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Research Article

Analysis of Causal Relationships Effective Factors on the Green Supplier Selection in Health Centers Using the Intuitionistic Fuzzy Cognitive Map (IFCM) Method

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Abstract

The healthcare sector is one of the largest service industries with the highest potential to improve environmental performance. Hospitals as an important part of the healthcare system must act in a way that reduces their environmental consequences, which requires having a green supplier. The aim of this study was to identify the effective factors on the green supplier selection (GSS) in the hospital and to present an excellent model for analyzing the relationships between these factors. In this study, 14 concepts that effect the green supplier selection of a hospital have been extracted from in-depth literature and interviews entailing: financial capability, creativity and innovation, green technology, flexibility, organizational capability, commitment, trust on supplier, green quality, green transportation, environmental cooperation with customers, hazardous materials management, buy green, green warehouse and green packaging. In addition, Intuitive fuzzy cognitive mapping approach was also used for data analysis and conclusion. The results showed that green technology index with 0.43 degree was the most influential and organizational capability index with 0.29 degree had the most influence over the other concepts. In addition, focusing on concepts like financial capability, trust on supplier and creativity and innovation process of green supplier selection of hospital. Taking these in consideration these factors should be given specific attention.

Keywords: Supplier selection; Green supply chain; Hospital; Fuzzy Cognitive Map

1. Introduction

Over the years, there has been a great deal of interest in research related to supply chain (Mendoza, 2007). Supply chain performance is a vital and multi - faced rapidly developing area of research in supply chain management (Chandak, Chandak, & Dalpati, 2021). In general, the key role of the supply chain is to effectively and efficiently manage the flow of products, services, finance and information from source to end customer, with the ultimate goal of creating added value and increasing customer satisfaction (Sabri, Micheli, Nuur, & Management, 2018). In other words, the purpose of any supply chain is to maximize the supply chain capability (Mendoza, 2007). The supply chain is a complex entity formed of different categories, for example, suppliers, manufacturers, distributors and consumers (Zhang & Han, 2011). Choosing the right suppliers and allocating orders to them in order to reduce costs and subsequently increase profits is counted as one of the strategic activities of supply chain management (Mendoza, 2007).

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Suppliers' performance can not only drive innovation through appropriate environmental standards, but also reduce overall costs and increase product value and productivity. In addition, dimensions of supplier performance like product quality, lead time, and security of supply are also improved through such operations (Blome, Hollos, & Paulraj, 2014). Since the traditional supply chain with waste production, creates environmental issues and do not consider society and environmental and caused the companies to be more exposed to the environment, companies pursue green supply chains with the aim of reducing waste, maintaining product quality and maintaining natural resources and serving customers better(Kazancoglu, Kazancoglu, & Sagnak, 2018). Activities, working with suppliers who consider environmental issues create significant advantages such as waste reduction (Savita, Dominic, & Ramayah, 2014; Yang & Environment, 2018) and more use of natural resources (Blome et al., 2014; Kazancoglu et al., 2018) ،cost control (Mendoza, 2007; Savita et al., 2014; C.-S. J. T. R. P. D. T. Yang & Environment, 2018) ، risk management (Savita et al., 2014), Quality promotion (Blome et al., 2014; Kazancoglu et al., 2018; Mendoza,

2007; Savita et al., 2014) and brand image (C.-S. J. T. R. P. D. T. Yang & Environment, 2018) for the organization. This can also help companies to simplify their supply chain (Amato, 2015). Therefore, improving the environmental performance of suppliers is critical to the development of green supply chains (Awasthi, Kannan, & Engineering, 2016). In particular, developing green suppliers can not only enhance the mix of resources and capabilities among supply chain partners, but also help companies mimic such resources and inter-organizational capabilities to create inter-organizational assistance that is more valuable, rare and difficult. Thus, the impact of green procurement on supplier performance can be substantially altered by the green supplier developer. This act can also help companies to simplify their supply chain (Blome et al., 2014). Therefore, improving the environmental performance of suppliers in the development of green supply chains is vital (Awasthi et al., 2016; Sancha, Longoni, Giménez, & Management, 2015). Over the past years, due to the increasing need to ensure the availability of an efficient and coordinated supply chain, supplier selection has been recognized as an essential component. Since one of the most important relationships between supply chain members is the coordination between the focal firm and the supplier, studies on supplier selection are mainly focused on decision-making methods. (Rezaee, Yousefi, & Hayati, 2017).

Over the years, for effective evaluation and green supplier selection, several methods based on multi-criteria decision-making techniques have been proposed. Bellman & Zadeh (1970) proposed a fuzzy programming model to evaluate suppliers in fuzzy environments.

Morlacchi (1997) presented a fuzzy set theory (FST) model with AHP to evaluate small suppliers in engineering and machinery. Yoon & Hwang (1995) used TOPSiS techniques to evaluate and select suppliers. Ghodsypour & O'Brien (1998) solved a supplier selection problem using a combination method of linear programming and nonlinear programming. Hwang, Moon, Chuang, & Goan (2005) presented a mathematical model for supplier selection considering changing supplier supply capacity and customer needs over a period of time. Ha & Krishnan (2008) describes a hybrid approach that combines multiple techniques into one evaluation process to select competing suppliers in the supply chain.

Aliakbari & Seifbarghy (2011) presented a model for Supplier Selection for Social Responsible Supply Chain. Supplier selection objectives such as cost minimization, quality maximization and on-time delivery maximization have already been surveyed. In this paper, they add objectives such as CSR maximization, maximization of advantages of domestic supplier selection and minimization of sum total distance to suppliers, to the prior objective functions while considering the quality and on time delivery constraints.

Shaw et al. (2012) presented an integrated approach for selecting the appropriate supplier in the supply chain, using fuzzy multipurpose linear programming (AHP). R. Rostamzadeh (2015) in his study proposed comprehensive criteria for evaluating GSCM practitioners using fuzzy VIKOR. Esfandiari & Adibi (2020). Used Association Rules Analysis for Identifying and Evaluating Effective Factors in Green Supplier Selection. Green data were collected first by reviewing the previous studies to identify various environmental criteria. Then, the suppliers were evaluated and ranked on the basis of those criteria.

Yemane et al (2020). Used Discrete Event Simulation method for Performance Measurement and Improvement of Healthcare Service. The performance measurement for this study are patients output, service rate, service efficiency and it is directly related to waiting time of patients in each service station, work in progress, resource utilization.

In spite of studies taken place, few studies have evaluated the relationships between the criteria for green supplier selection in health centers. The present study seeks to analyze the causal relationships of factors influencing green provider selection in health centers using the intuitive fuzzy FCM approach.

2. Literature Review

2.1. Supply chain

The supply chain network is a complex network (Zhang & Han, 2011) consisting of several members involved directly or indirectly in the process of transferring goods and services from suppliers to end customers (Hosseini-Motlagh, Nematollahi, & Nouri, 2018). In other words, the "supply chain" encompasses all the processes involved in the manufacture, transfer, maintenance, service, or sale of physical goods or services from raw material producers to end customers. Supply chain activities entail internal processes such as manufacturing, purchasing, warehousing, transportation, and existential management as well as external activities performed by suppliers, logistics partners, transport, distributors, service organizations, repairing and maintenance (Amato, 2015; Savita et al., 2014). A review of the literature on supply chain management shows that research in this field has focused more on Production Supply Chain subjects and little attention has been paid to the problems of the service industry (Mirghafoori, Sharifabadi, & Takalo, 2018).

The service supply chain can be defined as a network of suppliers, service providers, customers, and other support units, representing the exchange of resources needed to provide services, converting those resources into primary services, supporting, and also delivering services to customers (Baltacioglu, Ada, Kaplan, Yurt and, & Cem Kaplan, 2007).

The healthcare supply chain is mistakenly known as purchasing and contract management, while the supply chain is more than purchasing and contract management. However, the term "supply chain management" is often used by healthcare professionals (Kwon, Kim, Martin, & Change, 2016). On the one hand, the healthcare supply chain is very complex, fragmented, diverse and dynamic. The main reason for this increase is the complexity of the involvement of the various organizations involved throughout the supply chain (Lenin & Management, 2014). The hospital supply chain also includes three elements of manufacturers, buyers and providers or presenters of healthcare. The healthcare industry has been slow to adopt supply chain management techniques that have proven successful in other industries (Toba, Tomasini, & Yang, 2008). In the area of health centers, investigations show that hospital supply chain performance is becoming increasingly important because healthcare organizations strive to improve operational efficiency and reduce cost (Chen, Preston, & Xia, 2013).

2.2. Environmental issues

The contribution of the supply chain activities in global warming and the depletion of natural resourses and non-reproducible through the distribution, transportation and disposal of materials is high. This act has led to a greater focus on supply chain sustainability in existing researches and the development of the concept of sustainable supply chain management (Jadhav, Orr, & Malik, 2018). Sustainability for the organization between the three environmental aspects, economic and social aspects are linked (Abbas & Sağsan, 2019; Fritz, Schöggl, & Baumgartner, 2017; Wittstruck & Teuteberg, 2012) and when it is said to be a sustainable organization, that is, a state of stability rules over it and it is at a level of stability (Van Marrewijk & Werre, 2003). Sustainability in the environmental dimension means maintaining and reinsforcing the production of environmental systems and renewing their capacity (Tang, Liao, Wan, Herrera-Viedma, & Rosen, 2018). Environmental supply chain management plays a vital role in activities including reduction, recycling, reuse and replacement of materials (Amato, 2015). Fossil fuels are also being replaced by renewable energy sources, thereby improving the environment (de Vargas Mores, Finocchio, Barichello, & Pedrozo, 2018). Managers have consistently realized that environmental monitoring is needed rather than environmental compliance (Kazancoglu et al., 2018). Hence, reducing environmental impacts has become an objective that is currently at the same level as economic and quality objectives (Srivastava, 2007). In addition, Costs can also be decreased by reducing environmental emissions and reducing material waste (Blome et al., 2014). In hospitals, measuring environmental performance leads to reduction in the environmental impacts of operations and improves the quality of processes and outcomes. Health services utilize a significant amount of hazardous and non-hazardous substances and produce pollutant emissions. A new framework is needed to determine relevant and meaningful indicators for monitoring and evaluating environmental performance if health and operational systems need to be improved(Blass, da Costa, de Lima, & Borges, 2017).

2.3. Green supply chain

The environmental supply chain is a challenge for many businesses in the 21st century. Therefore, adding green component to supply chain management (SCM) is necessary, leading to an understanding of the influence and relationship between SCM and the natural environment(Savita et al., 2014). On the other hand, adding the green component to supply chain management involves removing barriers and relationships between supply chain management and the natural environment. The concepts of greening are described as a competitive initiative by Porter and van Lind. Their basic argument is that investing in greening can save resources, eliminate waste and improve efficiency(Srivastava, 2007). Green Supply Chain Management (GSCM) is an emerging organizational philosophy that integrates elements of corporate environmental management and supply chain management. GSCM helps to improve the ecological productivity of its main companies and its partners by reducing the environmental risks and impacts. GSCM literature is growing increasingly, because in recent years, GSCM initiatives have been popular and widely used by companies to protect the environment and improve their green image (Chithambaranathan, Subramanian, Gunasekaran, & Palaniappan, 2015; C.-S. Yang, Lu, Haider, Marlow, & Review, 2013). Many activities are involved in integrating natural environmental factors and have a role in supply chain management. Examples include: green supplier selection, green purchasing, extending product life cycle environmental analysis to supplier processes, assisting supplier organizational structure through the development and implementation of environmental management systems, etc (Fu, Zhu, & Sarkis, 2012). The success of a green supply chain depends heavily on the commitment of its shareholders. In other words, if the suppliers of a company do not implement green initiatives in their facilities, the impact of the company's green efforts will be very limited. Therefore, it is an effective tool for ranking suppliers based on their environmental performance (Demir, Akpınar, Araz, & Ilgın, 2018).

The hospital service supply chain has some environmental benefits and health product manufacturers. When hospitals demand that their suppliers also meet their environmental needs, the environmental impact of the health care industry will decrease. In order to integrate supply chain strategies that improve the environmental performance of the entire health care sector, it is

necessary to examine the strategies of the firm. One vital process for greening the healthcare supply chain is environmental product design (EPD) (Messelbeck & Whaley, 1999).

2.4. Green supplier selection

Among the new strategies for buying and producing, suppliers play a key role in achieving competitive advantage for companies. Therefore, selecting the right suppliers is a vital component of these strategies (Amid, Ghodsypour, & O'Brien, 2006). The process of selecting a supplier is a complex activity that affects profitability and customer satisfaction. Therefore, selecting suppliers is a key strategic decision for the long-term survival of the company (Shaw et al., 2012). Supplier Selection Issue, the process of evaluating, comparing and finding the right supplier who is able to meet the needs of the buyer with the best quality expected, in the right place, at the right volume and at the right time. Each supplier alone is able to meet all customer demands in terms of quantity, quality, delivery, etc.(Aissaoui, Haouari, Hassini, & research, 2007). The issue of supplier selection is also a multi-criteria decision-making problem that is influenced by several factors that often contrast with one another. In most issues, supplier selection has been taken into consideration goals such as minimizing costs, maximizing quality, and minimizing delivery time (Lukinskiy, Lukinskiy, Churilov, & Journal, 2014). The overall goal of the supplier selection process is to reduce purchasing risk, to maximize overall value to the buyer, and to establish close and long-term relationships between buyers and suppliers. In addition, supplier selection plays an important role in creating a green supply chain. A positive review between the green suppliers selection and the implementation of the green supply chain has been observed in the study of Seuring & Müller (2008). Many researchers have addressed the issue of supplier selection in the green supply chain from the perspective of environmental sustainability On the one hand, leading companies are trying to increase the supply of environmentally friendly products by green supplier selection (Blome et al., 2014). Identifying and prioritizing the relationship of Green Supplier Development Plans (GSDPs) potentially helps organizations to identify resources and focus on the most important programs that establish the foundation and relationships with other environmental programs and objectives, increase formal organizational performance.This formal methodology is valuable for planning, designing, implementing or maintaining GSDPs in organizations (Fu et al., 2012).
Health care suppliers play an important role in ensuring the quality of the healthcare supply chain that is economically and environmentally is affordable. They can influence suppliers of their raw materials to meet the same requirements (Messelbeck & Whaley, 1999).
The purpose of this paper is to investigate the causal relationships between factors influencing green supplier selection. In this regard, the first step is to identify the factors influencing green supplier selection. After reviewing the research literature and similar studies, in continuation these factors will be described:

Financial Capability (GSS1): Financial capability is "readiness for joint venture financing with suppliers for reinforcing the achievement of goals"(Closs & Mollenkopf, 2004) . Traditional credit rating models is approved by financial institutions to assess a company's credit risk, adopt a purely financial perspective and often do not have proper evaluation for small and medium-sized companies. On the other hand, buyers usually evaluate suppliers by providing comprehensive sales figures and considering a wide range of operations(Moretto et al., 2018).
Due to the recent recession, need for efficient hospitals to meet financial challenges is vital. Historically, expenses related to hospital equipment and materials account for up to 45% of hospital operating budget (Chen et al., 2013).

Creativity and Innovation (GSS2): Innovation is widely considered in the field of supply chain (Sabri et al., 2018). Zhu et al (2012)؛ Bellamy et al.(2013)؛ Zimmermann et al. (2016) examined issues related to innovation and their relationship to aspects of the supply chain. The use of innovation affects the structure of the supply chain and can be used as a tool to rebuild the supply chain. In addition, it also affects supply chain performance in terms of direct production and overhead costs, delivery time and inventory. Some researchers consider decisions related to innovation methods as key decisions in redesigning the supply chain(Sabri et al., 2018). Creativity and innovation in Green Logistics helps companies identify suppliers that can be options for developing green suppliers. On this basis, innovation and green logistic creativity can serve as antecessors in the green advancement and development provided by the partners (Blome et al., 2014).

Green Technology (GSS3): Technology and catalystic systems implement efficient processes, and causes effective relationship. In general, it can be said that technology and systems implement all businesses. On the other hand, we are faced with technology as long as the environment and costs are reasonable and logical for the company(Savita et al., 2014). The role of technological components, especially information and environmental technologies, in companies leads to initiative in the measures and provision of supply chain (Savita et al., 2014).
Technology is evolving as a result of the short product life cycle and high costs for physician's preferred items (McKone-Sweet, Hamilton, & Willis, 2005). In addition, the field of therapy also has an unprecedented opportunity to achieve technological advancement for creating a more effective supply chain, reduce unnecessary costs, and improve patient's safety (Chen et al., 2013).

Supply Chain Flexibility (GSS4): Healthcare systems worldwide are under immense structural challenges to meet normative healthcare needs , and they have very little flexibility to respond to unusual events such as

natural disasters and epidemics . Consequently , developing production / delivery flexibility to respond to changes has become a high priority(Yu, Zhao, Liu, & Song, 2021) .The flexibility of the supply chain responds to the ability of the supply chain to face with the consequences of unavoidable dangerous accidents, which is done in order to return to its original operation or move to a new and more desirable state after turmoil (Jüttner & Maklan, 2011). In other words, supply chain flexibility refers to the ability of the supply chain to face with change, which is through the readiness to tolerate future changes, to be aware of changes, and to have response against environmental change (Li, Wu, Holsapple, & Goldsby, 2017).

Organizational Ability (GSS5): According to Grant (1996) organizational capability can be defined as "the ability to repeatedly perform a productive task that is directly or indirectly related to a company's capacity to create value by making changes in inputs to outputs." This is considered to be a competitive performance or operational strength allocated in the organization's operations management (Huo, 2012). As a result, the Green Supplier Developer lash up to create deep, implicit capabilities that are implicitly specific and not easily replicated by competitors. Therefore, taking in consideration resource-based perspectives that believe that the advantage of long-term competition directly with companies' ability to create strategic resources and capabilities that are difficult to imitate, can cause the development of green suppliers and significant competition, and the advantages are not only for the buyer's company but also for supplier's company (Blome et al., 2014).

Commitment (GSS6): Increasing global pressures, especially competition among low-cost countries, are leading to conflicts between international buyers and domestic suppliers. The result is a strained relationship that creates lower levels of commitment, increased risk, and threatens the stability of local suppliers(Tolmay & Antwerpen, 2021). On the one hand Green supplies require the commitment of the company, which is environmental responsibility. Environmental commitments of senior management are considered as a strategic stimulus in promoting green supply methods. Therefore, high managerial commitment is positively related to green supplies (Blome et al., 2014).

Confidence on the Supplier (GSS 7): Inter-organizational developing behaviors can dramatically strengthen suppliers' trust in the organization, and confidence norms can be complementary to performance advancement (Blome et al., 2014).
Trust in the hospital is to ensure that the hospital's primary suppliers are safe from environmental damage (Chen et al., 2013). The direct effect of trust depends on the integrity of the hospital supplier. Hospital supplier integration is a comprehensive process that requires extensive collaboration on both the sides. Based on the above discussion, it can be argued that the hospital's perceived trust in key suppliers has a positive impact on hospital investment in integrating supply chain activities with the suppliers (Chen et al., 2013).

Green Quality (GSS8): Quality and on time delivery in the context of supplier selection is part of a fundamental structure of adaptation (Choi & Hartley, 1996). Supplier performance points like product quality, guiding time and supply safety are improved through well-designed environmental standards (Blome et al., 2014). In addition, the quality of the final set of suppliers to a large extend depends on the quality of all the steps involved in the selection process (Mendoza, 2007) . The manufacturer must determine the level of investment in the green quality of the new product. On the other hand, a retailer can offer a warranty period for a new product to ensure its quality. The warranty period can reduce the risk of customers buying green products and thus can stimulate market demand. Coordinating the green quality of the manufacturer and the retail warranty period of retailers not only benefits all members of supply chain, but also increases the green quality of the new product and the warranty periods offered will be competitive, therefore, consumers can enjoy products with the highest green quality and longer warranty period (Hosseini-Motlagh et al., 2018).
In health care centers, improving quality leads to less resource waste, improved patient satisfaction, and the effectiveness of medical care and health care services (Blass et al., 2017).

Green Transportation (GSS9): The development of green supply chain management is as an opportunity for the transportation industry to provide an environmentally friendly image (C.-S. J. T. R. P. D. T. Yang & Environment, 2018) . Transportation plays an important role in providing low-cost and efficient services. Thus, globalization has led to more intense competition, and today it is changing transportation companies (C.-S. Yang et al., 2013). Green transportation operations are practical from the environment and entail adopting optimal speed programming, an optimal routing system, as well as performing ISO 14000 series auditing (C.-S. J. T. R. P. D. T. Yang & Environment, 2018) . Internal green practices not only cause the performance of transport companies, but also act as a mediator between organizational pressure and external green cooperation and institutional pressures and green performance(C.-S. Yang et al., 2013)
The healthcare industry is still using the amount of cargo transportation LTL (60% of transport), which is more expensive and damaging (Kwon et al., 2016).

Customer Environmental Cooperation (Customer Training, Customer Support) (GSS10): External green partners typically need to work with external stakeholders such as suppliers, partners, and customers (C.-S. J. T. R. P. D. T. Yang & Environment, 2018). On the other hand, environmental cooperation, and especially its development, which improves the various capabilities of

the supplier in the field of the company's activities, is increasing to settle the environmental challenges (Blome et al., 2014).

Lack of co-operation by health care and therapy supply partners is a serious obstacle to the implementation of the standardized process in the healthcare industry (Kwon et al., 2016). Environmental information should also be linked to the training of health care professionals so that they meet the changing trends of the disease and increase its awareness of proper use and resource disposal(Kaiser, Eagan, & Shaner, 2001).

Hazardous Materials Management (GSS11): Hazardous material management includes processes to minimize production waste, toxins and wastes, as well as reducing pollution from any energy consumed, and overall optimal use of renewable resource systems and avoiding depletion of non-renewable resouces (Martens & Carvalho, 2017).

Adopting preventive strategies in the company's environmental management not only prevents companies from facing environmental protests or penalties, but also helps reduce costs, increase revenue, improve services and customer satisfaction, and increase new market (C.-S. J. T. R. P. D. T. Yang & Environment, 2018) .

Green procurement (GSS12): Within an organization, activities related to the procurement process usually include: determining the need, selecting the supplier, entering the appropriate price, determining the conditions, issuing the contract or order, cooperating in the design, preparing, analysis of resources and ensuring proper delivery(Aissaoui et al., 2007; Mendoza, 2007). in the shopping section (Sarkis, 2006) Buy Green is introduced as sellers' selection and logistics.

In addition, the purchasing mechanism is also a promising way to take action that can be used to improve the use of productd preferably environmentally friendly products in the healthcare industry; healthcare and therspy centers can improve environmental performance reduce costs. Tools that focus on buying and selling better than the environment can help hospitals select products that creates minimum environmental pollution.In addition, Healthcare facilities can also use "green" shopping initiatives to ensure superior environmental products (Kaiser et al., 2001). A procurement procedure will be considered as " green " only if it has led to the purchase of a substantively " greener " product and only if the environmental characteristics of this product go beyond what needs to be complied with on the basis of European or national environmental legislation (Busu & Busu, 2021).

Green Warehouse (GSS13): The rapid development of e - commerce makes warehouse efficiency a focus . As one of the core operations of the warehouse , picking occupies an important position in the operations of the entire warehouse(Shen, Yi, & Wang, 2021) . Recently, companies have come to understand the green warehouse crisis to save expenses, costs) and energy. In an effort to minimize costs and increase social responsibility, many warehouse companies are looking to implement environmentally friendly ways that reduce carbon emissions and reduce environmental pollution (R. Rostamzadeh, K. Govindan, A. Esmaeili, & M. J. E. I. Sabaghi, 2015). Green warehousing (GW) is used to demonstrate managerial concepts that integrate and implement environmentally friendly operations with the aim of reducing harmful emissions , reducing comsumption resources , and increase ecological valule of the facility(Margareta, Ridwan, & Muttaqin, 2020).

Green Packaging (GSS14): One of the concepts of green procurement management that had been discussed is the principles of green packaging. Green package management can be promoted directly and indirectly through laws and regulations, taxes, organizational measures and other cases (Hosseini-Motlagh et al., 2018). In short, green packaging is appropriate packaging that can cause reuse, recycling or destruction, corruption and pollution in humans and the environment during the product life cycle (Cherrafi et al., 2018; Hosseini-Motlagh et al., 2018).

2.5. Fuzzy cognitive map (FCM)

In this method, each variable that has numerical measurements (data) available is represented by a numerical vector, where each vector element represents one measurement. The numerical vectors are transferred into fuzzy sets and each vector element is represented by a grade of membership. Then the relationship between the variables is determined by examining the data, whether the relationship is direct or inverse, and also the closeness of the variables are determined. Finally the correlations among variables are determined and assuming these correlations represent causative relationships the cognitive map can be coded (Özesmi & Özesmi, 2004; E. I. J. I. T. o. S. Papageorgiou, Man, & Cybernetics, 2011).

The cognitive maps model is represented by a simple graph, which consists of nodes and edges. The nodes represent concepts relevant to a given domain and the causal relationships between them are depicted by directed edges. Each edge is associated with a positive or negative sign that expresses a specific type of relationship (Stach, Kurgan, Pedrycz, Reformat, & systems, 2005).

Like the traditional cognitive maps, FCM consists of a number of nodes that represent variable concepts. A fuzzy cognitive map with n concepts is represented by an n×n matrix. Generally, the causality relationship between two concepts is described by the nonlinear function e(ci, cj) representing the extent of influence of ci on cj. Schneider, Shnaider, Kandel and Chew (1998) developed a method for automatic generation of fuzzy cognitive map (E. Papageorgiou, Stylios, & Groumpos, 2003).

model to developed an advanced FCM based on four matrices: i) the initial matrix of success, ii) the fuzzified matrix of success, iii) the strength of relationship matrix of success, and iv) the final matrix of success (Kosko, 1986).

2.6. Intuitionistic fuzzy

In general, cognitive maps are too binding for knowledge-based building. For, in general, causality is fuzzy. Causality admits of degrees, and vague degrees at that. It occurs partially, sometimes, very little, usually, more or less, etc. More generally still, the knowledge-based building promise of cognitive maps is combining knowledge sources' cognitive maps, but the fuzziness of the combined knowledge rises to the level of fuzziness of the fuzziest knowledge source. Fuzzy cognitive maps accommodate this knowledge-based building property (Kosko, 1986; Özesmi & Özesmi, 2004).

Fuzzy sets only consider the degree of acceptance, but IFS is characterized by a membership function and a non-membership function so that the sum of both values is less than one. Presently, IFSs are being studied and used in different fields of science. Among the research works on IFS we can mention Atanassov, Atanassov and Gargov (1989), Szmidt and Kacprzyk (2000), Ban (2006), Deschrijver and Kerre (2002) (Mirghafoori, Sharifabadi, Takalo, & Management, 2018).

Definition 1- Assume reference set $X=\{x_1,x_2,x_3,...\}$. In this case, set A which is a subset of X is an intuitionistic fuzzy set defined as below:

$$A=\left\{\prec x,u_A(x),\nu_A(x)\succ \forall x\in X\right\} \tag{1}$$

In the above definition, $u_A(x),\nu_A(x)$ are degree of membership and non-membership respectively, which are defined as $u_A(x):x\to[0,1],\nu_A(x):x\to[0,1]$ and satisfy $0\le u_{ij}(x)+\nu_{ij}(x)\le 1$. In addition, for each $x\in X$, intuitionistic index π_x is defined as $\pi_x=1-u_x-\nu_x$ (Atanassov, 1986).

Definition 2- $\left(u_{ij}(x),\nu_{ij}(x),\pi_{ij}(x)\right)$ is an intuitionistic fuzzy number that satisfies the following conditions as below :

$$\begin{aligned}&u_{ij}(x)\in[0,1],\nu_{ij}(x)\in[0,1],\pi_{ij}(x)\in[0,1],\\&0\le u_{ij}(x)+\nu_{ij}(x)\le 1,\pi_{ij}(x)=1-u_{ij}(x)-\nu_{ij}(x)\end{aligned} \tag{2}$$

It must be noted that although intuitionistic fuzzy number is similar (in appearance) to triangular fuzzy number (a,b,c), it is quite different. Triangular fuzzy number is a convex normal fuzzy set with a membership function in which $(a\prec b\prec c)$; while an intuitionistic fuzzy number is a point in three-dimensional space constructed by axes $u_{ij}(x),\nu_{ij}(x),\pi_{ij}(x)$ (Szmidt & Kacprzyk, 2001). Atanassov and Gargov(1989) and Gau and Buehrer(1993) have described intuitionistic fuzzy number $(0.50,0.20,0.30)$ as a scenario where votes in favor of adoption are 0.5, votes against it are 0.2 and abstained votes are 0.30.

In this context the following relationship holds.

$$\begin{aligned}&\mu_{ij}^{\beta}(x)+\nu_{ij}^{\beta}(x)\le 1,\ 0\le\mu_{ij}^{\alpha}(x)\le u_{ij}^{\beta}(x)\le 1,\\&0\le\nu_{ij}^{\alpha}(x)\le\nu_{ij}^{\beta}(x)\le 1\end{aligned} \tag{3}$$

These numbers are better suited to deal with uncertainty and provide a more logical mathematical framework to deal with inexact facts and incomplete information (Zhang, Jiang, Jia, & Luo, 2010). Some of the operators and relationships between these numbers are provided in the following. For simplicity's sake, these numbers are expressed as $\left[\mu_{ij}(x),\nu_{ij}(x),\pi_{ij}(x)\right]$ where $\mu_{ij}(x)$, $\nu_{ij}(x)$ and $\pi_{ij}(x)$ are numbers in the range [0,1].

Definition 3- Assume intuitionistic fuzzy numbers $A=\left\{\left\langle x,\mu_A(x),\nu_A(x)\right|x\in X\right\rangle\}$ and $A_1=\left\{\left\langle x,\mu_{A1}(x),\nu_{A1}(x)\right|x\in X\right\rangle\}$ $A_2=\left\{\left\langle x,\mu_{A2}(x),\nu_{A2}(x)\right|x\in X\right\rangle\}$ the real number n. According to Zeshui Xu, Xiaoqiang Cai(2012) the following relationships are defined as below :

$$\bar{A}=\left\{\left\langle x,\nu_A(x),\ \mu_A(x)\right|x\in X\right\rangle\} \tag{4}$$

$$A_1\cap A_2=\left\{\left\langle\begin{matrix}x,\min\left\{\mu_{A_1}(x),\mu_{A_2}(x)\right\},\\\max\left\{\nu_{A_1}(x),\nu_{A_2}(x)\right\}\end{matrix}\right|x\in X\right\rangle\} \tag{5}$$

$$A_1\cup A_2=\left\{\left\langle\begin{matrix}x,\max\left\{\mu_{A_1}(x),\mu_{A_2}(x)\right\},\\\min\left\{\nu_{A_1}(x),\nu_{A_2}(x)\right\}\end{matrix}\right|x\in X\right\rangle\} \tag{6}$$

$$A_1+A_2=\left\{\left\langle\begin{matrix}x,\mu_{A_1}(x)+\mu_{A_2}(x)-\mu_{A_1}(x)\cdot\mu_{A_2}(x),\\\nu_{A_1}(x)\cdot\nu_{A_2}(x)\end{matrix}\right|x\in X\right\rangle\} \tag{7}$$

$$A_1\cdot A_2=\left\{\left\langle\begin{matrix}x,\mu_{A_1}(x)\cdot\mu_{A_2}(x),\\\nu_{A_1}(x)+\nu_{A_2}(x)-\nu_{A_1}(x)\cdot\nu_{A_2}(x)\end{matrix}\right|x\in X\right\rangle\} \tag{8}$$

$$nA=\left\{\left\langle\begin{matrix}x,1-\left(1-\mu_A(x)\right)^n,\\\left(\nu_A(x)\right)^n\end{matrix}\right|x\in X\right\rangle\} \tag{9}$$

$$A^n=\left\{\left\langle x,\left(\mu_A(x)\right)^n,1-\left(1-\nu_A(x)\right)^n\right|x\in X\right\rangle\} \tag{10}$$

Where n is a Positive integer.

3. The Main Text

The aim of this study was to identify the effective factors on green supplier selection and provide a model for analyzing the causal relationships of these factors for hospital supply chain. There is a wide range of literature on green supplier selection, but the relationship between the effective factors on green supplier selection has not yet been developed. The study population are hospital experts familiar with the issue of green supplier selection. In addition, the sampling method is snowball sampling. As a result, by examining the research literature and

similar studies, the concepts effective on the selection of green supplier in hospital services were extracted and then 14 concepts were selected by reconciliation and revision. In order to ensure the validity of the causal model designed in this study, the experts expressed their corrective views on the process and their results. The causal model was created by using the Intuitionistic Fuzzy Cognitive Map (IFCM) Method and by the Rogriguez-Repiso, Setchi and Salmeron (2007) models, which is an intuitive fuzzy expansion. According to the research objectives, this study was conducted in two phases.

3.1. Phase I: Development of Framework of select the green supplier in hospitals supply chain

Considering the deficiency of subject literature, the concepts were identified by in-depth interviewing of healthcare experts in multiple stages. Given the large number of concepts and the resulting difficulties in development of framework, Delphi method was used to reorganize the initial concepts into 14 concepts.

3.2. Phase II: development of causal model of select the green supplier in hospitals supply chain using of ifcm method

IFCM method consists of following steps.
Step 1 - Constructing the intuitionistic fuzzy matrix of success:
This is a $[n \times m]$ matrix where n is the number of green supplier in hospitals (A_i) and m represents the number of hospital experts who provide the data (E_k).(Table 1).
In this matrix $\tilde{r} = [\mu_{ij}(x), v_{ij}(x), \pi_{ij}(x)]$ represents the intuitionistic fuzzy degree of importance given by expert j to concept i of the green supplier in hospitals.
Step 2 - Constructing the strength of relationship matrix of success:
This is a $[n \times m]$ matrix where each element represents the relationship of factor i with factor j. S_{ij} is the degree of proximity of the two vectors i and j. S_{ij} can take values in the range $[-1 \times 1]$.Each critical success factor is represented by the numerical vectorS_i which consist of n elements, one for each concept in the map. There are three possible scenarios for relationship between concepts i and:
- A direct relationship represented by $S_{ij} \succ 0$
- An inverse relationship represented by $S_{ij} \prec 0$
- No relationship represented by $S_{ij} = 0$

Assuming $\tilde{V}_i$ as the intuitionistic fuzzy vector of m elements related to concept i the similarity of relationships between vectors $\tilde{V}_i$ and $\tilde{V}_j$ will be:
This gives the strength of relationship between concepts $i$and j as the similarity of these two vectors, represented by S_{ij}. The similarity of two vectors is measured by their distance, as defined in the intuitionistic fuzzy logic. In this study, this distance was considered to be the normalized Euclidean
distance given by the following formula:
As a result, the closeness or similarity of two factors (S_{ij}) is given by:
$S = 1$ signifies perfect similarity and $S = 0$ means no similarity.
Step 3 - Constructing the final matrix of success:
The matrix obtained from the previous step contains some data that might be misleading. Simply put, some of the concepts of the matrix may be unrelated to each other and have no causal relationship. Thus, to construct the final matrix of success, expert inputs are again used to separate those intuitionistic fuzzy elements that represent causal relationships between concepts.
Step 4 - Graphical representation of intuitionistic fuzzy cognitive map:
In this step, the results are plotted as an intuitionistic cognitive map of critical success factors. In this
graphical representation, causal relationship between two concepts is represented by an arrow, which has a weight representing the strength of this direct or inverse relationship.

Table 1
Intuitionistic fuzzy matrix of success

Experts / Concepts	E_1	E_2	…	Em
A_1	$\tilde{r}_{11}$	$\tilde{r}_{11}$	…	$\tilde{r}_{1m}$
A_2	$\tilde{r}_{12}$	$\tilde{r}_{22}$	…	$\tilde{r}_{2m}$
…	…	…	…	…
A_n	$\tilde{r}_{n1}$	$\tilde{r}_{n2}$	…	$\tilde{r}_{nm}$

4. Results

In this section, the results are presented in two phases in accordance with the phases described in the previous section.

4.1. Phase I: Development of Framework of Hospital Green Supply Chain

As mentioned earlier, the concepts were identified by reviewing research literature and similar studies. Kerman hospitals were considered as study areas. The final list of key concepts related to the effective factors on green supplier selection for a hospital supply chain is presented in Table 2.

Table 2
Green Supplier Selection Indicators in Hospital

	Concepts
Gss1	Financial capability
Gss2	creativity and innovation
Gss3	Green technology

	Concepts
Gss4	Flexibility
Gss5	Organizational capability
Gss6	Commitment
Gss7	the trust
Gss8	Green quality
Gss9	Green transport
Gss10	Environmental co-operation
Gss11	Hazardous materials management
Gss12	Green shopping
Gss13	Green storage
Gss14	Green packing

4.2. Phase II: Development of Causal Model of select the green supplier in hospitals supply chain with IFCM Method

After identification of major concepts in phase 1, IFCM method was used to develop the causal model of sustainable hospital supply chain management in 4 steps:
Step 1 - constructing the intuitionistic fuzzy matrix of success:

There were 14 final concepts and 15 experts available for analysis, so a 14 × 15 matrix was created. Experts were asked to describe the importance of each concept for one of five linguistic terms given in Table 3. To simplify the analysis, these terms were also assigned with codes 1 to 5, representing the lack of impact, weak impact, moderate impact, strong impact, and very strong impact, respectively.

Table 3

Intuitionistic fuzzy linguistic terms

Linguistic term	Cods	IFNs
No Influence	1	(0.1,0.9)
Very Low Influence	2	(0.35,0.6)
Low Influence	3	(0.5,0.45)
High Influence	4	(0.75,0.2)
Very High Influence	5	(0.9,0.1)

The intuitionistic fuzzy degree of importance of every concept was obtained by the method described. As mentioned, this parameter represents the importance of concept i for selection Green Supplier of Hospital in view of expert j. The results of this step are presented in Table 4.

Table 4

Intuitionistic fuzzy matrix of success

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Gss1	(0.75, 0.2)	(0.36, 0.6)	(0.75, 0.2)	(0.75, 0.2)	(0.36, 0.6)	(0.75, 0.2)	(0.75, 0.2)	(0.36, 0.6)	(0.75, 0.2)	(0.75, 0.2)	(0.36, 0.6)	(0.75, 0.2)	(0.75, 0.2)	(0.36, 0.6)	(0.75, 0.2)
Gss2	(0.5, 0.45)	(0.9, 0.1)	(0.75, 0.2)	(0.5, 0.45)	(0.9, 0.1)	(0.75, 0.2)	(0.5, 0.45)	(0.9, 0.1)	(0.75, 0.2)	(0.5, 0.45)	(0.9, 0.1)	(0.75, 0.2)	(0.5, 0.45)	(0.9, 0.1)	(0.75, 0.2)
Gss3	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)
Gss4	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)
Gss5	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)
Gss6	(0.9, 0.1)	(0.5, 0.45)	(0.9, 0.1)	(0.9, 0.1)	(0.5, 0.45)	(0.9, 0.1)	(0.9, 0.1)	(0.5, 0.45)	(0.9, 0.1)	(0.9, 0.1)	(0.5, 0.45)	(0.9, 0.1)	(0.9, 0.1)	(0.5, 0.45)	(0.9, 0.1)
Gss7	(0.5, 0.45)	(0.5, 0.45)	(0.9, 0.1)	(0.5, 0.45)	(0.5, 0.45)	(0.9, 0.1)	(0.5, 0.45)	(0.5, 0.45)	(0.9, 0.1)	(0.5, 0.45)	(0.5, 0.45)	(0.9, 0.1)	(0.5, 0.45)	(0.5, 0.45)	(0.9, 0.1)
Gss8	(0.9, 0.1)	(0.9, 0.1)	(0.9, 0.1)	(0.9, 0.1)	(0.9, 0.1)	(0.9, 0.1)	(0.9, 0.1)	(0.9, 0.1)	(0.9, 0.1)	(0.9, 0.1)	(0.9, 0.1)	(0.9, 0.1)	(0.9, 0.1)	(0.9, 0.1)	(0.9, 0.1)
Gss9	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)
Gss10	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)
Gss11	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)
Gss12	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)	(0.9, 0.1)	(0.75, 0.2)	(0.9, 0.1)
Gss13	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)
Gss14	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)	(0.75, 0.2)	(0.75, 0.2)	(0.9, 0.1)

Step 2 - constructing the strength of relationship matrix of success: This matrix, which shows the closeness of two concepts, was obtained using Equation (9) and (10). The resulting strength of relationship matrix is given in Table 5.

Table 5

Strength of relationship matrix of success

	Gss1	Gss2	Gss3	Gss4	Gss5	Gss6	Gss7	Gss8	Gss9	Gss10	Gss11	Gss12	Gss13	Gss14
Gss1	0	0.30	0.28	0.23	0.22	0.12	0.17	0.92	0.23	0.23	0.27	0.23	0.22	0.22
Gss2	0.30	0	0.15	0.22	0.21	0.29	0.21	0.21	0.22	0.22	0.13	0.22	0.16	0.16
Gss3	0.28	0.15	0	0.10	0.12	0.21	0.24	0.07	0.10	0.10	0.07	0.10	0.07	0.07
Gss4	0.23	0.22	0.10	0	0.07	0.13	0.24	0.07	0	0	0.12	0	0.07	0.07
Gss5	0.22	0.21	0.12	0.07	0	0.15	0.25	0.10	0.07	0.07	0.10	0.07	0.10	0.10
Gss6	0.12	0.29	0.21	0.13	0.15	0	0.20	0.20	0.13	0.13	0.22	0.13	0.15	0.15
Gss7	0.17	0.21	0.24	0.24	0.25	0.20	0	0.28	0.24	0.24	0.25	0.24	0.19	0.19
Gss8	0.29	0.21	0.07	0.07	0.10	0.20	0.28	0	0.07	0.07	0.10	0.07	0.10	0.10
Gss9	0.23	0.22	0.10	0	0.07	0.13	0.24	0.07	0	0	0.12	0	0.07	0.07
Gss10	0.23	0.22	0.10	0	0.07	0.13	0.24	0.07	0	0	0.12	0	0.07	0.07
Gss11	0.27	0.13	0.07	0.12	0.10	0.22	0.25	0.10	0.12	0.12	0	0.12	0.10	0.10
Gss12	0.23	0.22	0.10	0	0.07	0.13	0.24	0.07	0.00	0.00	0.12	0	0.07	0.07
Gss13	0.22	0.16	0.07	0.07	0.10	0.15	0.19	0.10	0.07	0.07	0.10	0.07	0	0
Gss14	0.22	0.16	0.07	0.07	0.10	0.15	0.19	0.10	0.07	0.07	0.10	0.07	0	0

Step 3 - constructing the final matrix of success: As mentioned, the strength of relationship matrix may contain misleading data signifying false causal relationships between concepts. To avoid false results, all 15 experts were asked to re-examine this matrix and express their views on the derived inter-concept relationships. Accordingly, the false relations were removed and the final matrix was obtained (Table 6).

Table 6

Final matrix of success

	Gss1	Gss2	Gss3	Gss4	Gss5	Gss6	Gss7	Gss8	Gss9	Gss10	Gss11	Gss12	Gss13	Gss14
Gss1			0.28											
Gss2			0.15											
Gss3								0.07						
Gss4		0.22												
Gss5	0.22			0.07										
Gss6									0.13	0.13				
Gss7												0.24		
Gss8							0.28							
Gss9										0.10				
Gss10											0.12			
Gss11								0.10						
Gss12													0.07	
Gss13					0.10									
Gss14													0.10	

Step 4. Using this matrix, the causal model of factors influencing green supplier was obtained as shown in Fig. 1.

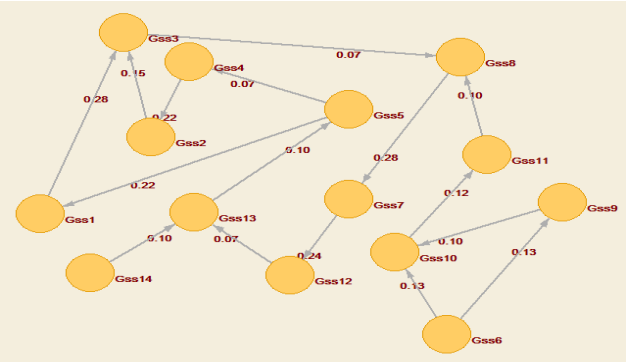

Fig. 1. Causal Model Select a Green Supplier in the Hospital

After identifying the concepts, the causal model was designed based on the Intuitionistic Fuzzy Cognitive Map

(IFCM) method. For this purpose, the Rodriguez fuzzy cognitive mapping method was combined with the principles of intuitive fuzzy logic (IFS). For statistical analysis, the output was used to design a causal map of the effective factors on the hospital green supplier selection, in which the centrality of nodes (concepts) could be an appropriate measurement for this analysis.

According to the causal diagram, outdegree, indegree and centrality of concepts can be shown as Fig. 2, 3 and 4. The centrality of nodes is defined based on the sum of the outdegree and indergee concepts (nodes). Outdegree is the sum of the absolute values of the external relations of the node, and the "indegree" is the sum of the absolute values of the input relations of the node.

As can be seen in Fig. 2, the concepts of green technology and buy green with 0.07 degree have the least outdegree and organizational capability with 0.29 degree have the most outdegree. According to Fig. 3, green technology with 0.43 degree has the highest degree and commitment and green packaging with zero has the least indegree, and also according to Fig. 4, trust in suppliers has the highest degree of centrality and green packaging has the lowest degree of centrality.

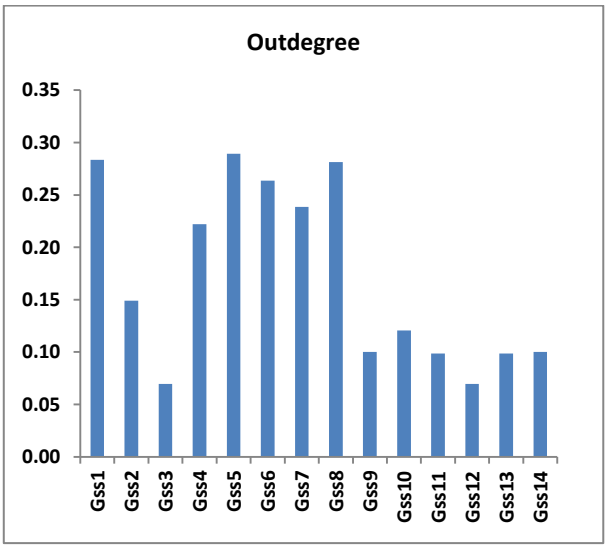

Fig. 2. Outdegree of concepts

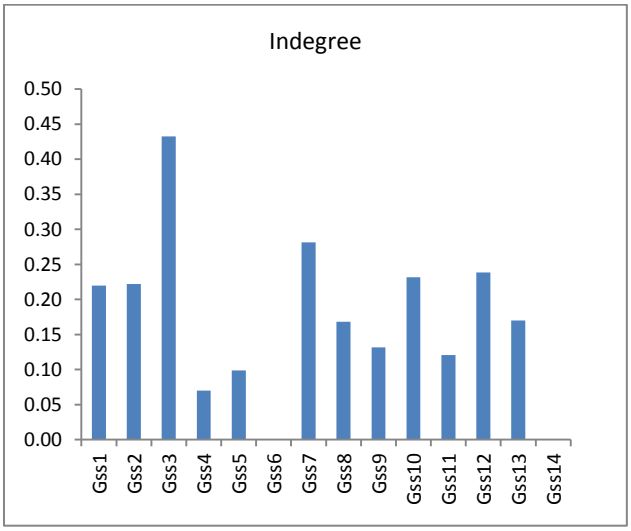

Fig. 3. Indegree of concepts

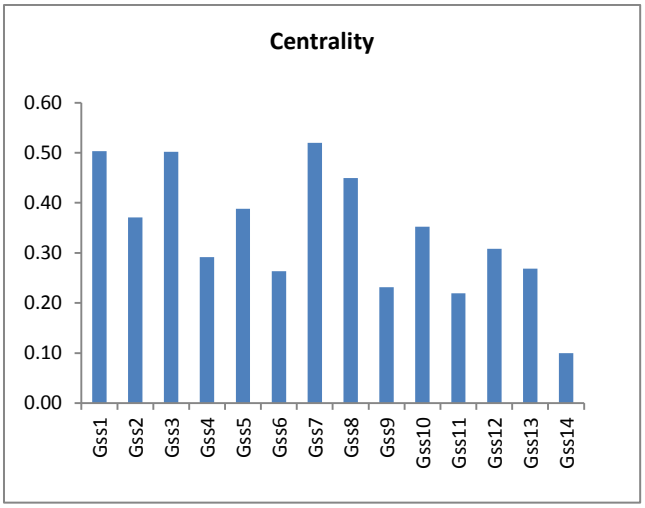

Fig. 4. Centrability of concepts

To examine the concepts in more detail (according to Table 7), as shown in Fig. 5, they can be divided into four sections:

Section One: This section includes concepts that are highly indegree and outdegree. Financial Capability (Gss1), Trust in supplier (Gss7), Creativity and Innovation (Gss2) are in section one. A concept that is in this section should be given special attention and should be carefully managed.

Section Two: This section includes those concepts that have low outdegree but high indegree. Green procurement (Gss12), Customer Environmental Cooperation (Gss10) and Green Technology (Gss3) are in this section. These indexes are more outdegree and less indegree on other indicators, therefore, it is difficult to manage this factor because many factors are the cause of it.

Section Three: Includes (Gss4) Supply Chain Flexibility Indicators, Commitment (Gss6), Organizational Ability (Gss5), Green Quality (Gss8), which are highly outdegree and low indegree. The importance of these indexes are

high in the occurrence of changes. Therefore, special attention should be given to these indicators.

Section Four: Factors that have both low outdegree and low indegree. The importance of these factors compare to others in change management is less. Factors such as Green Warehouse (Gss13), green packaging (Gss14) , Hazardous Materials Management (Gss11), Green Transportation (Gss9) are in this section.

Table 7

Outdegree, indegree and centrality of each node

Concepts	Outdegree	Indegree	Centrality	%Outdegree	%Indegree
Gss1	0.28	0.22	0.50	0.98	0.51
Gss2	0.15	0.22	0.37	0.52	0.51
Gss3	0.07	0.43	0.50	0.24	1
Gss4	0.22	0.07	0.29	0.77	0.16
Gss5	0.29	0.10	0.39	1	0.23
Gss6	0.26	0	0.26	0.91	0
Gss7	0.24	0.28	0.52	0.82	0.65
Gss8	0.28	0.17	0.45	0.97	0.39
Gss9	0.10	0.13	0.23	0.35	0.30
Gss10	0.12	0.23	0.35	0.42	0.54
Gss11	0.10	0.12	0.22	0.34	0.28
Gss12	0.07	0.24	0.31	0.24	0.55
Gss13	0.10	0.17	0.27	0.34	0.39
Gss14	0.10	0	0.10	0.35	0

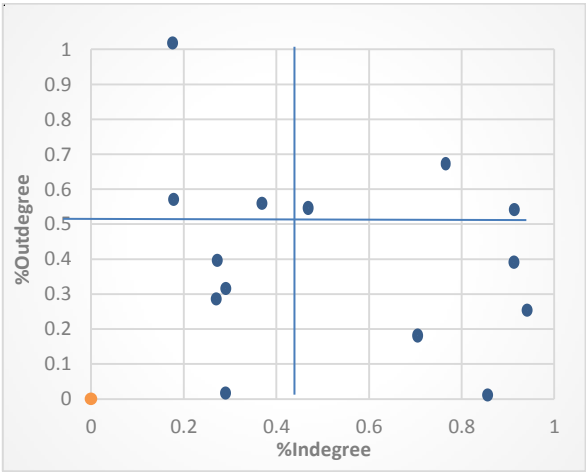

Fig. 5. Grouping nodes in four regions

5. Discussion

According to Fig. 2, the criterias of green technology and green buy green with 0.07 degrees had the least outdegree and organizational capability with 0.29 degrees had the most outdegree.

According to the findings Ulrich and Lake (1991) the creation of organizational capability and competitive advantage had changed to a main program of management. and will continue to be a key management program. According to them believe organizational capability is based on the assumption that organizations do not think and make decisions or allocate resources.

In addition, the results of the study Liu and Yang also confirm the effect of organizational capabilities in shaping the company's performance and indicate that organizational capabilities can help small and medium enterprises survive with higher competitive advantage. According to Figure 3, green technology with 0.43 degrees has the most indegree, commitment and green packaging with zero degree has the least indegree.

According to Allan, Jaffe, and Sin (2014) distinctive feature a "green technology" is that, which facilitates the reduction of environmental side effects compared to the current situation.

Deng, You, and Wang (2019) The following results were obtained in the research related to green technology: (1) Depending on the effect of political competition, innovation strategies in the field of green technology in governments and local companies are different for different situations. (2) Political competition not only directly affects the desired level of innovation in green technology, but also indirectly affects the optimal investment ratio of environmental management. (3) The way of decisions making in corporations, in local governments and lack of environmental focus have significant effects on the optimal level of innovation in green technology that must be considered when developing effective environmental policies.

In addition, this study also Du, Li, and Yan (2019) examined the impact of green technology innovations on carbon dioxide (CO2) emissions. In particular, it has been investigated whether income levels are important for the effect of green technology innovations. The results suggested that the effect of green technology innovations on income levels had only one threshold. In particular, green technology innovations have significantly reduced CO2 emissions for economies whose income levels are not below the threshold.

Rokka and Uusitalo (2008) In their study, it examined the choice of consumer environment by analyzing the relative importance of green packaging compared to other characteristics of the product. The results showed that the largest consumer section, that is one-third of consumers, considered green packaging to be the most important selection criterion. In the hospital field for green supplier selection, green packaging is one of the least indegree concepts, which indicates that it is an important concept and is more outdrgree.

In addition, according to Fig. 4, trust in the supplier has the highest degree of centrality and and green packaging has the lowest degree of centrality.

According to the research conducted by Dyer and Chu (2000) trust or confidence has been described as an important background (experience) for inter-organizational collaboration and economic productivity. In fact, recent research indicated that trust in supplier-buyer relationships may be an important source of competitive advantage because it reduces transaction costs, facilitates investment in specific assets, in addition, it also leads to the sharing of superior information.

According to Paparoidamis, Katsikeas, and Chumpitaz (2017) studies it is clear that creating trust in buyer-seller relationships is a key issue in marketing. However, there

are different results about trust. In addition, no attention has been paid to the relationship between the performance aspects of the supplier and the increase in trust. Observational results suggest that supplier performance in the product quality and sales service quality leads to trust. In addition, the performance of the supplier in supporting technical services increases the trust in the market context. Furthermore, the results showed that trust increases customer loyalty.

Abdallah, Abdullah, and Mahmoud Saleh (2017) In his study, examined the effect of trust on suppliers about integration in the hospital – the supplier and the performance of the hospital supply chain. The proposed hypotheses were tested using structural equation modeling. The results showed a positive effect of trust on suppliers in the hospital performance. In addition, the findings of this study also provided helpful insight into the role of trust in strengthening the performance of the supply chain in the healthcare sector. On the other hand, the high level of integration of the suppliers not only improves the performance of the hospital supply chain, but also increases the conversion of the advantages of trust in the performance of the supply chain.

6. Conclusion

Examining the effective factors on green supplier selection, especially in medical centers, is considered a potential priority for society. So that by examining the existing literature, we have found out a point that for accelerating the green supplier selection in the medical sector which stimuli have the most and which have the least effect. In this study, by researching the literature, the focus was on providing a causal model for stimuli and determining their outdegree and indegree on each other for progressing the organizational development goals of a logical and practical framework according to the study context presented. The results of this study, respectively, include the following: First, identification of developmental indexes with the help of the literature study and experts, which is important in the field of health services. In this regard, a new work has been done. Second, there is a causal model of the relationship between these dimensions and the fuzzy cognitive map approach, which gives researchers a good insight into this area and can be used in dynamic systems. Third, it provides a framework for research into the criteria for selecting a green supplier in the healthcare sector, and finally, to what extent do the indicators for selecting a hospital green supplier affect and influence each other? . Based on the results of this study, suggestions can be provided for both groups. The first group is researchers who can use this article to expand the discussion of identifying factors influencing the choice of green supplier to other areas of service, such as banks, institutions, and organizations. Researchers can also conduct quantitative research at the development level of the green supplier selection process. The second group is health officials, especially hospital officials, who can use the model presented in this study to improve the performance of their supply chain. Second, the causal model was built on the relationship between these dimensions and the fuzzy cognitive map approach, which gives researchers a good insight into this area and can be used in dynamic systems. Third, it provides a framework for research in the field of indexes of green supplier selection in the healthcare sector, and finally, the result obtained was to what extend the indexes in the field of green supplier selection in the hospitals affect and influence each other.

Based on the results of this study, suggestions can be provided for two groups. The first group is researchers who can use this article as a sample to expand the discussion of identifying factors influencing green supplier selection to other areas of service, such as banks, institutions, and organizations. In addition, researchers can also conduct quantitative research in the development level of the green supplier selection process. The second group is health officials, especially hospital officials, who can use the model presented in this study to improve the performance of their supply chain.

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