such as checking the borrower's credit and obtaining collateral, issuing and clearing checks, market research, preparing accounting reports, payroll systems and even more important activities such as liquidity management and investment management in some banks in the world. He eats his eyes [6]. Organizations must be able to always adapt themselves to the changes in the environment, and this requires the ability of the organization to have easy and quick access to the required resources, such as specialized manpower, technical knowledge and advanced technology outside the organization [6]. Today, these benefits cannot be obtained by just one company alone, because companies try to focus their business around activities that they know better and outsource other activities to other companies. Although cost reduction is considered as the most important motivation for outsourcing, it should be said that the motivations are different depending on the industry and business. In the 8th annual outsourcing index report prepared by the Outsourcing Institute in 2005, the most important incentives for companies to outsource are reduction and control of operating costs, improvement of organizational focus, and access to new technology [5].

The European Central Bank has also examined the motivation of European banks for outsourcing, according to which cost reduction and focus on core activities are the most important motivations. This result has also been confirmed by Gutner's research group. This research group has found that out of 39 banks selected by Fortune magazine, 21 banks mentioned the most important reason for outsourcing is to focus on core capabilities, followed by creating value for shareholders and eliminating risk [13]. PSP companies attract banks by offering different sales models and using advertising tools and offering privileges for the owners of these devices. Banks are also trying to use this tool effectively to attract and retain customer resources. But the conflict of interests of the bank and the companies providing these services has created a special complexity in the relationship and the way banks and companies interact. Based on the business model and profitability of PSP companies, planning is done in attracting customers with a high number of transactions and encouraging customers to increase daily transactions, but banks do not seek to increase transactions due to the transaction fee system. The basis of customer evaluation for the bank is the average account [13]. This conflict of interest has created a serious conflict in the interactions of banks with companies, so that banks have turned to analyzing transactions, calculating the fee paid to Shoprak and comparing the amount of the fee with the value that the customer has created for the bank [7].

And if there is a balance between the lack of customer fees and the added value for the bank, an order to cancel the acceptance is issued. Considering the high importance of this tool for banks and PSP companies and the existence of common interests, it is necessary to adopt solutions that minimize conflicts. By choosing and applying these strategies, the marketing mix can play an important role. The marketing mix is a conceptual framework that describes the decision-making principles of managers to correctly configure understanding of consumer needs. This technique can develop long-term strategies and short-term tactical plans. So far, a lot of research has been done to determine the marketing strategy of companies based on the marketing mix. However, the comprehensiveness of the marketing mix has always been questioned by critics. There are also criticisms such as inefficiency of combined components, directing costs towards non-profit activities, ignoring shareholders and beneficiaries, orientation towards consumer markets, inefficiency in service markets, inappropriateness for high-value products, ignoring strategic management approaches [8]. Focusing on internal components and ignoring the customer's favorite components, being product-oriented and not paying attention to the customer, paying too much attention to a component and ignoring the weight of the components, etc. are things that have entered the marketing mix. Model. Another drawback of the marketing mix is the one-sidedness of the strategies adopted based on it. Organizations and companies usually plan their marketing strategies based on mix components independently and rarely coordinate their strategies with competitors. Given that a sudden change in a company's marketing strategy is not apparent until it is implemented, information and adaptation may cause heavy losses to competitors. But these items are considered requirements for competition and maintaining

market share. But sometimes it is necessary for companies to look for win-win strategies by eliminating conflicts in some cases [9]. One of the decision-making tools that helps to plan marketing strategies in conflict situations is game theory. The theory of games uses mathematical models to analyze the methods of cooperation or competition of logical and intelligent beings, hence the present research examines the best mutual cooperation strategy between the bank and PSP companies for long-term interaction and cooperation using the identified strategies. Bank and PSP companies pay

## 2 Research literature

### 2.1 Outsourcing banking services

Today banking industry is considered as a leading and fast-changing industry which along with the continuous changes in the capital markets, competition in this industry is also increasing significantly. In such circumstances to achieve a competitive advantage, reduce costs and increase the number of customers, the bank needs methods that can both protect and strengthen the current market, and also simultaneously take steps to develop new markets. Many investigations have been done on marketing methods 1 and also on diversifying the banks services to the customers 2 For instance, studies have been conducted on various channels for providing services to clients 3 and also on the use of service methods through the web and mobile networks 4, 5 Typically banks compete with each other to reach more customers [15]. In this case, if the bank presents a model for cooperation with other banks in order to reduce costs and increase the number of customers then with the formed coalition can attract more customers with lower costs, Increase profits and boost its share in the capital market [11]. Outsourcing refers to handing over the internal processes or activities of a business to an external supplier under a specific contract. When an organization entrusts some of its activities or business processes to a supplier outside its company or organization, this practice is called outsourcing. In many cases, in outsourcing, the decision-making right and production factors are transferred to another organization [11]. The global capital markets have undergone extraordinary changes for more than a decade. Because of this, strategies, risk frameworks, and operating models in the banking sector have undergone revisions. That is because of more regulations, a greater reliance on technology, a drop in revenue, a more aggressive approach to finding new business opportunities, and a need to cut costs. Furthermore, the fundamental societal changes pose further challenges to the existing setups [5]. It is clear to the banks that they cannot handle the challenges on their own. Outsourcing operational activities to cut costs is a phenomenon that has been around for a bank. But as outsourcing models have changed, these banks have realized that they could partner with these service providers to save money and get expert help from these outsiders [12]. According to estimates, 81% of banks will outsource at least one primary function. Moreover, this figure will continue to grow as more banks realize the potential of outsourcing for their operations and business growth. Banks that embrace this trend can leverage the advantages of outsourcing by focusing on strategic priorities, reducing operational costs, staying up-to-date with the latest industry trends, and strengthening their competitive edge in an ever-changing market landscape [8]. In the banking industry, outsourcing often serves as a way to cut costs. However, it can also help improve efficiency and service quality. In addition, outsourcing can help banks stay ahead of their competitors if done carefully. For years, banks have outsourced various activities such as customer contact center services and back office operations. Recently, they have started outsourcing critical IT and HR functions [7].

There are various motivations why banks outsource. The most common reason is to save operating costs. Banks can reduce operating costs by outsourcing non-core operations to a specialized provider. In addition, outsourcing can help banks improve the efficiency and quality of their services. However, outsourcing can be complicated, so working with a reputable and experienced provider is essential. When choosing a provider, banks should consider their reputation, track record, and ability to meet the bank's specific needs [14]. Devices that enable the transfer of funds using smart cards electronically at the point of sale are called sales terminals. The sales terminal system, using a smart card that has the ability to store and convert information in its memory, provides buyers (card holders) with the opportunity to purchase without cash. In this way, the money paid is transferred from the buyer's account to the seller's account .Point of sale machines mean the electronic transfer of funds at the point of sale, according to which the customer can withdraw money from his bank account at any point of time and place when he wants the goods or services, using various forms of safe identification and secure electronic connection ring. or the financial institution transfers to the seller.

### 2.2 Sales terminals

With the beginning of the use of modern banking, the banks were gradually equipped with ATMs, branch terminals and sales terminals. Sepeh Bank was the first Iranian bank that succeeded in installing a bank teller machine and issued

an electronic card in the banking system, and National Bank was the first bank to install a sales terminal in stores and shopping centers. Currently, in the state banking system, Saderat Bank among commercial banks, Agricultural Bank among specialized banks, and New Economy Bank among private banks have the most sales terminals [11]. POS devices are set up in such a way that by installing the mentioned devices in shopping centers and stores, the connection between the account introduced by the receiving store and the planned POS device is established through the telephone lines by the modem with the switch card of the banks. And the POS device as an intermediary means that when the customer visits the store to buy, he can make a purchase using all kinds of electronic cards issued by Shatab member banks with a high reliability factor by swiping the card on the device and entering the password and purchase amount. Sales terminal devices have many advantages for the entire banking system and customers of banks and money and financial markets of the country, including:

1- Reduction of customers visiting bank branches in order to receive cash and also deposit money into centralized accounts.

2- Less consumption of bank ATMs due to fewer customers visiting to receive cash

3- Reducing the wear and tear of circulating banknotes due to the exchange of banknotes and as a result preserving the national capital

4- Reducing the volume of transactions of Iran checks and other traveler's checks issued by banks, and as a result, reducing the volume of operations of the banking document tracking room.

5- No withdrawal of cash from the banking system and from customers' accounts and deposits in the hands of the people

6- Improving the level of public health and reducing infectious diseases due to contact with banknotes and coins

7- Reducing traffic and noise pollution and reducing gasoline and vehicle consumption, especially in big cities.

8- Improving the level of awareness of customers and the general public

9- Increasing employment and creating job opportunities and generating income and generating wealth in the society [5].

### 2.3 Game theory

Game theory uses mathematical models to analyze the methods of cooperation or competition of logical and intelligent beings [8]. Game theory is a branch of applied mathematics that is used in social sciences and especially in economics, biology, engineering, political science, international relations, Computer science, marketing, philosophy and gambling are used. Game theory tries to use mathematics to estimate behavior in strategic situations or in a game in which the success of the individual in choosing depends on the choices of others. Slow And it models the mathematical behavior governing a strategic situation (conflict of interests). This situation arises when a person's success depends on the strategies that others choose. The ultimate goal of this knowledge is to find the optimal strategy for the players. In the beginning, game theory was equivalent to a zero-sum game, in which the profit (or loss) of one participant is exactly balanced by the losses (or profits) of other participants, and the players have something They get it if another player has lost it. [9].

Game theory is a parent word for sciences that analyze the mutual logical behavior of humans, animals and computers. Game theory is a theoretical framework for imagining social situations among competing players. In some respects, game theory is the science of strategy, or at least the optimal decision-making of independent and competing actors in a strategic environment. The main pioneers of game theory were mathematician John von Neumann and economist Oskar Morgenstern in the 1940s. Mathematician John Nash is considered by many to have provided the first significant development of von Neumann and Morgenstern's theory [10]. According to this theory, the behavior and decisions of economic actors, unlike traditional economic theories, depend not only on the behavior and decisions of the individual, but also on the behavior and decisions of other actors in that field of activity. Therefore, according to this theory, decisions are made in a strategic interactive space. One of the applied models in game theory is the manager-agent model. According to this model, a player (manager) entrusts the performance of an economic activity to another and motivates him to perform the said action, while their desirability and benefit may be different. The manager-agent model seeks to provide solutions that align the different interests resulting from the economic interest of both parties to the contract and resolve the conflict of their interests [6].

## 3 Research methodology

The current research is practical in terms of direction because it seeks to identify a balanced and win-win strategy in the interaction of banks and PSP companies in outsourcing the activities of card reader devices. The research approach is comparative, inductive, and the research methodology is hybrid. The method of collecting field data and the research strategy is content analysis. The purpose of research is exploratory and the method of collecting information is through interviews and questionnaires. In this research, in the first step, to identify the priorities and strategies of the bank and PSP companies, an interview was conducted with the company's experts. The interview protocol of the parties was revised in several stages by conducting pre-interviews and receiving experts' opinions. Since there was no suitable and documented database to determine the interviewees, sample collection was done by judgment and snowball method until theoretical saturation was reached. Theoretical saturation means until new data does not create new added value. This was achieved in the sixth sample of the company's experts and the seventh of the bank's experts, but to ensure the sufficiency of the data, interviews were continued up to the 16th sample (8 banking experts and 8 corporate experts). The interview was conducted in a semi-structured manner and the duration of the interviews varied from 40 to 60 minutes for each person. The interviewees were free to respond and at the beginning of the interview, the purpose of the research and explanations about the topics discussed in the interview were presented. Participant feedback strategy was used for the reliability of research findings. This means that the interpretation of the participant's statements was presented to them and the cases that were the result of incorrect perception were corrected. After the completion of the interview, the content analysis method was used to analyze the text of the interviews using the Max Kyuda software, which is widely used in qualitative research. In order to measure the validity of the results obtained from the content analysis, the results were sent to several experts and received approval in terms of appropriateness and applicability. Each type of indicators and main sub-indices were identified as the common strategies of the parties, but considering that these strategies did not have the same value for the parties, a pairwise comparison questionnaire was used to identify the weight of the indicators, and the opinions of the experts of each party were collected separately. Hierarchical analysis was used to obtain the weight of each index and consistency rate index was used to check the reliability of the obtained results. The research steps are shown below.

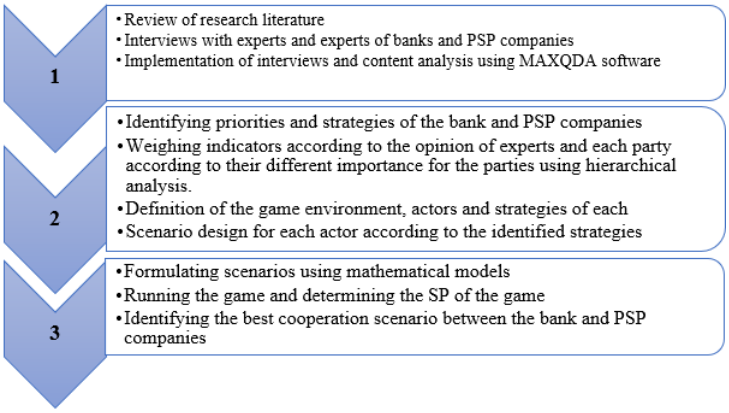


Figure 1: Steps to identify the best strategy of PSP banks and companies

## 4 Data analysis and hypothesis testing

In this research, in order to identify the bank's strategies and priorities in outsourcing card reader devices and to identify the company's strategies and priorities in accepting and persuading the bank to cooperate, 16 semi-structured interviews were conducted with experts from PSP companies (3 companies) and bank experts (8 experts). The company and 8 bank experts) accepted. In terms of demographic data, in terms of gender, the statistical population includes 5 women and 11 men, in terms of degree, it includes one doctoral student, 11 master's degree and 4 bachelor's degree, in terms of job rank, it includes 3 people over 20 years old, 6 people between 15 and 20, 3 7 people were under 15 years old.

Strauss and Corbin's method of continuous comparison was used for analysis. In this method, data collection and analysis take place at the same time, that is, after each interview and before proceeding to the next interview, the data

Table 1: Demographic information of the interviewees

| Row | Organization | gender | Work Experience | education | Side |
|---|---|---|---|---|---|
| 1 | Bank | Man | 22 | PHD student | Vice President of Customer Affairs |
| 2 | Bank | Man | 16 | Masters | Expert in charge of electronic banking |
| 3 | Bank | Female | 15 | Masters | Electronic banking expert |
| 4 | Bank | Man | 17 | Masters | Expert in charge of marketing |
| 5 | Bank | Man | 22 | Masters | Head of the branch |
| 6 | Bank | Man | 8 | Masters | Electronic banking expert |
| 7 | Bank | Female | 12 | Masters | The senior banker of Tahizhimanabe |
| 8 | Bank | Female | 20 | Bachelor's degree | Head of the branch |
| 9 | Company PSP | Female | 15 | Masters | Company manager of Sistan and Baluchistan province |
| 10 | Company PSP | Female | 6 | Bachelor's degree | Company manager of Sistan and Baluchistan province |
| 11 | Company PSP | Man | 9 | Masters | Company manager of Yazd province |
| 12 | Company PSP | Man | 8 | Bachelor's degree | Company marketing expert |
| 13 | Company PSP | Man | 5 | Bachelor's degree | Company marketing expert |
| 14 | Company PSP | Man | 15 | Masters | Head of South Khorasan Company |
| 15 | Company PSP | Man | 10 | Masters | Responsible for Qom province company |
| 16 | Company PSP | Man | 8 | Masters | The head of the company in Kerman province |

Source: research findings

are coded. Based on the three-step process of thematic analysis, in the first step, to perform open coding, the text of the interview was entered into Microsoft Word software, and then the file was transferred to Max Kyuda software. By examining and analyzing the interviews line by line, important sentences were identified and selected as open codes. These codes were a directional interpretation of the writings and in some cases the same writings that in this research, at the end of the analysis of the 16th interview, 273 initial codes or open codes were created. In the second stage, by continuously comparing the open codes created several times, similar codes were grouped based on the similarity of the degree of compatibility and similarity with the discovered concepts, and in this research, 16 subgroups were created, and then the subgroups were created in 4 product categories. , price, distribution and promotion were categorized based on semantic, conceptual and operational affinity. Table 2 summarizes the codings.

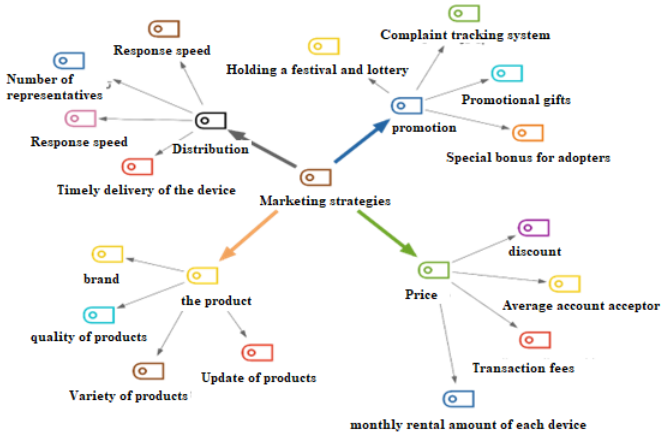


Figure 2: Codes and sub-codes segmented model of strategic priorities of PSP banks and companies

### 4.1 Assumptions identified from the interviews of bank experts and PSP companies

Price: the total income and cost that each device has for the parties during a month. Rent: the cost that the bank pays to the company every month for supporting each sales terminal device. Transaction fee: a fee that is deducted from the bank account for each transaction and a percentage of it is deposited into the PSP company account. High transaction devices are more profitable for the company. Discount: reduction of the rental amount when the contract is signed by the bank, which can be in the form of non-payment of rent for a number of devices (for example, in the case of a contract of 5 thousand devices, the company allocates a thousand free devices to the bank) or in the form

Table 2: Summary of coding priorities and strategies of banks and PSP companies

| **Main article** | **Subcategories** | **open codes (concepts)** |
|---|---|---|
| Price | Monthly rental amount<br>Discount<br>Transaction fees<br>Average device count | Bank: The rental of the device must be in accordance with the bank's standards. Devices with high transaction should have a discount. Considering that the only benefit of the bank is in the average of the accounts connected to the sales terminal in order to prevent the collection of the device, the average account should be considered in the marketing of the company.<br><br>Company: The rental of the device should be proportional to the service and maintenance costs of the device. The status of the number of transactions of devices. The devices should be installed in more commercial and high-transaction locations, according to the number of transactions, the profit received by the company increases. |
| the product | Device brand<br>Variety of products<br>Device quality<br>Update of products | Bank: Past history and past performance of the company. Allocation devices must be new and of a valid brand. The company's portal should be fast and easy to use. The devices should be purchased from a reliable place and a reputable company. The device should be up-to-date in terms of hardware. The device software can be automatically updated. timely supply of all types of terminals such as LAN, wireless, ChPRS, touch and Android. The devices should be of high quality in terms of construction, body, antenna, battery charging rate.<br><br>Company: According to the needs of the bank, the company can provide different types of devices in terms of telecommunication platform and service delivery method. : Providing the most up-to-date and diverse products and services with the highest quality. |
| Distribution | Number of representatives<br>Response speed<br>Timely delivery<br>Response hours | Bank: The backups of the company should be in accordance with the geographical location and the number of devices. Considering that the number of banks and companies providing card reader devices is large, the acceptor has the option of choosing, and in case of delay, he will definitely go to the competitors. Supporters' response hours should be according to the working hours of the receivers. The follow-up of complaints of breakdowns from the time of customer contact to solving the problem should be done according to the standards and in the contract according to the conditions and distance.<br><br>Company: Increasing the number of support offices and backups in proportion to the installed card readers.<br>Increasing the response time of the support staff in accordance with the working hours of the markets in the covered areas. Increasing the number of backup devices to quickly replace the faulty device |
| promotion | Lottery<br>gifts<br>Special privileges<br>Complaint tracking system | The bank conducts a lottery among the acceptors of the agricultural bank system.<br>Donation of advertising gifts to the acceptors of the Bank of Agriculture<br>Providing special services to recipients such as accounting software<br>The company should have a complaint follow-up system for registration and follow-up by the recipients.<br>Necessary information to customers regarding how to follow up requests.<br><br>Company: The company organizes a seasonal festival for device adopters and draws based on the number of transactions performed for each device. Apart from that, promotional items such as gift cards, flash cards, etc. are given to special recipients. For chain stores and companies that have contracted out, it is possible to install an accounting system with the ability to connect wireless devices to the company's accounting system.<br>Providing a complaint registration and follow-up system for recipients. |

Source: research findings

of a discount in the rental of high-transaction devices The cost is for the bank. Deposit of the device: It is called the monthly average of the account connected to the sales terminal that is deposited in the bank. Considering that the only profit of the bank comes from this place, this index is very important for the bank.

Product: the physical device by which the needs and demands of the customers (acceptors) applying for the sales terminal are met. Brand: model, company and country of device manufacturer. Product quality: including the quality of the hardware parts of the device, antenna, charging time, speed of device charging, speed of transaction, quality of customer receipt printing. Product variety: providing different types of fixed card readers such as telephone, network, internet and computer and mobile card readers including SIM card, mobile and Android. Up-to-date products: using the latest and most advanced models of card readers available in the market. The latest software versions, the possibility of automatic software updates

Distribution: All matters related to registration, allocation, delivery, installation and support of card reader devices. Number of representatives: the number of company support centers located in the main cities of the province or the number of support centers located in different regions of the province to respond to the receivers of the sales terminals. Timely delivery of the device: the time it takes from the registration of the customer's request to the allocation and installation of the device at the customer's workplace. This time should be defined according to the standard and acceptable. Answering hours: the time period that the company's support is answering to the receivers of the device. This time should be in accordance with the working hours of the regional markets. Response speed: the time it takes from the announcement of the device failure by the receiver to the time the company representative arrives and solves the problem.

Promotion: to the set of actions that the company takes to encourage the acceptors to use bank card reader devices. Holding seasonal festival and lottery: at the end of each season, the company organizes a lottery among the owners of bank card reader devices and awards them. Does. Promotional gifts: The company gives gifts to customers such as flash drives, scales, wireless modems, etc. Special privilege: The company assigns special privileges to VIP customers. Membership in the customer club, enjoying special discounts from the company's special apps, installing the connection of the customer's mobile card reader with its accounting system, etc. Complaint tracking system: a system with an easy user interface in the form of 724, to record and track customer complaints.

As shown in Table 3, the strategies of response speed, brand, number of representatives, rental amount and product quality were the most repeated in the interviews of the parties. Bank experts emphasized the speed of response, quality of products, brand, and number of agents, and company experts emphasized rent, speed of response, and transaction fees, and did not mention the average account acceptor.

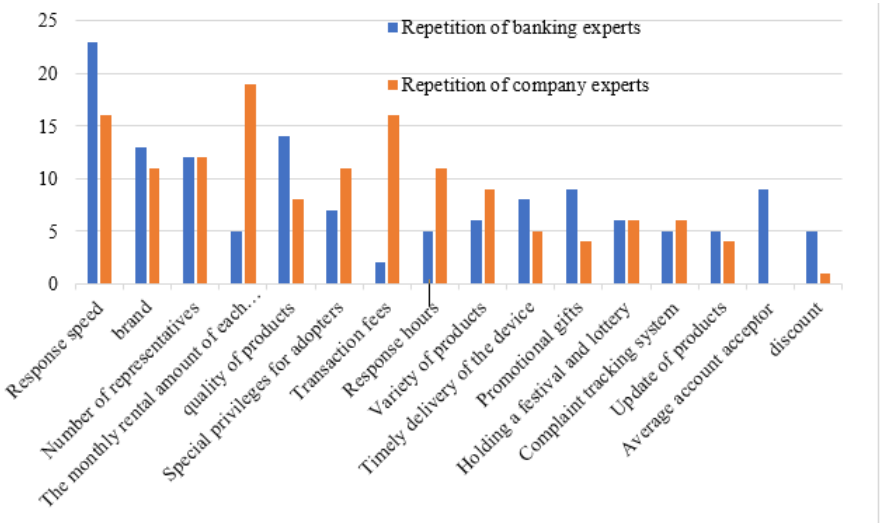


Figure 3: Bar graph of the repetition of strategies identified in the interviews of banking experts and company experts

### 4.2 Weighting of identified strategies

After identifying the strategies and priorities of PSP companies, considering that the identified concepts are not of equal importance to the parties, we need to identify the weights of each of these indicators. For this purpose, by using a questionnaire of paired comparisons, the opinions of experts and experts of each side were collected about the

Table 3: Repetition of the concepts identified in the interviews of bank experts and PSP companies

| Main | Identified strategies | Repetition rate | Percentage of repetitions of the total | Repetition of banking experts | Percent | Repetition of company experts | Repetition percentage |
|---|---|---|---|---|---|---|---|
| Distribution | Response speed | 39 | 14 | 23 | 59 | 16 | 41 |
| the product | brand | 24 | 9 | 13 | 54 | 11 | 46 |
| Distribution | Number of representatives | 24 | 9 | 12 | 50 | 12 | 50 |
| Price | Rent | 24 | 9 | 5 | 21 | 19 | 79 |
| the product | quality of products | 22 | 8 | 14 | 64 | 8 | 36 |
| promotion | Special privileges | 18 | 7 | 7 | 39 | 11 | 61 |
| Price | Transaction transaction fee | 18 | 7 | 2 | 11 | 16 | 89 |
| Distribution | Response hours | 16 | 6 | 5 | 31 | 11 | 69 |
| the product | Variety of products | 15 | 5 | 6 | 40 | 9 | 60 |
| Distribution | Timely delivery | 13 | 5 | 8 | 62 | 5 | 38 |
| promotion | Promotional gifts | 13 | 5 | 9 | 69 | 4 | 31 |
| promotion | Holding a festival and lottery | 12 | 4 | 6 | 50 | 6 | 50 |
| promotion | Complaint tracking system | 11 | 4 | 5 | 45 | 6 | 55 |
| the product | Update of products | 9 | 3 | 5 | 56 | 4 | 44 |
| Price | Account average | 9 | 3 | 9 | 100 | 0 | 0 |
| Price | discount | 6 | 2 | 5 | 83 | 1 | 17 |

Source: research findings

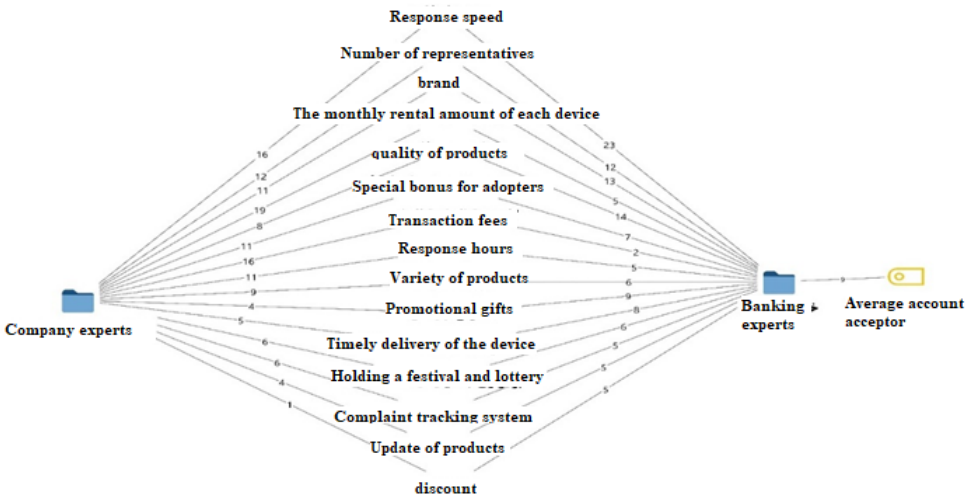


Figure 4: The level of emphasis of the bank experts on the identified strategies compared to the company experts

weight of each of the 4 main indicators of the product, price, distribution and triage and the sub-indicators of each separately. The questionnaires are attached.

After collecting the questionnaires, we formed a matrix of paired comparisons based on the scores and prioritization of the variables. And we calculate the weight of each index using hierarchical analysis. One of the advantages of hierarchical analysis is the ability to control and measure the validity of experts' answers by calculating the inconsistency rate. The inconsistency rate is an index whose value indicates possible contradictions and inconsistencies in the matrix of pairwise comparisons. According to Mr. Saati, the founder of the AHP method, if the inconsistency rate is less than 0.1, the compatibility of the comparison matrix is confirmed and acceptable. But if the inconsistency rate is greater than 0.1, it indicates a contradiction in the evaluations and judgments of experts. The weight and compatibility rate of the identified indicators are shown in the following tables.

Table 4: The weight of the identified indicators based on the opinion of the experts of the bank and PSP companies

| The main indicator | Symbol | Bank weight | Compatibility rate | The weight of PSP companies | Compatibility rate |
|---|---|---|---|---|---|
| the product | $P_t$ | 0.50 | 0.052 | 0.49 | 0.065 |
| Price | $P_e$ | 0.23 | | 0.27 | |
| Promotion | $P_n$ | 0.10 | | 0.11 | |
| Distribution | $P_r$ | 0.16 | | 0.13 | |

Source: research findings

In the main concepts identified, the product is the most important from the point of view of the bank and the company, after that the price is chosen as the second priority. The bank's experts have chosen distribution as the third priority and promotion as the fourth priority, and according to the company's experts, promotion was the third priority and distribution was the fourth priority.

In the distribution index, from the perspective of the bank, response speed, on-time delivery, number of agents and response hours, and from the perspective of the company, the number of agents, response speed, on-time delivery, and response hours were selected priorities. As indicated in the above tables, the calculated consistency rate is less than 0.1 in all cases, which confirms the reliability of the questionnaire.

Table 5: The weight of the identified indicators based on the opinion of the experts of the bank and PSP companies

| **The main indicator** | **Sub-index** | **Symbol** | **Bank weight** | **Compatibility rate** | **Weight of PSP companies** | **Compatibility rate** |
|---|---|---|---|---|---|---|
| the product | brand | $P_{t1}$ | 0.13 | 0.015 | 0.45 | 0.095 |
| | Variety | $P_{t2}$ | 0.26 | | 0.27 | |
| | Quality | $P_{t3}$ | 0.47 | | 0.17 | |
| | being up to date | $P_{t4}$ | 0.14 | | 0.1 | |
| Price | Rent | $P_{r1}$ | 0.28 | 0.052 | 0.45 | 0.063 |
| | Wage | $P_{r2}$ | 0.12 | | 0.26 | |
| | Sediment | $P_{r3}$ | 0.55 | | 0.16 | |
| | Discount | $P_{r4}$ | 0.06 | | 0.12 | |
| promotion | Lottery | $P_{n1}$ | 0.34 | 0.074 | 0.39 | 0.041 |
| | gifts | $P_{n2}$ | 0.21 | | 0.28 | |
| | Special privileges | $P_{n3}$ | 0.27 | | 0.19 | |
| | tracking system | $P_{n4}$ | 0.17 | | 0.14 | |
| Distribution | Number of representatives | $P_{e1}$ | 0.23 | 0.096 | 0.37 | 0.88 |
| | Response speed | $P_{e2}$ | 0.36 | | 0.33 | |
| | Timely delivery | $P_{e3}$ | 0.28 | | 0.2 | |
| | Response hours | $P_{e4}$ | 0.13 | | 0.1 | |

Source: research findings

### 4.3 Implementation of the problem in game theory

The elements of the game

Actors

First player: Bank

Second player: PSP companies.

**Player strategy**

Based on interviews with experts, 16 strategies based on a mix of 4 marketing pillars were identified for each player. Based on this, each player can.

Choose your strategy based on these 16 strategies. Players are free to choose the number of strategies, with the condition that the priorities and choices of both parties are not the same. This means that the strategy that is chosen as a priority for one side cannot be chosen by the other side. for example

Table 6: trategies faced by actors

| Strategy | Pt1 | Pt2 | Pt3 | Pt4 | Pr1 | Pr2 | Pr3 | Pr4 |
|---|---|---|---|---|---|---|---|---|
| Bank | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| Company | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |

Source: research findings

Based on this, the players' strategies will be as follows.

**Player strategy 1**

$$
\begin{aligned}
S1 &= w_1 P_t + w_2 P_r + w_3 P_n + w_4 P_e \\
P_t &= w_{11} P_{t1} + w_{12} P_{t2} + w_{13} P_{t3} + w_{14} P_{t4} \\
P_r &= w_{21} P_{r1} + w_{22} P_{r2} + w_{23} P_{r3} + w_{24} P_{r4} \\
P_n &= w_{31} P_{n1} + w_{32} P_{n2} + w_{33} P_{n3} + w_{34} P_{n4} \\
P_e &= w_{41} P_{e1} + w_{42} P_{e2} + w_{43} P_{e3} + w_{44} P_{e4} \\
S1 &= w_1 (w_{11} P_{t1} + w_{12} P_{t2} + w_{13} P_{t3} + w_{14} P_{t4}) + w_2 (w_{21} P_{r1} + w_{22} P_{r2} + w_{23} P_{r3} + w_{24} P_{r4}) \\
&\quad + w_3 \left(w_{31} P_{n1} + w_{32} P_{n2} + w_{33} P_{n3} + w_{34} P_{n4}\right) + w_4 (w_{41} P_{e1} + w_{42} P_{e2} + w_{43} P_{e3} + w_{44} P_{e4})
\end{aligned}
$$

**Player strategy 2**

$$
\begin{aligned}
S2 &= w‘_1 p‘_t + w‘_2 p‘_r + w‘_3 p‘_n + w‘_4 p‘_e \\
p‘_t &= w‘_{11} p‘_{t1} + w‘_{12} p‘_{t2} + w‘_{13} p‘_{t3} + w‘_{14} p‘_{t4} \\
p‘_r &= w‘_{21} p‘_{r1} + w‘_{22} p‘_{r2} + w‘_{23} p‘_{r3} + w‘_{24} p‘_{r4} \\
p‘_n &= w‘_{31} p‘_{n1} + w‘_{32} p‘_{n2} + w‘_{33} p‘_{n3} + w‘_{34} p‘_{n4} \\
p‘_e &= w‘_{41} p‘_{e1} + w‘_{42} p‘_{e2} + w‘_{43} p‘_{e3} + w‘_{44} p‘_{e4} \\
S2 &= w‘_1 (w‘_{11} p‘_{t1} + w‘_{12} p‘_{t2} + w‘_{13} p‘_{t3} + w‘_{14} p‘_{t4}) + w‘_2 (w‘_{21} p‘_{r1} + w‘_{22} p‘_{r2} + w‘_{23} p‘_{r3} + w‘_{24} p‘_{r4}) \\
&\quad + w‘_3 \left(w‘_{31} p‘_{n1} + w‘_{32} p‘_{n2} + w‘_{33} p‘_{n3} + w‘_{34} p‘_{n4}\right) + w‘_4 (w‘_{41} p‘_{e1} + w‘_{42} p‘_{e2} + w‘_{43} p‘_{e3} + w‘_{44} p‘_{e4})
\end{aligned}
$$

Consequences of the game

The purpose of playing the game is to find strategic priorities for each player. Therefore $P_{ij}$ and $P‘_{ij}$ have zero and one values, and we know that $P_{ij}$ and $P‘_{ij}$. Considering that $P_{ij=\{0,1\}}$ and $i \star j = 16$, for player 1, we will have $2^{16}$. 65,536 scenarios, and similarly, the scenarios facing player 2 will be equal to $2^{16}$. We calculate the consequences of all scenarios using equations. An example of the calculation results is shown in Table No. 7.

Table 7: An example of the outcome of the execution scenarios of the bank and PSP companies

| scenario | Bank | Company | Absolute value | difference | rank |
|---|---|---|---|---|---|
| 1 | 0.49 | 0.51 | 0.0222 | -0.02 | 3028 |
| 2 | 0.51 | 0.49 | 0.0116 | 0.01 | 1633 |
| 3 | 0.53 | 0.48 | 0.0486 | 0.05 | 6752 |
| 4 | 0.55 | 0.47 | 0.0824 | 0.08 | 11463 |
| 5 | 0.54 | 0.46 | 0.0783 | 0.08 | 10939 |
| 6 | 0.56 | 0.45 | 0.1121 | 0.11 | 15613 |

Source: research findings

Out of 65536 possible scenarios for each player, we have 8 scenarios with the same outcome that are candidates for Nash equilibrium. The scenario that has the most points for both sides is chosen as the best scenario and the result of the game.In the selected scenario, which has the most points for the parties as a result of the game, bank choices, variety, quality, freshness, deposit, discount, lottery and choice of PSP company, brand, rent, fee, gifts, special privileges, follow-up system , the number of agencies, response speed, timely delivery and response hours. Choosing these strategies does not mean eliminating other strategies, but it means that more focus has been made on these strategies. The Nash equilibria of the game and the result of the game are shown in Table No. 8.

Table 8: Nash equilibria identified from the game

| rank | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| | 0.609 | 0.606 | 0.596 | 0.531 | 0.502 | 0.453 | 0.439 | 0.436 |
| Bank strategies | Variety | Variety | Quality | Variety | brand | Variety | brand | brand |
| | Quality | Quality | updated | updated | Quality | updated | updated | Rent |
| | updated | Sediment | Rent | Rent | updated | Rent | Rent | Sediment |
| | Sediment | Lottery | Sediment | Sediment | gifts | Wage | Sediment | gifts |
| | Discount | Special privileges | Lottery | gifts | tracking system | Discount | Discount | Special privileges |
| | Lottery | tracking system | gifts | tracking system | Number of representatives | Lottery | gifts | tracking system |
| | brand | Number of representatives | Timely delivery | Response speed | Response speed | gifts | Response speed | Number of representatives |
| | Rent | brand | brand | Timely delivery | Variety | Special privileges | Response hours | Response speed |
| Company strategies | Wage | updated | Variety | brand | Rent | Timely delivery | Variety | Response hours |
| | gifts | Rent | Wage | Quality | Wage | Response hours | Quality | Variety |
| | Special privileges | Wage | Discount | Wage | Sediment | brand | Wage | Quality |
| | tracking system | Discount | Special privileges | Discount | Discount | Quality | Lottery | updated |
| | number of representatives | gifts | tracking system | Lottery | Lottery | Sediment | Special privileges | Wage |
| | Response speed | Response speed | Number of representatives | Special privileges | Special privileges | tracking system | tracking system | Discount |
| | Timely delivery | Timely delivery | Response speed | Number of representatives | Timely delivery | Number of representatives | Number of representatives | Lottery |
| | Response hours | Response hours | Response hours | Response hours | Response hours | Response hours | Timely delivery | Timely delivery |
| The outcome of the company | 0.609 | 0.606 | 0.596 | 0.531 | 0.502 | 0.453 | 0.439 | 0.436 |

Source: research findings

The proposed model of the best scenario of the bank's interaction with PSP companies based on game theory is proposed as follows.

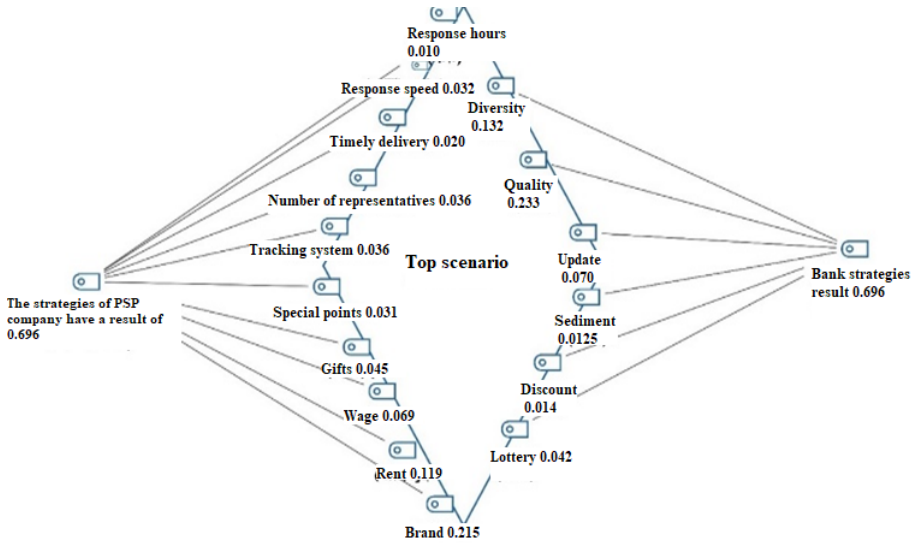


Figure 5: Proposed model of bank interaction with PSP companies
Source: research findings

## 5 Discussion and conclusions

The importance of the present research, apart from the mathematical modeling of the managerial process of outsourcing the organization's activities, is to examine this process with a different perspective from the studies conducted in this field. In outsourcing researches, usually only the strategies and priorities of the organization delegating the activities are examined and the priorities and strategies of the organizations involved are not given importance, which in many cases causes problems for the parties in the stages after the transfer. Although this problem can be solved by changing the contractor, it will impose a lot of costs on the assigning organization. In this research, in addition to identifying the priorities and strategies of the organization delegating activities and services, we have also tried to identify the goals and strategies of the companies applying for these activities. Usually, in such collaborations, most of the strategies are shared and only in terms of weight and importance, there are differences for the parties, which is also considered in the research. Finally, according to the need to make decisions in the conditions of conflict and cooperation, game theory has been used. Game theory deals with the mathematical study of the decision-making process and mathematical models of conflict and cooperation. This means that it can model the behavior of people in certain conditions and provide the possibility of examining the relationships between decisions and results.In this research, the interaction of PSP companies with the bank in the outsourcing of card reader devices was developed based on the strategies of the parties with the aim of reaching a common equilibrium point using non-cooperative model game theory and based on complete information.

At first, through interviews with experts and using content analysis, 16 strategies were identified for banks and PSP companies, then through questionnaires and hierarchical analysis, the weight of each strategy was obtained separately for banks and companies. Considering that the bank and the companies had freedom of action in choosing a number of strategies and the chosen priorities could not be shared, $16^2$ or in other words 65,536 scenarios were identified for the parties. After performing calculations and obtaining the consequences of possible scenarios for the parties, 8 scenarios with the same consequences were identified as equilibrium scenarios or Nash game equilibria. The scenario that had the most consequences for the parties was chosen as the outcome of the game.

In the selected scenario, the bank emphasized the strategies of variety, quality and freshness from the product sub-set, deposit and discount from the price sub-set and lottery from the promotion sub-set.

Considering that it is very important for the bank to have a colorful presence in the market and increase the market share of this service among the banking network, the quality of the product offered to the customer and the possibility of providing different types and updates of these devices according to the needs of the customers can be very effective in achieving this goal. In addition to that, the quality, diversity of the product and the presentation of the latest and most advanced models of the device are important factors in the satisfaction of the receivers, who are actually the final customers of this service for the bank. In terms of financial benefits, the average account connected to the device or the deposit of the device is the only benefit of the bank in this interaction. In fact, these factors are

interdependent and the interests of the bank will not be provided without the possibility of providing a quality device with the latest technology and in accordance with the customer's needs. And the advantage of the lottery strategy for the bank is that this strategy, unlike other promotion strategies that are only carried out for special customers with high transactions, includes all acceptors.

For PSP companies in this scenario, the brand is selected from the product, rent and fee from the price, gifts, special privileges and follow-up system from the promotion and number of agents, response speed, on-time delivery and response time from the distribution. Considering that a part of the credit of the companies is determined based on the name and brand that they represent, the device brand has a special importance in advertising and marketing of the companies. The financial interests of the company are from the rent and fees received from device transactions, and the selection of these strategies provide the financial interests of the company. Although the gifts and special privileges involve costs for the company, they are justified because they are only for special customers who usually have high transactions and a percentage of the fees of these transactions are deposited into the company's account. The number of agencies, response hours, follow-up system, response speed and on-time delivery are among the competitive advantages of the companies that banks emphasize on these when outsourcing this service, and a company that lacks some of these factors or has a good history If it does not provide the mentioned services, it will not have much chance to start this interaction.

By examining the interviews and opinions of banking experts, quality, variety, deposition and novelty were the first to fourth priorities, lottery was the eighth priority and discount was the last priority. In the opinions of the company's experts, the brand was the first priority, the rent was the third, the fee was the fifth, the gifts were the eighth, and the rest of the strategies were in the tenth priority.

It may seem that in the selected scenario some strategies are not the priorities of the parties and even the selection of some strategies is considered a privilege for the other party, but it is necessary to mention that this research seeks to find the best strategy for the bank or PS companies. It was not followed and its main goal was to reach the equilibrium scenario or the Nash equilibrium with the greatest consequences, so that by choosing it, the possibility of mutual and long-term cooperation between the parties is provided.

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