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ANALYSIS OF THE INFLUENCE OF THE SUPPLY CHAIN MANAGEMENT CONCEPT ON USER SATISFACTION IN THE DENTAL INDUSTRY OF THE REPUBLIC OF CROATIA

Original Paper
https://doi.org/1059014/NAZF9524

Abstract

This paper analyzes the influence of supply chain management factors on patient satisfaction in the dental supply chain of the Republic of Croatia. 102 dental polyclinics and 915 users of dental services participated in the research. The data were collected using a questionnaire, and were statistically processed first by factor and then by regression analysis in order to determine the influence of the researched factors. After the analysis was carried out, it was determined that the supply chain management factors include flexibility, integration, responsiveness, supplier performance, quality of relationships between partners and customer satisfaction. Regression analysis found that only the quality of the relationship between partners contributes to user satisfaction, which partially confirmed the research hypothesis. The contribution of the conducted research is manifested in the realization that the concept of supply chain management has been successfully implemented in the dental industry of the Republic of Croatia, but unlike the cases in developed countries in Europe (Germany, Switzerland, France), it is necessary to more intensively include other factors of supply chain management in the work, such as would contribute more strongly to patient satisfaction.

Key words: strategic alliances, supply chain management, vertical integration

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Introduction

Supply chain management today represents one of the most current business strategies in modern business, which is based on the application of a unique approach to flow management within strategic alliances. Successful application refers to a view of the supply chain in which the business processes of all involved entities are successfully integrated, including producers of raw materials, suppliers of goods, producers, distributors (intermediaries) and end consumers. Examples of successfully integrated business systems (global corporations) add great importance to the concept of supply chain management, primarily because it positively affects user satisfaction and consequently contributes to better positioning of own products and services on the market.

By including in the work of modern supply chains, companies willingly participate in the work of strategic alliances by developing long-term relationships with partners (suppliers and customers), continuously improving the quality of their own processes, products and services, developing human resources and regularly modernizing their operations, which enables new, more efficient, integration opportunities with members of the strategic alliance, which ultimately leads to an increase in customer satisfaction. Supply chain management has found its successful application in a whole range of different industries such as automotive, wood, food, and more recently research has intensified in the dental industry as well.

Current research in the dental industry (Jaggaer, 2021) confirm that supply chain management plays a crucial role in ensuring the efficient and seamless delivery of products, materials, and services needed to support dental practices, clinics, and laboratories. From dental tools and consumables to high-tech diagnostic equipment and specialized materials, the dental supply chain is complex and requires careful coordination among manufacturers, distributors, suppliers, and end-users.

Furter more effective supply chain management is vital not only for maintaining a steady flow of essential products but also for ensuring that those products meet stringent regulatory standards, are delivered on time, and align with the evolving needs of dental professionals. As patient care and safety are directly impacted by the quality and reliability of dental

supplies, SCM in this field must prioritize consistency, quality assurance, and responsiveness to demand fluctuations.

An optimized supply chain not only helps dental providers deliver high-quality care but also ensures that dental professionals can rely on a steady and responsive flow of products, enabling them to focus on their primary mission—delivering excellent patient outcomes.

Throughout the long history, until recently, providers of dental care services were small private or public practices whose activity was limited mainly to the repair and extraction of teeth and limited dental structures. The supply chain, from the reception of patients, through X-ray imaging services and procurement of materials to the final service, was procedurally fragmented and formally disjointed. However, nowadays, especially in the countries of the European Union and the United States of America, supply chains are managed much more efficiently, which is a consequence of their modernization of operations and reengineering of business processes. With the reorganization of business operations, new organizational entities (corporate dentistry) were established that operate in one or more countries and are managed by investment companies (CED, 2018).

In Croatia, as in most other European countries, dental care has been organized for many years in smaller clinics within the public health network, but also traditionally in small private practices. Therefore, it can be concluded that for many years dental care was extremely fragmented and relied mainly on small dental entities (Crnjak, 2022). Until recently, there were no large private dental clinics. In the last fifteen years, ten significant private trading companies have been founded in Croatia, which represent more complex organizations in terms of covering most of the activities of the supply chain of dental medicine. Given that there are four or five public health institutions in Croatia where specialist activities are performed (HZJZ, 2022), it can be concluded that there are about fifteen more significant clinics in terms of managing the extended supply chains of dental medicine (HKDM, 2018).

This research aims to investigate how successfully the concept of supply chain management has been implemented in the Croatian dental industry and whether it contributes to the satisfaction of the end customer or patient in the Republic of Croatia. As the majority of dental organizations in Croatia are small private polyclinics, and there are only a few larger

polyclinics, we want to determine the relationship between the implemented supply chain management factors (integration, flexibility, partnership quality, supplier performance and responsiveness) and patient satisfaction.

Overview of supply chain management factors

The success of the supply chain is reflected in the way it is managed. Its management is key to achieving efficiency and effectiveness, therefore the question arises as to how supply chain management can be improved, that is, what factors need to be implemented in order to optimize its operation? As a large number of supply chain management factors positively affect the efficiency and effectiveness of the supply chain in many industries (wood, automotive, pharmaceutical), it is important to identify them first.

In the literature, larger or smaller sets of supply chain management factors are distinguished depending on the subject and research objectives. The most frequently used factors are supply chain performance and customer satisfaction (Quesada, Gazo and Sanchez, 2012, Samaržija, 2014).

The performance of the supply chain represents a set of different indicators that measure the success of the application of supply chain management in a business system. However, their definition is not unambiguous, so according to Zhang et al., (2011) they measure the degree of internal flexibility of the supply chain, while according to Soon and Udin, (2011) they measure the ability of the supply chain to quickly react to changes from external environment.

Within this research, supply chain performance consists of 5 indicators: flexibility, integration, responsiveness, supplier/partner performance and the quality of the relationship established between supply chain members.

a) Supply chain flexibility. Supply chain flexibility refers to the ability of a supply chain to adapt to changes and disruptions effectively (Ananna & Suvash, 2024). It also describes the organizational ability to adapt to the market without significant use of resources, i.e. costs, time and downtime in the development of production processes or loss of performance. Vickery et al., (1999) suggest that flexibility is viewed from the perspective of the entire supply chain, as a value-adding system from an integrative,

consumer-oriented perspective. Flexibility should be aimed at satisfying consumer needs (activities that add value to products or services) that are achieved by integrating internal (production) and external (marketing) functions.

Flexibility is also reflected in performing non-standard procedures, meeting the special needs of users, offering different products/services and quick reaction to the needs and wishes of users.

b) Supply chain integration. It defines the extent to which all supplier and customer activities within the supply chain are linked (Narasimhan & Jayaram, 1998). There are two directions of integration, the first is forward and involves the integration of the flow of goods from suppliers to manufacturers and customers. The other goes in the opposite direction, from the customer to the manufacturers and suppliers. It is no longer enough to observe the customer only through the prism of marketing, but it is necessary to establish a long-term relationship based on mutual satisfaction. The more integrated member processes are, the faster organizations will adapt to customer needs and will be more efficient than non-integrated organizations. In today's environment, it is necessary to change the business paradigm, since companies cannot survive on the market without a close relationship with customers, therefore there is a need to include as many partners as possible from all phases of the supply chain. Integration is measured through communication and coordination between supply chain participants, information sharing, collaboration with partners, and alignment of processes with supply chain partners (Zhang et al., 2011).

c) Supply chain responsiveness. Supply chain responsiveness refers to a firm's ability to react quickly to changes in demand and supply conditions (Tuna & Swinney, 2023). It is a critical capability that allows firms to minimize mismatches between supply and demand, especially in environments with high demand uncertainty. A responsive supply chain can adjust its operations to meet customer needs in a timely manner without excessive cost, while maintaining product quality and service levels.

Responsive supply chains are characterized by reduced lead times, multiple sourcing options, and quantity flexibility, enabling firms to better align resources with fluctuating demand and mitigate mismatch risks (Biçer, 2023). A responsive dental supply chain refers to a dental practice, distributor, or manufacturer's ability to quickly adapt and react to changing

needs, demand fluctuations, or unforeseen disruptions in the delivery of dental products and services. This responsiveness is critical in ensuring that dental professionals have the necessary tools, materials, and equipment when they need them to deliver quality care to patients.

Enhancing supply chain responsiveness involves strategies like lead time reduction, multiple sourcing, and quantity flexibility, which help minimize mismatches between supply and demand (Biçer, 2023). In the dental industry, specific technological and strategic solutions have been proposed to improve supply chain responsiveness and resilience.

d) Supplier performance. Supplier performance refers to how well a supplier meets the expectations and requirements of a business in delivering goods or services (Afrizal et al. 2022). It is a critical aspect of supply chain management because a supplier's ability to meet performance standards directly affects the efficiency, cost, quality, and reliability of the entire supply chain. Supplier performance is integral to lean supply chain management, sustainability, and project execution, and it involves strategic collaboration and evaluation processes. Supplier performance in the dental supply chain is a critical factor that influences the overall efficiency, cost-effectiveness, and quality of the supply chain. Evaluating supplier performance involves assessing various key performance indicators (KPIs) that reflect the supplier's ability to meet the demands of the dental industry. These KPIs include cost, quality, delivery reliability, and responsiveness, among others. The evaluation process is essential for maintaining a competitive edge in the market and ensuring that dental products meet the required standards and customer needs.

e) The quality of the relationship. It defines the extent to which the partners' expectations from the implementation of cooperation within the supply chain are met. Its measurement is cited as a common problem, as it is based on subjective assessments of the participants, and not on objective indicators that measure the intensity of established connections between all participants of the internal supply chain.

The quality of partnerships in supply chains is crucial for long-term relationships, impacting profitability and competitiveness (Ramana et al. 2014). These partnerships are built on trust, collaboration, and a shared commitment to achieving common goals such as delivering high- quality

products, improving efficiency, reducing costs, and enhancing customer satisfaction.

In a supply chain context, the quality of these partnerships can significantly impact the overall performance and resilience of the supply chain. Strong partnerships help businesses respond better to challenges, adapt to market changes, and continuously improve operations. Conversely, poor partnerships can lead to disruptions, delays, higher costs, and subpar product or service quality.

The quality of partnership in the dental supply chain is crucial for ensuring efficient operations, cost-effectiveness, and high standards of service delivery. Effective partnerships in this context are characterized by trust, communication, and mutual benefits, which are essential for navigating the complexities of the supply chain. These partnerships can lead to improved quality and reliability, cost savings, and enhanced supply chain resilience.

Close partnerships contribute to achieving high-quality standards, which are critical in the dental supply chain due to the need for precision and safety in dental products (Cooper, 2024).

f) Customer satisfaction. Refers to the degree which a company's supply chain meets or exceeds the expectations and needs of its customers. Customer satisfaction in supply chain management is influenced by several factors, all of which contribute to the overall experience of the customer when interacting with the company's products, services, and delivery processes. Proper implementation of SCM can significantly impact customer satisfaction by integrating business processes across suppliers, manufacturers, and retailers, thus aligning the supply chain with customer expectations (Fadilah et al., 2024). Customer satisfaction plays a crucial role in enhancing the overall performance of a supply chain by acting as a mediator between supply chain performance and customer satisfaction. Efficient supply chain management, characterized by quality service, timely delivery, and transparent pricing, significantly boosts customer satisfaction, which in turn positively impacts organizational performance. This relationship is evident across various industries, where customer satisfaction serves as a key performance indicator for supply chain success.

Customer satisfaction in the dental supply chain is driven by the consistent availability of high- quality products, timely deliveries, responsive

customer service, and competitive pricing. Satisfied customers are more likely to remain loyal, place repeat orders, and recommend suppliers to others. In the highly competitive dental industry, maintaining customer satisfaction through a well-managed supply chain is essential for fostering long-term relationships and growing a strong reputation.

In this research, service satisfaction is measured through several indicators (Narayanan and Greco, 2014): patient satisfaction with the organization of the service, satisfaction with the dentist's relationship with the user, satisfaction with the dentist's key competencies, and satisfaction with the outcome of the treatment and the price of the service. In order to create patient satisfaction through the aforementioned elements, it is important to point out that the entire supply chain management process needs to be at a high level.

Starting from the assumption that it does not matter whether the patient is right or wrong, it only matters how the patient felt during the treatment, although the health care provider's perception of reality may be quite different (Petersen, 1988).

Research model proposal

After the supply chain management factors have been previously elaborated, the following research model is proposed.

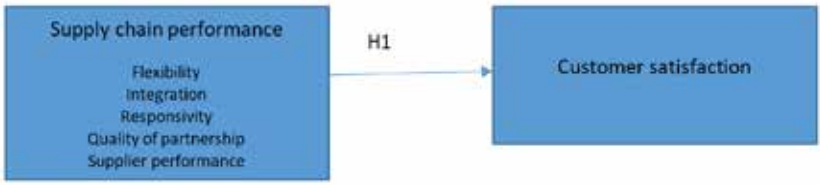

Figure 1: Research model
Source: author

Based on the proposed model, the main research hypothesis is:

Supply chain management performance strongly and positively contributes to customer satisfaction.

Along with the main hypothesis, auxiliary hypotheses of the model are also defined: H1a: Flexibility positively and strongly contributes to customer satisfaction

H1b: Integration positively and strongly contributes to customer satisfaction H1c: Responsiveness positively and strongly contributes to customer satisfaction

H1d: Partnership quality strongly and positively contributes to customer satisfaction H1e: Supplier performance positively and strongly contributes to customer satisfaction

Proving the main hypothesis is important because the ability to create higher levels of customer satisfaction is considered an important competitive differentiator and has therefore become a key element of many companies' business strategies (Ellinger et al., 2012).

Other studies can be found in the literature that have proven a positive correlation between supply chain performance and a higher level of customer satisfaction (Ellinger et.al., 2012). Furthermore, Chavez et al. (Chavez et al., 2014) proved that product quality and delivery is a direct consequence of supply chain performance and significantly affects customer satisfaction. In order to more precisely explain the impact of supply chain performance on user satisfaction, auxiliary hypotheses of the model were defined. It is assumed that, in the long term, a higher degree of flexibility of the supply chain will enable a greater ability to adapt to user requirements and changes in the environment, then improve the ability to perform non-standard services and procedures and fulfill special needs, which will have a positive impact on patient satisfaction. By testing the hypothesis, it will be determined to what extent patients are satisfied with the dentist's key competencies, the outcome of the treatment and the price of the service. A high degree of supply chain integration enables the development of strategic partnerships with suppliers, facilitates the understanding and forecasting of manufacturers' needs in order to better meet the changing demands of customers and increase their overall satisfaction (Zhang et al., 2011). The aim of the integration of the dental supply chain is to improve the internal quality of the process and optimize the available resources through the management of material, financial and information flows. By testing the hypothesis, it will be determined how much the integration of the dental supply chain contributes to patient satisfaction.

A quality relationship with partners is based on mutual trust and the fulfillment of assumed obligations, which means that ultimately the promised service will be performed in the required time, at the specified quality and at an acceptable price, which ultimately increases patient satisfaction. The functioning of the dental supply chain is contributed by various partners who provide services that are essential for creating additional value within the supply chain, such as diagnostics, prosthetics, transportation, accommodation or marketing. Successful long-term cooperation with partners within the supply chain is based on trust, communication, joint planning and mutual respect for different business goals, which enables continuous satisfaction of the growing needs of patients. By testing the hypothesis, it will be determined if the quality of the relationship positively contributes to patient satisfaction.

Customer satisfaction is an important indicator of the success of the functioning of the supply chain (Soon and Udin, 2011). At the same time, users look at different aspects of its performance. At the very center of the dental service is the focus on the end user, and the patient is put first (Narayanan and Greco, 2014). Patient satisfaction is reflected through the organization of dental service provision, the dentist's competence and the dentist's attitude towards the patient, satisfaction with the outcome of the treatment, the price of the service and the intention to return to the clinic (Narayanan and Greco, 2014). In order to analyze patient satisfaction through the above indicators, it is important to point out that it is necessary to analyze the entire service provision process, which includes all phases of supply chain management.

In order for the patient to receive adequate service, it is necessary that internal processes within the supply chain are successfully integrated, which will quickly meet the customer's requirements (Duclos et al, 2003). Also important are the performance of suppliers and the quality of relationships with partners who ensure that the supply chain is supplied with quality and adequate materials and additional services necessary for the provision of dental services.

Research results

The research was conducted in the period from March 2021 to January 2022. Owners, directors, heads of clinics and/or directors of the largest organizations of dental medicine in the Republic of Croatia were contacted personally. Given that they represent the management staff, they had the best insight into the examined performance factors of supply chain management in their organizations. Along with the request to the managers to participate in the research, a cover letter was delivered in which the basic goals and hypotheses of the research were explained, and a questionnaire for patients was also delivered, based on which their satisfaction with the service was assessed. The research population consists of dental medicine organizations in the Republic of Croatia and users of dental clinic services.

The questionnaire filled out by managers of dental organizations included questions that collected data on socio-demographic characteristics of respondents such as age, gender, professional education, total work experience and work experience in the current organization, and the position of the respondent in the observed organization. Also, the questionnaire contained constructs used to measure the performance of supply chains: flexibility, integration, responsiveness, performance of suppliers and quality of relationships between members of the supply chain. In the end, the sample consists of 102 polyclinics/dental practices from the Republic of Croatia. It was determined that the largest number of respondents had a university degree (67.65%) and were male (54.90%). Work experience ranges from 1 to 50 years of work experience with an average work experience of respondents of 19 years (χ = 19.19), while experience in the current job position ranges from 1 year to 32 years with an average experience in the current position of 12 years (χ = 11.92). The age varies from 25 to 74 years with the average age of the respondents being 45 years (χ = 45.19).

With regard to the size of the organization, observed through the number of employees, the most represented organizations in the sample are organizations with a small number of employees, that is, organizations that employ 1 to 4 people (48.04%) and dental medicine organizations with 5 to 9 employees (18.63%). , followed by dental medicine organizations with 20 to 59 employees, representing 15.69% of the sample. In most dental medicine organizations, the number of users has increased (65.69%), while 12.75% of them note that the number of users has decreased compared

to 2019. The majority of respondents were in the position of team leader (32.4%), then director (8.8%), owner (7.8%), director (4.9%), and the rest are in the position of senior professional associate (2 %). The others did not define their function in the organization of dental medicine.

The second questionnaire, which examined the patient's satisfaction with the service provided, included 915 respondents. In the first part of the questionnaire, the socio-demographic characteristics of the respondents were collected, and in the second part, the constructs used to measure patients' satisfaction with the service provided were listed. After processing the data, it was determined that the respondents were on average 45 years old (χ = 44.72). The values range from 18 to 89 years, and are female (53.6%). By education, they obtained a university degree (33%), a higher vocational degree (28.1%), a secondary vocational education (27.3%) and a postgraduate study (master's degree, doctorate) (11.6%).

In the next phase, the analysis of the results of surveys completed by managers of dental medicine institutions and users of dental services was started. In order to determine the characteristics of the sample in terms of validity and reliability for further research, an exploratory factor analysis was conducted. The principal component analysis method was applied in the SPSS program with oblimin rotation and Kaiser normalization. After the analysis, it was found that all particles have utilities above 0.5 as suggested by Field (2009) and that they describe supply chain management factors: flexibility, integration, responsiveness, supplier performance, relationship quality and customer satisfaction.

Table 1. Characteristics of measurement scales of supply chain performance factors

Factors	Number of statements n	Mean M	Standard deviations	Cronbach alpha α	% Explained variances	Eigenvalue
Flexibility	6	26,06	3,594	0,889	35,037	7,007
Integration	3	12,57	2,027	0,783	12,454	2,491
Responsiveness	4	18,78	1,596	0,792	9,439	1,888
Supplier performance	4	17,64	2,232	0,861	7,742	1,548

Quality of relationship	3	11,16	2,139	0,717	5,373	1,075
Customer satisfaction	5	22,925	2,423	0,812	5,972	1,194

Source: Research results

In the next step, a reliability analysis was performed using the Cronbach alpha coefficient. The results of that analysis are presented in table 1. All reliability coefficients for the extracted factors are above the acceptable level of 0.7 suggested by Peterson (1994), and it can be concluded that the factors are reliable for further analysis.

In order to be able to test the hypotheses, a multiple regression analysis was performed where the relationship between the dependent variable user satisfaction and the independent variable supply chain management performance was analyzed. The results of the analysis are shown in table 2.

Table 2. Multiple regression analysis with the dependent variable user satisfaction

Factors	B	b	t–value
Constant	3,918 (0,323)		12,120
Flexibility	0,009 (0,065)	0,020	0,136
Integration	-0,022 (0,057)	-0,058	-0,383
Responsiveness	0,080 (0,075)	0,123	1,071
Supplier performance	-0,089 (0,061)	-0,189	-1,454
Quality of relationship	0,131 (0,060)	0,296	2,174**
The coefficient of determination R2	0,072 (0,259)		

Source: research results

Based on the analysis, it can be concluded that not all tested independent variables have a statistically significant influence on the dependent variable. Only the relationship quality factor has a statistically significant positive influence on the dependent variable user satisfaction (β=0.296). Other variables do not significantly affect user satisfaction.

Conclusion

In the framework of this research, the application of the concept of supply management in the dental industry of the Republic of Croatia was analyzed. 102 polyclinics and 915 users of dental services participated in the research. After the survey research was conducted, the collected surveys were processed and it was determined that the concept of supply chain management was successfully applied in the dental industry. Namely, the concept of supply chain management in the dental industry can be analyzed through the implementation of supply chain performance. Supply chain performance represents a set of indicators that measure different aspects of the application of supply chain management factors. Statistical processing of the collected data determined that the following supply chain management factors were successfully implemented in the dental industry: integration, flexibility, responsiveness, partner performance, partnership quality, and customer satisfaction. The next step was to determine their impact on user satisfaction.

By testing the hypotheses of the model, it was determined that there is a statistically positive and significant influence of supply chain performance on customer satisfaction, but only on relationship quality (β=0.296). Thus, the main hypothesis of the work is partially accepted, so it can be concluded that the performance of the supply chain only partially affects user satisfaction. The aforementioned knowledge is in contrast to previously conducted research in the dental industries of developed countries (the United States of America and Switzerland). Also, Soon and Udin (2011) pointed out that customer satisfaction is an important indicator of the success of the supply chain, which is successfully influenced by all the tested factors of the supply chain.

As the results obtained by this research are in contrast to the previous ones, it remains to be further investigated the reasons why dental medicine organizations do not find a positive influence of all tested factors on user satisfaction. It is possible that it is about the specificity of the Croatian environment, the competencies of employees in dental medicine organizations or something else. Namely, in the future, it is necessary to expand the research sample to neighboring countries in order to take a closer look at all the specifics and factors of the supply chain that affect customer (patient) satisfaction.

Acknowledgment

„This paper was funded under the project line ZIP UNIRI of the University of Rijeka, for the project ZIP-UNIRI-2023-5".

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ANALIZA UTJECAJA KONCEPTA MENADŽMENTA OPSKRBNOG LANCA NA ZADOVOLJSTVO KORISNIKA U DENTALNOJ INDUSTRIJI REPUBLIKE HRVATSKE

Sažetak

U ovom se radu analizira utjecaj čimbenika koncepta menadžmenta opskrbnog lanca zadovoljstvo pacijenata u dentalnom opskrbnom lancu Republike Hrvatske. U istraživanju su sudjelovale 102 stomatološke poliklinike i 915 korisnika stomatoloških usluga. Podaci su prikupljeni upitnikom, te su statistički obrađeni najprije faktorskom, a zatim regresijskom analizom kako bi se utvrdio međusobni utjecaj istraživanih čimbenika. Nakon provedene analize identificirani su čimbenici menadžmenta opskrbnog lanca: fleksibilnost, integracija, responzivnost, učinak dobavljača, kvaliteta odnosa među partnerima i zadovoljstvo kupaca. Regresijskom analizom utvrđeno je da samo kvaliteta odnosa između partnera pridonosi zadovoljstvu korisnika, čime je djelomično potvrđena hipoteza istraživanja. Doprinos provedenog istraživanja očituje se u spoznaji da je koncept menadžmenta opskrbnog lanca uspješno implementiran u dentalnoj industriji Republike Hrvatske, no za razliku od slučajeva u razvijenim državama Europe (Njemačka, Švicarska, Francuska), potrebno je u rad intenzivnije uključiti i druge čimbenike upravljanja opskrbnim lancem koji bi snažnije pridonijeli zadovoljstvu pacijenata.

Ključne riječi: menadžment opskrbnog lanca, strateško povezivanje, vertikalna integracija