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(Research Paper)

Proposing an approach for selecting outsourcing strategies in the two-level bidirectional service supply chain with a case study in healthcare services

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Abstract

Purpose: This paper aims to propose an approach for selecting outsourcing strategies in the two-level bidirectional service supply chain.

Design/methodology/approach: Analytic hierarchy process (AHP) has been used for selecting two factors that have maximum influence on service outsourcing decisions. The selected factors have been integrated with quadrant analysis for selecting outsourcing strategies. Two questionnaires have been developed to indicate the importance and correlation of objectives of outsourcing and choosing factors that have an influence on service outsourcing decisions in the selected service supply chain of a hospital in Isfahan, Iran. Questionnaires have been fulfilled by senior managers and supervisors in a hospital.

Findings: Findings indicate that customer contact and relative capability position in the process have maximum effect on service outsourcing decisions in the selected service supply chain and when relative capability position in the process is high, it is better for the decision-makers to contribute with other organizations since it provides better situation to discover weaknesses of the organization.

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Research limitations/implications: The case study was limited only to one type of service supply chain, i.e., a two-level bidirectional service supply chain.

Practical implications: Managers of various (industrial and service) sectors by using the proposed model of this research can concentrate on the variables that have more influence on outsourcing the desired processes and choose appropriate supply strategies for their processes in various conditions.

Social implications: In this paper, customer contact and relative capability position in the process were found as having a maximum influence on pathology process outsourcing and they were selected for quadrant analysis and defining outsourcing strategies

Originality/value: The uniqueness of the subject of this paper is apparent as no similar research was found in the literature investigating the relationship between different service supply chains types and outsourcing.

Keywords: Outsourcing, Service Supply Chain Management (SSCM), Health care, Analytic hierarchy process (AHP), Quadrant Analysis

1. Introduction

Outsourcing is one of the most research fields in management studies applied as a managerial strategy to improve the efficiency and effectiveness of resource management. It has become a strategic decision for most organizations in the present context of globalization and circular economy (Agrawal & Singh, 2020). Outsourcing is a kind of delegation of authority process in which the production of service is assigned to the external suppliers to benefit the customer (Ikediashi & Okwuashi, 2015). Outsourcing describes the approach of organizations to make use of resources beyond their organizational boundaries (Gossler et al., 2020). It is a practice in which an organization contracts out one of its in-house operations that the organization cannot concentrate on anymore to the company (the service provider) specialized in that operation (Lee & Walsh, 2011). Outsourcing refers to the relocation of processes to external providers irrespective of the provider's location (Nassimbeni & Sartor, 2012). Outsourcing is a critical strategic decision in many organizational functions such as accounting, information systems management, human resources management, supply chain management, and manufacturing (Varadarajan, 2009). Some studies show that outsourcing allows a firm to not only cut costs but also focus on its core competencies and help speed up its innovation processes (Florin et al., 2005; Graf & Mudambi, 2005).

Services are motivated by the evolution of the world's economies. Developed economies of the world have continued their evolution to becoming predominantly service-based. With the fast-developing world economy and global marketplace, there has been a drastic increase in the pressure on organizations to find new ways to create and deliver value to customers through supply chain management (Seth et al., 2006).

Service Supply Chain Management (SSCM) is an analogous system approach that is especially suitable for delivering mobile services such as parcel delivery and home health care (Shahin, 2010). There has been a growing recognition of building a relationship with the

customer for improvements in profitability and reduced costs in the supply chain (Seth et al., 2006). There do not seem to be enough references on SCM in service applications and service supply chains outsourcing. Available references are relatively old and include Sampson (2000), who demonstrated customer-supplier duality and bidirectional supply chains in service organizations; Shahin (2010), who explained customer-supplier duality and addressed particular elements and impacts of SSCM. He emphasizes that SCM in service is more complicated than in manufacturing. The other types of a service supply chain include a single-level bidirectional supply chain, two-level bidirectional supply chain, and Unidirectional supply chain (Sampson, 2000; Shahin, 2010).

Baltacioglu et al. (2007), conducted a study in the field of the service supply chain. They proposed a general supply chain model for the services industry is proposed. The model included all elements of the supply chain (supplier, service provider, and consumer) and defined the managerial activities to be fulfilled for effective management of service supply chains. Such activities were identified as demand management, capacity and resources management, customer relationship management, supplier relationship management, order process management, and service performance management. The proposed model was applied in the healthcare industry.

One of the cases that are the component of service classification is healthcare services; today, hospital executive managers must decide on patients' clinical needs. They must make sure that the hospital has enough personnel, medical practitioners, and equipment and can maintain hospital systems relaxed and safe. The list of clinical responsibilities is expensive and their number is growing daily. In addition, managers must decide on the non-clinical services too; they have concluded to give non-clinical services to service providers (Bates et al., 2014); to this end for decades, the health organizations have outsourced services such as dietary and nursing services. Nowadays, managerial programs are trying to reduce the costs of healthcare centers. The extent of the use of outsourcing in health care has been widely investigated in the USA, UK, New Zealand, Canada, and Greece. The general conclusion from these studies indicates that health care organizations, outsource a variety of services ranging from specialist services, logistics services, and facilities management (FM) services. It also indicates that major benefits from outsourcing these services are improved performance, cost savings, increased focus on core business, and improved quality of service (Ikediashi & Ekanem, 2015). Factors such as market pressures, the needs of care organizations, ownerships and merging of companies, and competition with the industry have created demands for healthcare organizations that to respond to these needs outsourcing is focused on as a possible solution (Moschuris & Kondylis, 2006). It should be mentioned that due to the importance of what was said on the issue of outsourcing, the existence of a place in

the healthcare centers with the processes by the characteristics of supply chain services and also to reduce the costs, flexibility in the long term, increase of profit, focusing on the key activities of the organization and improving the management in the healthcare centers by outsourcing strategy is one of the main objectives of applying this research in the hospital.

As it is apparent, research on service supply chains outsourcing is limited. Such a type of outsourcing strategy is different in each service supply chain and according to what was mentioned, it can be concluded that in previous studies, not all of the variables influencing service outsourcing were studied simultaneously. What makes this study different from other similar studies is the determination of outsourcing strategy for a single service supply chain (a two-level bidirectional service supply chain). Another advantage of this study is the application of quadrant analysis in determining the suitable outsourcing strategy. Quadrant analysis is one of the effective techniques used for strategic and innovative decision-making, by which the outsourcing strategies can be better analyzed.

Thus, this paper aims to propose an approach for selecting outsourcing strategies in service supply chains. In the following, literature on outsourcing, reasons for outsourcing, factors affecting outsourcing decisions in service organizations, and literature review of service outsourcing are addressed. SSCM and different types of service supply chains are also demonstrated; then, the new methodology is proposed and findings of the case study are discussed and major conclusions are derived.

2. Outsourcing

Nowadays with increasing competitive pressures and progressing globalization, firms have to reduce their costs and build new opportunities via optimized use of internal and external resources (Taponen & Kauppi, 2020). Outsourcing describes a pervasive business practice in which one company hires another company to perform a particular function on its behalf (Mohr et al., 2011). The overriding goal of outsourcing is to achieve, maintain, or enhance the effectiveness of the organization (Lee & Walsh, 2011). After the first wave of outsourcing with a primary emphasis on manufacturing activities in the 80s and 90s, more firms have begun to outsource service processes including information technology and business processes, resulting in the second wave of outsourcing (Lee & Kim, 2010).

2.1 Objectives of outsourcing

In many investigations, the reasons for outsourcing have been studied. For example, Kotabe et al. (2008) outlined different arguments to explain why firms would want to outsource. These reasons include strategic focus, lower production costs, strategic flexibility, avoiding bureaucratic costs, and rational rent. In another study, it was emphasized that while

cost reduction is important, it is only one of the objectives expected from outsourcing and other objectives include improved flexibility, quality, and control (Quelin & Duhamel, 2003). Brown & Wilson (2005) stated that the most important reasons for outsourcing include acquiring new skills, better management, focusing on strategy, focusing on core functions, avoiding major investments, assisting a fast-growth situation, handling overflow situations, improving flexibility, improving financial ratios, reduce costs, improve overall performance and enhance credibility.

2.2 Factors influencing outsourcing decisions

In some studies, the factors affecting outsourcing decisions are studied. For example, McIvor (2008) proposed a practical framework that managers can use to identify suitable outsourcing strategies. The framework provides a mechanism for understanding which processes should be kept internal and which should be outsourced based on relative capability position and contribution of the process to competitive advantage. Legal restrictions, technical capabilities, and cultural norms also should be considered when deciding to outsource (Balakrishnan et al., 2008). Ashrafzadeh (2003) addressed factors affecting service outsourcing decisions as customer contact, intangible nature of services (service intangibility), standardization process, demand uncertainty, technology uncertainty, the complexity of the process, and the number of suppliers.

For decades, healthcare organizations have outsourced services such as food services. Today, as managed care programs attempt to reduce healthcare costs, providers are turning to outsourcing in new ways to maintain high standards of care. Moschuris, & Kondylis (2006) stated that factors affecting outsourcing decisions in public hospitals include customer satisfaction, focus on core business, the flexibility of the process, lack of funds, and lack of personnel.

2.3 The literature review of service outsourcing

Service outsourcing has become increasingly important in the literature. While limited information is available on the subject, a strong relationship was found between service outsourcing and employee productivity; in other words, service outsourcing strongly influences workforce productivity as well as total productivity (Taponen & Kauppi, 2020).

Lou et al. (2020), conducted a study in the field of logistics service outsourcing choices in a retailer-led supply chain. In this research, the service outsourcing and cost-sharing contracts in a supply chain in which the retailer serves as a Stackelberg leader were studied by conducting a theoretical game model. The results showed that offering logistics service by the

retailer is not always the optimal choice although it alleviates the double marginalization effect. A variable cost-sharing contract benefits the retailer but hurts the logistics service provider. When a part of the fixed cost is shared by the retailer, a win-win outcome will be achieved.

Liu and Jayaraman (2019), conducted a study in the field of service outsourcing. They investigated how the professional service outsourcing (PSO) firm's external knowledge integration with global clients, internal integration across various functional units, and the synergistic effects between them in improving PSO performance. The results showed that a service provider's performance is positively associated with its external integration with global clients and internal integration across various functional units. A synergistic effect is generated from balanced high-level external and internal integration in improving PSO performance.

A study by Bian et al. (2017) was carried out in an article entitled "Service outsourcing under different supply chain power structures". In this research, three supply chain power structures are manufacturer-Stackelberg, vertical-Nash, and retailer-Stackelberg supply chains. In this research, price and service decisions by comparing the integrated channel and the decentralized channel with service outsourcing are studied. The results showed that a lower retail price or a higher service level could occur in the decentralized channel with service outsourcing compared to those in the integrated channel, but they never occur simultaneously.

A study by Ikediashi & Okwuashi (2015) was carried out, and the important factors influencing the decisions of outsourcing the facilities management services in Nigeria's public hospitals were identified. In this research, decision factors were classified into 6 groups named as criteria related to cost, criteria related to strategy, criteria related to innovation, criteria related to quality, time, and social. The results showed that improvement criteria of service quality standard from the group quality and improvement, service delivery time from the group of time had the greatest impact on the decision of outsourcing of the facilities management services in Nigeria's public hospitals. Espino-Rodríguez & Lai (2014) conducted a study in the field of outsourcing and competitive strategy in the hotel industry. In this research, a comprehensive model was offered in which the communications of outsourcing activity and asset specificity were considered. To classify the activities in respect of outsourcing and asset specificity a matrix named outsourcing-asset specificity was created. The results showed that the cost leadership strategy has a positive and partial impact on outsourcing, while the differentiation strategy harms the outsourcing activity. There is also a negative relationship between outsourcing and asset specificity. Bates et al. (2014), in an

article entitled " successful outsourcing: improving the quality of life with integrated support services," have stated the possible ways of outsourcing healthcare service facilities that have a potential impact on the patient's experiences. In this research, the outsourcing model of support services outsourcing is reviewed and various logistics methods and models of contract delivery are investigated. This research ends with the maximum advantages obtained from the model of integrated support services. In this research, this point is implied that the centers of healthcare services can offer better services to the patients through innovative ways such as Lean and Six Sigma, and to this end, they should contract with outsourcing companies that provide defined operating models and experienced staff. These measures result in increased patient satisfaction, shorter hospital stay, and appropriate facility budgets.

Nassimbeni & Sartor (2012), who proposed an FMEA assessment framework that highlighted the main risks of service outsourcing/offshoring, their causes, the effects, and some possible actions, along all of the phases of typical outsourcing/offshoring projects; Lee and Kim (2010), who demonstrated implications of service processes outsourcing on firm value. They found that outsourcing, in general, creates positive firm value Banerjee and Williams (2009), proposed a model that determined the degree to which value-added services can be outsourced. They found key dimensions that influence the degree of outsourcing; and Kakabadse & Kakabadse (2001), analyzed thinking and practice concerning outsourcing in the public services.

3. Service Supply Chain Management (SSCM)

A service supply chain (SSC) is a network of suppliers, service providers, customers, and other support units operating to exchange the resources required for service supply (Balouei Jamkhaneh & Safaei Ghadikolaei, 2020). SSCM is an analogous system approach that is especially suitable for delivering mobile services such as parcel delivery, cable installation, and home health care. The key elements that distinguish SSCM from SCM are bidirectional optimization, perishability, and simultaneous management (Shahin, 2010). Service supply chains, unlike physical goods supply chains, often involve the customer as an active participant in the production process (Sampson, 2000). All services act on something which is provided by the customer. The implication is that all services have customers as primary suppliers of inputs. In other words, customers are suppliers in most service businesses and this implies the customer-supplier duality (Shahin, 2010).

3.1 Different types of Service Supply Chains

Customer-supplier duality implies that production flows not only from suppliers to customers but also from customers to suppliers. Therefore, production flow is bidirectional, which is a key factor in linking traditional supply-chain concepts to service process realities (Sampson, 2000). The simplest form of a bidirectional supply chain is for the customers to provide their inputs to the service provider, who converts the input into an output that is delivered back to the customers. This single-level bidirectional supply chain is depicted in Figure 1.

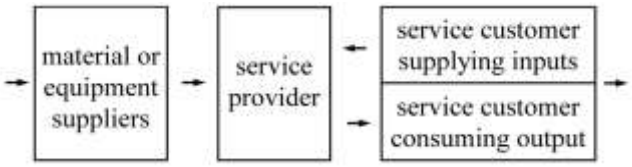

Fig 1. Single-level bidirectional supply chain (Sampson, 2000; Shahin, 2010)

Things get more complicated when the service provider employs another service provider to assist with the processing of customer inputs. The result is a two-level bidirectional supply chain. Such a two-level bidirectional supply chain is depicted in Figure 2. In two-level bidirectional supply chains, the initial service provider is an interface between the service customer and the service supplier.

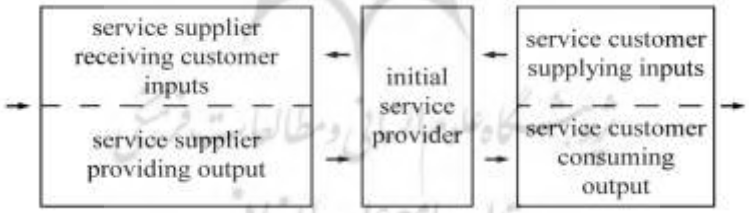

Fig 2. Two-level bidirectional supply chain (Sampson, 2000; Shahin, 2010)

There is a third type of service supply chain that is not bidirectional but incorporates the customer-supplier duality. This is a class of service processes in which the customer provides inputs to the service provider, who processes the inputs and delivers them to an entity that is different from the customer. Even if the original customers never see the originally delivered output, they do receive benefits from the delivery. An example is postal or packages delivery, where customers deliver their documents/packages to the delivery service provider to be spatially transformed to the desired location (Sampson, 2000; Shahin, 2010).

4. Analytical Hierarchy Process (AHP)

AHP is a multi-objective or multi-criteria measurement that helps to address complicated decision problems. It does so by structuring the problem, identifying decision-making factors, measuring the importance of the factors, and synthesizing all the decision-making factors (Saaty, 1980; Saaty, 2008). AHP involves three steps. The first step is to structure the problem into a hierarchical framework with successive levels of goals, criteria, and alternatives. The alternatives are placed at the bottom level. Such structuring requires experience with the AHP technique, while the following guidelines are helpful:

1. Start structuring top-down – specify an overall goal first, then criteria and the alternatives that have an impact on the goal, or will help to achieve that goal.

2. Comparison analysis: Once the hierarchy has been structured, the next step is to establish ratio priorities for each node of the hierarchy. This comparison analysis is generally conducted from bottom to top. Once sufficient comparisons have been made for a node, the principal eigenvector of the comparison matrix is standardized so that it sums to one and becomes the ratio measure of the relative importance of each item. Since these priorities reflect the relative importance of just the items below a parent node, they are called local weights.

3. Aggregate the local weights into a composite priority – This is the AHP's final step and is done through the principle of hierarchic composition that first multiplies local weights by the result of all higher-level priorities. Within the hierarchy, this process transforms the local weights into global weights that measure the importance of each node in the total hierarchy. These global weights are then summed for a specific alternative to yield a composite priority that measures the joint impact of all of the criteria. Then, the alternative with the highest weight is selected (HajShirmohammadi & Wedley, 2004; Shahin & Mahbod, 2007).

5. Proposed methodology

The objective of this paper is to propose an approach for selecting outsourcing strategies in service supply chains. For this purpose, the research implementation steps are represented in Figure 3.

Step 1: Defining the objectives of outsourcing

It is assumed that the objectives of outsourcing are its criteria. Criteria are determined based on literature review and some of the references include Quelin & Duhamel (2003), Brown and Wilson (2005), and Kotabe et al., (2008). It should be noted that some criteria has had similar definition and are combined under one title. For instance, it is assumed that strategic focus, focus on strategy, and focus on core functions are almost the same and respectively, strategic focus is used for them. The criteria are represented in Table 1.

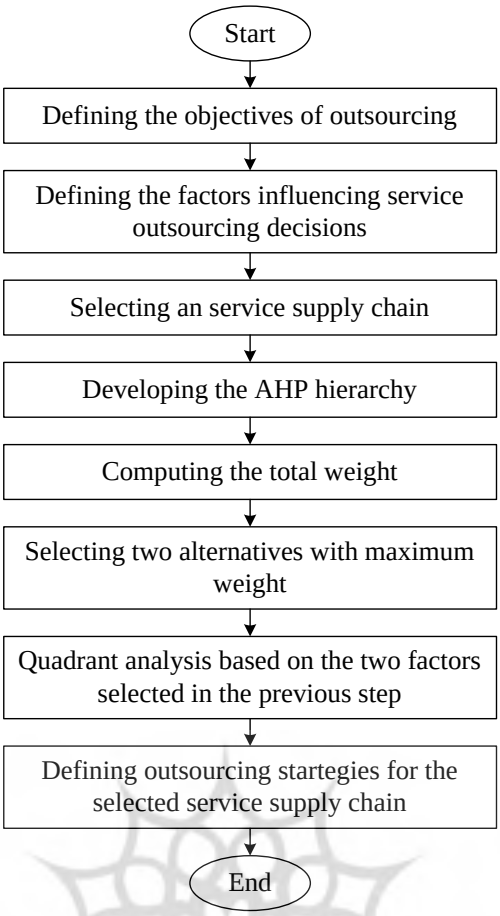

Fig 3. The research steps

Table 1. The objectives of outsourcing - extracted from Quelin & Duhamel (2003); Brown & Wilson (2005); Kotabe et al. (2008)

Criteria	Description
Improve flexibility	When a function experiences large swings in the volume of work it handles, it may be easier to eliminate the fixed cost of internal staff and move the function to a supplier that will be paid only for the work done. This converts a fixed cost into a variable cost. Generally, outsourcings enhance the strategic flexibility of an organization.
Reduce costs	-
Improve quality	-
Improve control	-
Strategic focus	Outsourcing the tactical part of each manager's job to a supplier allows the managers to spend more time on such strategy-related issues as market positioning and new product development. A company that has a very small number of functions as the key to its survival may want to focus all of its energies on those functions and distribute all other functions among a group of outside suppliers so that company management is free to manage.
Improve financial ratios	Outsourcing a function that involves transferring assets to suppliers will increase the company's return on assets.
Enhance credibility	A company can enhance its credibility by contracting with highly reputable outsourcing suppliers.
Assist a fast-growth situation	If a company is rapidly acquiring market share, the managers will be stretched to its limits in handling the increased volume of business. In such situations, the managers will desperately need additional help in running the firm. A supplier can step in and take over a function, freeing the managers to focus on core activities.
Acquire new skills	A company may find that the skill set of its in-house staff is inadequate for a given function. A company can solve this problem by outsourcing.

Step 2: Defining the factors influencing service outsourcing decisions

In this paper, alternatives are assumed to be the factors influencing service outsourcing decisions. They are determined based on previous research, such as Ashrafzadeh (2003), Moschuris & Kondylis (2006), and McIvor (2008). They are represented in Table 2.

Table 2. Factors influencing service outsourcing decisions - extracted from Ashrafzadeh (2003); Moschuris & kondylis (2006); McIvor (2008)

Factor	Description
Relative capability position in the process	Processes that are critical to competitive advantage have a major impact upon the ability of an organization to achieve competitive advantage either through, creating higher levels of differentiation than competitors.
Contribution of the process to competitive advantage	A key issue in competitive strategy includes understanding why one firm differs in performance from another. Some organizations gain an advantage over others because they can conduct certain organizational processes in a superior manner relative to their competitors.
Legal restrictions	
Customer contact	Customer contact is defined as the ratio of the time during which a customer is in direct contact with the service facility to the total time required for the creation of the service.
Intangible nature of services	Services are ideas and concepts. Therefore, it allows that services are not patentable. The intangible nature of services presents a problem for customers. When buying a product, the customer can see it. For a service, the customer must rely on the reputation of the service organization.
Standardization process	Standardization refers to the process of developing an international standard that enables organizations to focus their attention on delivering excellence in customer service.
Demand uncertainty	-
Technology uncertainty	-
Complexity of process	-
Number of suppliers	-
Customer satisfaction	-
Focus on core business	-
Flexibility of process	-
Lack of funds	-
Lack of personnel	-

Step 3: Selecting a service supply chain: To identify outsourcing strategies in service supply chains, a two-level bidirectional supply chain is selected as the case study of this paper.

Step 4: Developing the AHP hierarchy.

Step 5: Calculate the total weight.

Step 6: Select two alternatives with maximum weight.

Step 7: Quadrant analysis based on the two factors selected in step 6.

Step 8: Defining outsourcing strategies for the selected service supply chain.

6. Case study and findings

One of the public hospitals in Iran is selected as the case study. This medical center was established in the city of Isfahan in 2015 and delivers various healthcare services.

To identify outsourcing strategies in service supply chains, a two-level bidirectional supply chain is selected. The hospital's pathology process which is following the two-level bidirectional supply chain depicted in Figure 2 is selected for analysis.

To study the importance and correlation of variables (the criteria addressed earlier), a questionnaire is developed as presented in Appendix 1. Five-point Likert scale is considered for the options of answers (1="strongly low"; 2="low"; 3="medium"; 4="high"; and 5="strongly high").

To study the influence of the factors on pathology outsourcing, another questionnaire is developed as addressed in Appendix 2. The answers are considered to be given as yes or no.

The validity of the questionnaires is proved using the Delphi technique in which 12 university scholars and 30 hospital managers are involved. The reliability of the data is measured using Cronbach's alpha which is equal to 0.725 and 0.75 for the first and the second questionnaires, respectively, and seem satisfactory.

The first questionnaire is filled out by senior managers and supervisors of the hospital. Five senior managers and eight supervisors filled the questionnaires (Altogether, 13 respondents). Spearman correlation test is used to analyze the correlations of variables. The summary of the results is represented in Table 3.

Table 3. Summary of the results of Spearman correlation test

variables		Improve control	Improve financial ratios	Assist a fast-growth situation	Acquire new skills
Improve control	Correlation Coefficient	1	0.855**	.014	-0.088
	p-value	-	0	0.965	0.776
Improve financial ratios	Correlation Coefficient	0.855**	1	0.276	0.152
	p- value	0	-	0.361	0.62
Assist a fast-growth situation	Correlation Coefficient	.014	0.276	1	0.819**
	p- value	0.965	0.361	-	0.001
Acquire new skills	Correlation Coefficient	-0.088	0.152	0.819**	1
	p-value	0.776	0.62	0.001	-

The second questionnaire is also filled out by the senior managers and supervisors of the hospital. Five senior managers and 10 supervisors filled the questionnaires (Altogether, 15 respondents). A binomial test with a confidence level of 0.95 is used to analyze and show

factors that influence pathology outsourcing. The summary of the results is represented in Table 4.

Table 4. Summary of the results of Binomial test

Factor			Test prop	P-value	Factor			Test prop	P-value
Customer satisfaction			50	0.001	Legal restrictions			50	0.118
Intangible nature of services			50	0.302	Lack of personnel			50	0
Standardization process	50	0.035	Relative position process	capability in the	50	0.001			
Demand uncertainty	50	0.118	Number of suppliers		50	0.035			
Technology uncertainty	50	0.118	Flexibility of process		50	0.035			
Complexity of process	50	0.001	Lack of funds		50	0.001			
Customer contact	50	0.118							
Focus on core business	50	0.035							
Contribution of the process to competitive advantage	50	0.035							

According to the results of the Binomial test, factors that have a p-value greater than 0.05 are omitted and other factors will be used for the AHP model as alternatives. Also, considering the results of the Spearman correlation test, there is a significant correlation between improved control and improve financial ratios and between assisting a fast-growth situation and acquiring new skills, with p-values smaller than 0.05. Finally, correlated factors are combined, and respectively, improve control and acquire new skills are used as criteria for AHP (Figure 4).

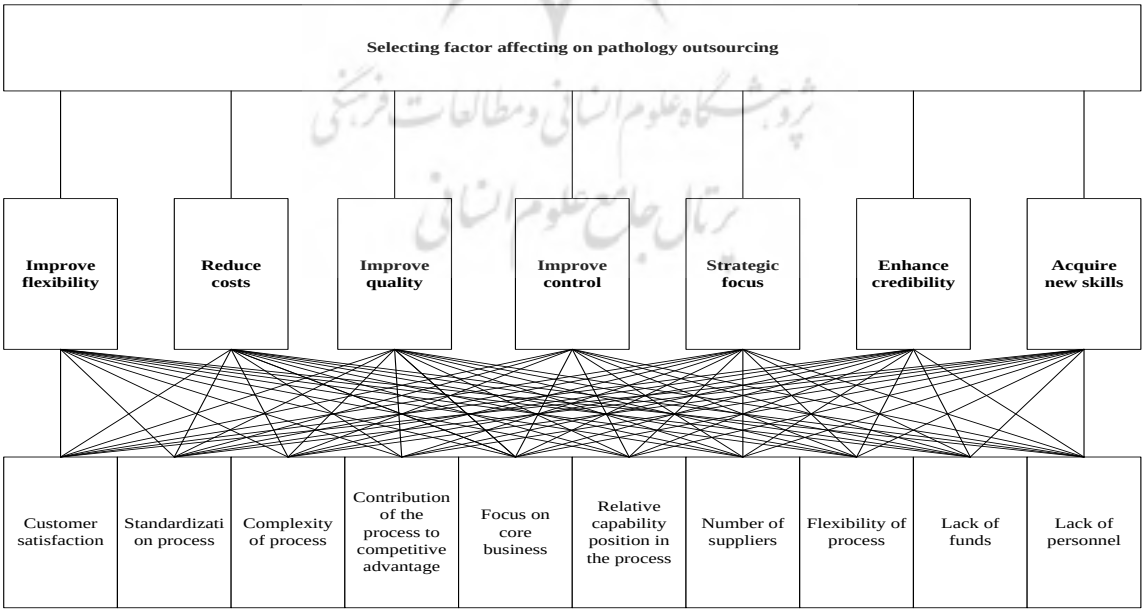

Fig 4. The structure of the AHP technique

To select two factors with maximum influence on pathology outsourcing, pair-wise comparisons are applied among the criteria and alternatives based on Saaty's 1-9 scales. The judgments are carried out by four managers of the hospital. Then geometric means of judgments are calculated. Judgment consistency is calculated by using the consistency ratio (CR). The averaged judgment matrix is then determined by the geometric mean of each row in the pair-wise comparison matrices and the weights are calculated. It is important to note that the pair-wise comparison matrices of this paper become too large and therefore, they could not be illustrated in this paper. Saaty (1990) used the principal eigenvector of the comparison matrix to find the comparative weights among the criteria of hierarchy systems. For each $n \times n$ pair-wise comparison matrix A, by using the eigenvector theory, i.e. $(A - \lambda_{max}I)w = 0$, to calculate the eigenvalue λ_{max} and the eigenvector w $(w_1, w_2, \ldots, w_n)$, the weights of the criteria can be estimated. To measure the degree of consistency of the intuitive judgment, Saaty suggested using the consistency index $CI = (\lambda_{max} - n)/(n - 1)$. When the consistency degree is calculated, the result is compared with those of the same index of a randomly generated reciprocal matrix from a scale of 1-9, with forced reciprocals. This index is called the random index (RI). In the test of CR, the comparison value of CI and RI $(CR = CI/RI)$ is used and a CR of 0.10 or less is considered as positive evidence for an informed judgment.

Generally, the total score of alternatives (factors) is calculated by the following equation (step5):

$$E_i = \sum_{j=1}^{7} (A_{ij} \times w_j), i = 1, .., 9$$

Where E_i= Total score of alternatives; A_{ij}= Score of alternatives i on criteria j; w_j= weight of criterion j; i= alternative index; and j= criterion index.

The results of the total score of alternatives, i.e., factors that influence pathology outsourcing are computed using the Excel software and are presented in Table 5.

Table 5. The total score of alternatives (factors)

Factor	Score
Customer satisfaction	0.13
Standardization process	0.04
Complexity of process	0.07
Focus on core business	0.07
Contribution of the process to competitive advantage	0.09
Relative capability position in the process	0.20
Number of suppliers	0.10
Lack of funds	0.11
Lack of personnel	0.07
Flexibility of process	0.12

According to Table 5, relative capability positions in the process and customer contact have maximum weight values (i.e., 0.20 and 0.13) and they should be selected for quadrant analysis (step 6).

In the next step, the two addressed factors are used for quadrant analysis. This analysis provides a framework for selecting outsourcing strategies in the pathology process (Figure 5). It is important to note that an organization can provide its needs by insourcing, outsourcing, and contributing.

In quadrant 1, customer contact is high, and relative capability position in the process is low. A suitable strategy is to outsource the process or contribute with other organizations. In quadrant 2, both customer contact and relative capability position in the process are high. A suitable strategy is to outsource the process. In quadrant 3, both customer contact and relative capability position in the process are low. A suitable strategy is to keep the process internal (insource). Finally, in quadrant 4, customer contact is low, and relative capability position in the process is high. Therefore, a suitable strategy is to contribute to other organizations.

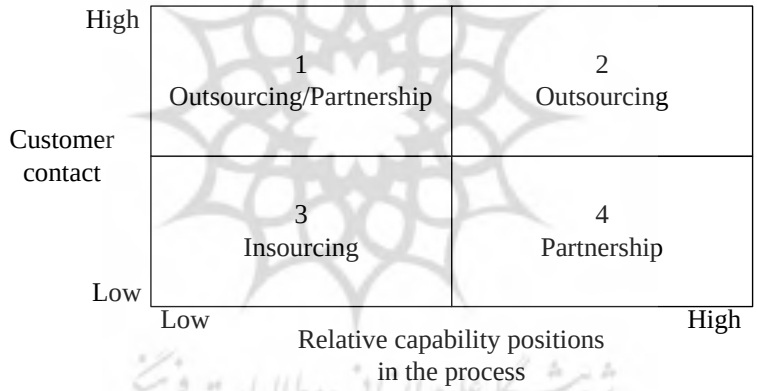

Fig 5. Quadrant analysis for selecting outsourcing strategies (Shahin & Rostamian, 2011)

7. Discussion

The objective of this paper was to propose a novel approach for selecting outsourcing strategies for two levels of the bidirectional supply chain.

In this study, the correlation test was performed to detect correlations between variables mentioned as targets of AHP. Based on the results obtained from this test, the variables of improved control and improve financial ratios, and the variables of acquiring new skills and fast- growth situation had a significant correlation with each other, so they were merged and improve control and acquire new skills were respectively used instead of them. It should be mentioned that other variables did not correlate with each other; hence, for this reason, the AHP technique was used to rank variables.

According to the results of the Binominal test, factors influencing pathology outsourcing included customer satisfaction, customer contact, standardization process, focus on core business, the contribution of the process to competitive advantage, relative capability position in the process, number of suppliers, lack of fund and lack of personnel. These factors are more similar to the factors introduced by Moschuris & kondylis (2006). The standardization process is similar to the factors suggested by Ashrafzadeh (2003). In comparison with previous studies, the factor of legal restrictions was not assumed to influence outsourcing strategies. While McIvor (2008) determined factors of the contribution of the process to competitive advantage and relative capability position in the process for quadrant analysis.

Based on the results obtained from the AHP technique according to the senior and junior managers of the hospital, the most influential factors on outsourcing the pathology process were customer contact and the relative capability position in the process.

According to the results of quadrant analysis (Figure 5), when customer contact has been increased due to outsourcing process of pathology and relative capability position in the process has been reduced (In quadrant 1) the organization turns to the strategy of outsourcing/ partnership as an important factor in terms of organization, meaning that it has increased customer contact, and the result of outsourcing has generally been negative, thus the organization by using partnerships strategy and continuing to cooperate with suppliers finds the cause of the reduction of the relative capability position in the process. If this result is due to weaknesses within the organization, it outsources the process fully.

As when customer contact reduces and the relative capability position in the process increases (In quadrant 4), the organization uses a partnership strategy, in this case, the organization does not choose complete outsourcing, because the important variable of customer contact has been declined. Of course, the result was not quite negative, and the next variable has increased, but the customer contact variable has more priority (preference) for the organization. So, it finds the cause of customer contact reduction through partnerships with suppliers and benefits from the advantages of participation too.

In the case that due to outsourcing both variables increase (In quadrant 2), so the organization does not choose the strategy other than outsourcing, because the increase of both variables is desirable for the organization.

Similarly, when the impact of outsourcing both variables reduce (In quadrant 3) outsourcing is not an appropriate supply strategy for the process, and does not provide any advantage for the organization; hence the organization chooses the outsourcing strategy and keeps the administration of the process within the organization.

In addition to the strategies derived from the quadrant analysis, it should be noted that an organization (e.g., the hospital in this paper) can choose two ways for outsourcing its process:

- Making a short-term contract with a supplier (e.g., one year), by which the organization will have better control on supplier and more desirable quality will be achieved. Organizations can concentrate on developing the supplier and suppliers will be more committed to the organization. However, this option may have the risk of buyer-supplier relationships.

- Making a close and long-term contract with more than one supplier. In this case, an organization can avoid the risk that may be posed by one supplier. This option will provide competition between suppliers for delivering the best quality and service. However, the organization might not have control over all suppliers.

It is important to note that the quadrant analysis should be filled by the top manager of the hospital since he/she is the person who will finally decide on insourcing/outsourcing of the process.

Since achieving customer satisfaction (patients) is a principle for the organization, to maintain this competitive advantage, the organization by using its skills and abilities in the form of partnership with suppliers or other organizations improves and promotes its strong points. If the organization by the analysis of the status quo concludes that it does not have enough ability to do some of the processes and also customer contact concerning service delivering in the same processes is low, it should outsource the desired process and devote the facilities of the organization to the activities that constitute the key activities of the organization by identifying professional suppliers in that field.

In this study, one of the two-level bidirectional service supply chains of the pathology process of a hospital was selected for determining the suitable outsourcing strategy. In this process, the patient refers to the practitioner and he/she introduces the patient to the laboratory. Based on the test results, the practitioner starts the treatment. Such a supply chain includes all of the elements of a developed supply chain, i.e., supplier, service provider, and consumer as addressed by Baltacioglu et al. (2007). According to Baltacioglu et al. (2007), the service provider provides the main service and plays the role of a producer in a basic manufacturing supply chain. This is compatible with the role of the practitioner in the two-level bidirectional service supply chain in which, the main service delivered is treatment. The supplier provides supportive service and plays a major role in developing the main service. The laboratory in the hospital is an example of a supplier. Finally, the consumer receives service, who is the patient in the case of hospital service. In addition to the study of Baltacioglu et al. (2007) in which, the necessary activities for effective management of

service supply chain were addressed (mentioned earlier in the introduction section), this study provides an opportunity to the managers to determine the suitable strategy for each activity using the proposed approach and to take advantages from both studies. Examples of such advantages include competitive advantage, effective cost management, service quality improvement, and increase in customer satisfaction.

Managers of various (industrial and service) sectors by using the proposed model of this research concentrate on the variables that affect more on outsourcing the desired processes and choose appropriate supply strategies for their processes in various conditions. In this way, by focusing on key and strategic activities of the organization, they can improve their competitive advantage among other organizations, reduce the risk of outsourcing, and by better control and management reduce the costs. Also, by using the skills of other suppliers, they can promote their experiences at a world-class level.

8. Conclusions

The results show that provided that the organization in this study has high strategic ability in doing the process, the organization keeps it inside, and does not choose the outsourcing strategy, because it can gain a competitive advantage.

In this paper, customer contact and relative capability position in the process were found as having a maximum influence on pathology process outsourcing and were selected for quadrant analysis and defining outsourcing strategies.

Based on the results, it is clear that increasing customer contact is a more important factor than the relative capability position in the process, and if outsourcing causes a reduction of customer contact, even with the increase of the relative capability position in the process, the organization does not choose complete outsourcing strategy and selects partnership strategy.

This research offers a standard framework for determining supply strategies that becomes clear with the actual data on the location and type of supply strategy of the organization. In the previous research, no systematic and separate approach was offered for different supply chain services to choose outsourcing strategies. In this research, a standard framework for choosing an outsourcing strategy in each one of the supply chains services has been offered and it is regarded as a competitive advantage for this research.

The uniqueness of the subject of this paper is apparent as no similar research was found in the literature investigating the relationship between different service supply chains types and outsourcing.

Analytic hierarchy process (AHP) was used to facilitate the prioritization of factors influencing service outsourcing. It allowed diverse viewpoints to be considered and

integrated ensuring that all participants have input to the final evaluation. While in AHP it is assumed that all criteria are independent, this precludes interactions among the criteria. One of the advantages of AHP is its capability and flexibility in changing the weights in different circumstances and thus, the new approach is easily adaptable with diverse areas of application. It is important to note that variation in the views of people who are responsible for rating the weight of factors influencing service outsourcing might lead to a result that is not certain.

The results of this research help the organizations, particularly the hospitals to know how to choose appropriate supply strategy for their activities, meaning that what activities should use the outsourcing and participation in a way that customers (patients) satisfaction is met, and provided that a hospital adopts an appropriate supply strategy for its processes, it will definitely have a positive impact on public health, and it will have a higher competitive advantage, and the profitability of organization will also be increased among other organizations.

The case study was limited only to one type of service supply chain, i.e., a two-level bidirectional service supply chain. Therefore, it is suggested to researchers to study and examine the proposed approach including its steps in other types of service supply chains, and to compare the results with the findings of this study. Furthermore, the case study was limited to one hospital, and studying the applicability of the proposed approach in a wider range of hospitals provides a good opportunity for future study. It is important to note that rating scales used in the AHP analysis are conceptual, further investigation is needed to enhance this part of the methodology. Finally, researchers can use other multi-criteria decision-making techniques for rating factors such as Topsis and so on.

In this research, to determine supply strategies, only two variables were used and this framework had a two-dimensional model. Provided that there are other variables at the time of decision making and determining supply strategies that cannot be disregarded, future researchers can design a three-dimensional framework and involve other effective variables while determining strategies.

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Appendix 1

This questionnaire is developed to determine the criteria of outsourcing in the hospital. Proposed variables might have strongly low, low, medium, high, and strongly high importance. Please mark the suitable option for each question.

Demographic characteristics

Organizational Duty: …….

Years of experience since employment: Under10 years ☐ 10-20 years ☐ 20 -30 years ☐

Education: B.Sc. ☐ M.Sc. ☐ PhD. ☐

Gender: Male ☐ Female ☐

Age: 20-30 years old ☐ 30-40 years old ☐ above 40 years old ☐

Question: How much is the importance of the following criteria of outsourcing?

No.	Variables	strongly low	low	medium	high	strongly high
1	Improve flexibility					
2	Reduce costs					
3	Improve quality					
4	Improve control					
5	Strategic focus					
6	Improve financial ratios					
7	Assist a fast-growth situation					
8	Enhance credibility					
9	Acquire new skills					

Appendix 2

This questionnaire is developed to determine factors influencing pathology outsourcing decisions. The proposed factors might have strongly low, low, medium, high, and strongly high importance. Please mark the suitable option for each question.

Demographic characteristics

Organizational Duty: ……

Years of experience since employment: Under10 years ☐ 10-20 years ☐ 20 -30 years ☐

Education: B.Sc. ☐ M.Sc. ☐ PhD. ☐

Gender: Male ☐ Female ☐

Age: 20-30 years old ☐ 30-40 years old ☐ above 40 years old ☐

Question: Do the following variables influence outsourcing of the pathology process

No.	Factors	Yes	No
1	Relative capability position in the process		
2	Contribution of the process to competitive advantage		
3	Customer contact		
4	Intangible nature of services		
5	Standardization process		
6	Demand uncertainty		
7	Technology uncertainty		
8	Complexity of process		
9	Number of suppliers		
10	Customer satisfaction		
11	Focus on core business		
12	Flexibility of process		
13	Lack of funds		
14	Lack of personnel		
15	Legal restrictions		