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# Determinants of Supply Chain Performance in Croatian Dental Care: A Factor-Based Analysis*

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***Abstract***

*The swift advancement of medical knowledge and technologies in dentistry has transformed the aesthetics and robustness of this sector in numerous ways. Consequently, supply chains have become increasingly complex, with a growing number of factors affecting their efficiency. The main goal of this paper is to determine the individual impact of supply chain management (SCM) factors on supply chain performance in the dental industry of the Republic of Croatia. This research examines the connection between several SCM factors (technology, digitalization of processes, information technology, partner relationships, availability of financing sources and value creation) and supply chain performance factors. Multiple regression analysis was used to test the hypotheses of the research model, while exploratory factor analysis was used to test the validity and reliability of the research variables. The findings indicate that technology and partner relationships among supply chain participants have a strong and positive influence on supply chain performance. In addition, value creation and information technology show only a partially positive influence on supply chain performance. The study also confirms that the availability of funding sources and the digitalization of processes do not have a strong positive impact on supply chain performance.*

***Keywords:*** *dental industry, supply chain management, SCM factors*

***JEL classification:*** *M10, I10, L22*

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## 1. Introduction

Until recently, dental service providers were predominantly small private or public practices primarily focused on the repair and extraction of teeth and restricted dental structures. Their supply chains, spanning patient intake, x-rays, material procurement, and ultimate service, were procedurally fractured and loosely coordinated. Today, however, dental industry has undergone substantial transformation, mainly due to rapid advances in medical technology and the need to improve efficiency. Larger entities capable of investing in advanced technologies, streamlining processes and leveraging economies of scale are increasingly dominating the market. These groups operate more efficiently, reduce operating costs and increase their market share (Wall & Guay, 2015). For instance, technology and digitalization play a central role in improving the performance of dental practices, while strategic mergers enable these larger groups to further optimize their supply chains and service delivery.

Small dental practices that traditionally offered basic services, such as extractions and fillings, are now struggling with increased operating costs and a growing demand for a wider range of services (Cooper, 2017). As a result, many independent practices are either closing or merging with larger *managed group* practices. Data show that independent practices are shrinking by approximately 7% annually, while managed dental groups are growing by around 20% annually (Cooper, 2017). The underlying assumption is that strategic alliances can generate certain benefits, such as improved supply chain performance, ultimately enhancing end consumer satisfaction (Porter, 1998). These benefits are believed to arise from the implementation of supply chain management (SCM) (Horvath, 2001; Mentzer, 2004), which shape supply chain processes more effectively than the natural processes that occur in the absence of structured SCM.

This research acknowledges that the use of the SCM concept, particularly the factors influencing SCM within dental businesses, has not yet been adequately explored. Therefore, the primary aim of this study is to identify SCM factors that positively contribute to supply chain performance in the Croatian dental industry. In this context, the study examines the relationship between six SCM factors (value creation, technology, information technology, digitalization of processes, partner relationships, and availability of funding sources) and supply chain performance. This study builds on the doctoral thesis of Pezo (2023).

The research significantly contributes to the domain of SCM within the dental industry, as the impact of individual SCM factors on supply chain performance has not been previously examined. Statistical analysis confirms a strong and positive impact of technology and relationship among participants on supply chain performance, whereas information technology and value creation contribute only slightly. The availability of funding sources and the digitalization of processes do

not significantly affect supply chain performance. Despite growing recognition of SCM's importance in healthcare delivery, substantial gaps remain in understanding SCM dynamics within the dental industry. Recent literature largely focuses on general healthcare supply chains (Apeh et al., 2024), with limited attention to the specific characteristics of dental service delivery and product supply networks. Whilst emerging technologies such as blockchain (Ingle et al., 2023) and additive manufacturing (Bhargav et al., 2018) have attracted scholarly interest, these studies remain mostly conceptual, lacking empirical validation of their impact on dental supply chain performance.

A critical gap exists in empirical research examining the relationships between specific SCM factors and performance outcomes in dental contexts. Existing research predominantly adopts theoretical or review-based methodologies (Hassani et al., 2021), with few studies providing quantitative evidence on how technology adoption, partner relationships, digitalization, and information systems influence operational performance in dental practices. A notable exception is research conducted by Başal and Sarkbay (2023), who examined lean supply chain strategies in Turkish dental hospitals. However, their study focuses primarily on consumer behavior, rather than a comprehensive analysis of SCM factors. This study addresses this gap by empirically testing the relationships between six key SCM factors (value creation, digitalization of processes, information technology, partner relationships, technology, and funding availability) and supply chain performance using multiple regression analysis of data from the Croatian dental industry.

Although digital transformation discourse dominates contemporary SCM literature (Singh & Rawat, 2024), the specific impact of digitalization on dental supply chains remains underexplored. Studies examining digital workflows in dentistry (Alberto et al., 2023) primarily concentrate on clinical applications rather than supply chain implications. Regional disparities in SCM implementation underscore the need for context-specific research; existing research provides limited insight into the operational dynamics of dental supply chains within particular national settings, outside overarching sustainability paradigms. This study contributes empirical evidence from Croatia, enriching the understanding of regional SCM dynamics. Nonetheless, significant opportunities remain for future research, including cross-national comparative studies, longitudinal analyses of digital transformation impacts, the development of comprehensive performance measurement frameworks integrating financial and non-financial metrics, and investigation of supply chain resilience factors in dental tourism and international procurement networks.

This paper comprises six sections. The first section outlines the concept of SCM and reviews previous studies on supply chains in the dentistry sector. The second section presents the theoretical foundations of incorporating SCM elements into complex business systems. This section is subdivided into seven subsections looking closely at SCM factors and supply chain performance. The third section

introduces the research model and hypotheses, whereas the fourth section describes the research methodology, including the questionnaire design, the pilot study and data collection. The research results and discussions are interpreted in the fifth section, while the conclusion is presented in the sixth section.

## 2. Literature review

Supply chains and SCM, in the modern sense of the term, did not gain prominence during the period when dentistry was practiced almost exclusively by small, individual, easily managed firms. However, rapid advancements in implantology and dental technologies have increased the importance of small dental firms (Boogaard et al., 2017; Poirier & Walker, 2005) and have encouraged their strategic integration into more complex supply chains (Guay & Wall, 2016). This shift has elevated the relevance of SCM as a means of improving both business and supply chain performance (Hsu et al., 2009). Accordingly, this study investigates how strategic dental supply chains are managed to enhance supply chain effectiveness. In this regard, the study highlights the function and significance of SCM in dental industry as a fundamental idea that facilitates the alignment and balancing of the diverse business objectives across supply chain participants (Guay & Wall, 2016).

The effectiveness of the dental supply chain largely depends on how it is managed. Consequently, SCM is essential for achieving efficiency and effectiveness across the entire chain. This raises the question of how SCM can be improved and which factors must be implemented to optimize its functionality on both sides of the supply chain. SCM factors have demonstrated a beneficial influence on the efficiency and efficacy of various supply chains, such as wood processing, automotive manufacturing, food production, and textile industries. Identifying these factors within the dental sector is equally important. Drawing on the experiences of other SCM researchers and practitioners in the dental industry, this paper identifies the following SCM factors: value creation, technology, information technology, digitalization of processes, relationships between supply chain participants, availability of financing sources and supply chain performances. These key factors of SCM are discussed in more detail below.

### 2.1. Value creation

The concept of value creation (Li, 2002; Samaržija, 2014) refers to activities that create value throughout the supply chain, benefiting all participating companies. Despite its relevance, research on value creation remains fragmented (Mukhtar & Azhar, 2020), reflecting the concept's complexity and ambiguity. The challenge lies in the fact that value is a socially constructed concept that is evaluated differently in different contexts.

There are two predominant frameworks which explain value creation: production theory, which focuses on value from a managerial perspective, and exchange theory, which focuses on value delivered to the customer. From a managerial standpoint, value creation is linked to quality integration within the supply chain, which enhances customer satisfaction and business performance. As an upgrade of the internal quality management systems, supply chain quality management (SCQM) ensures that consistent quality standards are implemented by all members. Implementing SCQM enables organizations to streamline processes, reduce costs, and improve overall efficiency (Ionel, 2024). In contrast, the marketing perspective views value as customer-centric and highlights the importance of customization. The customization of products and services in order to meet specific customer needs is becoming increasingly important in industries such as e-commerce, agriculture and manufacturing, leading to higher satisfaction and competitive advantage (Tian, 2023). Customization actively involves consumers and enhances consumer engagement and satisfaction.

### 2.2. Digitalization of processes

By enhancing the agility of information systems, digitalization can shorten information-processing cycles, strengthen environmental sensing, and improve rapid-response capabilities. It has therefore become a critical pathway and an urgent requirement for achieving decision optimization in supply chains (Ma & Kang, 2025). By utilizing state-of-the-art technologies such as the Internet of things (IoT), data analytics, and artificial intelligence, supply chain process digitization significantly improves operational efficiency and reduces costs. Supply chains become more resilient and agile as a result of leveraging these technologies, which enhance visibility, cooperation, and decision-making. Unlike information technology, digitalization refers to the process of transforming corporate operations using cutting-edge technologies to improve supply chain effectiveness and efficiency.

Digitalization transforms traditional processes into automated, data-driven workflows that facilitate real-time decision-making and improve responsiveness to customers. Furthermore, it enhances inventory visibility, improves demand accuracy, and increases overall performance. In traditional businesses, digital technologies optimize inventory control, reduce stockouts, and enhance customer satisfaction through faster order processing and delivery (Singh & Rawat, 2024).

Despite its benefits, digitalization also presents challenges that organizations inside the supply chain must navigate. Factors such as external uncertainties and organizational readiness can influence the effectiveness of digital transformation efforts. Therefore, a strategic approach that considers these complexities is essential for organizations to harness the full potential of digitalization and sustain enhanced performance.

### 2.3. Technology

Work processes in many industries, especially in medicine, are constantly evolving. Advances in work equipment enable the creation of more functional, higher-quality and cost-effective products, while also improving services. In this sense, technological development creates a competitive advantage for companies and their supply chains.

In the context of this paper, the term *technology* refers to the means of production which deliver products or services to consumers, such as CAM / CAD technologies and digital imaging tools. Intraoral scanners and CAM / CAD technologies have completely reshaped the creation of dental restorations, allowing for precise and efficient design and production. These technologies reduce chairside time and improve the fit and function of prosthetics, resulting in better treatment outcomes (Dhillon, 2024). Similarly, 3D imaging technologies provide detailed visualizations of the oral cavity, aiding in accurate treatment planning and diagnosis. These tools enable the creation of virtual patient models, which are instrumental in surgical planning and the development of patient-specific treatments (Zimmermann & Seitz, 2023).

Variations in technology adopted by different members of a supply chain can lead to differing degrees of value creation and customer satisfaction, even within the same industry.

Technological progress (Martinelli & Tunisini, 2019; Samaržija, 2014) has made it possible, for instance, to perform restorative procedures, such as the replacement of missing teeth, that were previously unimaginable. Advancements in technology are significantly transforming dental medicine, enhancing diagnostic accuracy, treatment planning, and overall patient care. These innovations, ranging from artificial intelligence (AI) to digital imaging and 3D printing, are reshaping the landscape of dentistry by improving precision, efficiency, and patient engagement. The integration of these technologies not only streamlines clinical workflows but also supports a more patient-centric approach to oral healthcare.

### 2.4. Information technology

Collaboration in supply chains is built on the efficient exchange of key information. A robust information system strengthens this collaboration by enabling faster and more accurate communication between partners. Progressive supply chains must continuously train their employees in emerging technologies and employ strategies that support timely modernization. Integrating information technology into SCM (Tadepalli, 2014) improves production control, inventory management and collaboration between partners, while also optimizing order and shipment tracking. Modern software and digital tools provide real-time insights into the production

process, enabling companies to anticipate potential problems and adapt accordingly. Improved inventory management, supported by enterprise information systems, reduces costs across the supply chain (Evangelista & Hallikas, 2022).

Today, information technology is changing business processes and the dynamics between supply chain participants (Scuotto et al., 2017) and transforming dental supply chains (Klingenburg, 2016) by leveraging digitalization, cloud technologies, artificial intelligence (AI) and user-friendly platforms. These innovations blur traditional organizational boundaries and enhance supply chain efficiency and resilience. Many industries, including manufacturing, healthcare, and logistics, now require AI systems capable of extending their intelligence into the physical world and interacting directly with objects, environments, and dynamic conditions (Bousetouane, 2025).

### 2.5. Partner relationships

Relationships between supply chain participants are essential for overall performance. The selection of partners and suppliers is crucial for delivering services that meet user expectations. Powerful relationships are based on mutual respect, trust and shared goals not only to improve SCM, but also to enhance performance (Li, 2002). Research confirms a positive correlation between the quality of these relationships and supply chain outcomes (Guay & Wall, 2016; Handfield & Nichols, 2002; Langelier et al., 2017).

Trust and a shared vision are key elements that foster collaboration and operational efficiency. A shared vision strengthens collaboration, aligns goals and improves communication between partners, which increases supply chain efficiency (Yang & Huang, 2018). It promotes transparency, reduces conflict and improves overall reliability. This alignment leads to improved operational performance, cost reductions and innovation. Partner responsibility ensures compliance with social, environmental and ethical standards (Han & Yuan, 2019). Mutual commitments promote win-win outcomes and ensure balanced profitability for all parties by promoting socially responsible practices without compromising business objectives. Trust is the foundation for supply chain relationships as it fosters collaboration and reduces risk (Cooper, 2024). Effective communication, cultural alignment and ethical practices are critical for building trust, which in turn strengthens supply chain resilience and competitiveness.

### 2.6. Availability of funding sources

Supply chain finance focuses on core enterprises, manages the capital flow, logistics and information flow of upstream and downstream small and medium-sized enterprises, and transforms the uncontrollable risks of individual firms into

the controllable risks of the supply chain enterprise (Liu et al., 2024). The intensity of this process depends on the financial investment opportunities of the members of the supply chain (Achermann, 2012). Efficient financial management in the supply chain is, therefore, a strategic priority of the company, requiring continuous investment to ensure supply chain efficiency and competitiveness. The sources of financing can be the company's own funds, but more often they are bank loans (Shen et al., 2020). As a result, supply chains evolve depending on the financial capabilities of their participants, but also on the possibilities of securing various sources of financing (Samaržija, 2014).

The default of one or more members significantly increases financial risk, which has a detrimental impact on the entire supply chain. Studies show (Caniato et al., 2016) that, on average, a quarter of the shock caused by a default in the supply chain is passed on to other members, and this process is stopped only once payment is made. In this context, a decrease in the availability of borrowing capacity increases the risk of non-payment or payment delays in the supply chain (Coricelli & Masten, 2004). Consequently, financial risk management must be recognized as an integral part of SCM and should find its place and importance across SCM (Raddatz, 2010). This study, therefore, investigates whether supply chain participants face difficulties in securing financing and whether they have access to favorable sources of financing to support operations within the supply chain.

### 2.7. Supply chain management performance

Supply chain performance is a complex, multifaceted concept that differs across industries and requires customized indicators that reflect the unique challenges of each industry. Effective performance indicators must cover all critical dimensions of the supply chain. Integration between partners is crucial for seamless operations and thus a key indicator of supply chain result (Flynn et al., 2010). Furthermore, the capability to adapt to internal and external changes is crucial in order to respond quickly to new products and market demands (Soon & Udin, 2011). Meeting customer needs promptly and providing quick feedback are essential elements of responsiveness, depending heavily on supplier and partner performance to ensure reliable, on-time delivery (Duclos et al., 2003).

Li (2002) identifies five key indicators for evaluating supply chain performance: flexibility, integration, responsiveness, partner performance and relationship quality. Flexibility enables supply chains to adapt to market fluctuations and uncertainties, which is critical for maintaining a competitive advantage in a dynamic environment. Integration refers to seamless coordination between stakeholders, improving efficiency and reducing costs. Responsiveness measures the capability of a supply chain to adjust quickly to change and maintain customer satisfaction. Partner performance assesses the reliability of partners and their alignment with

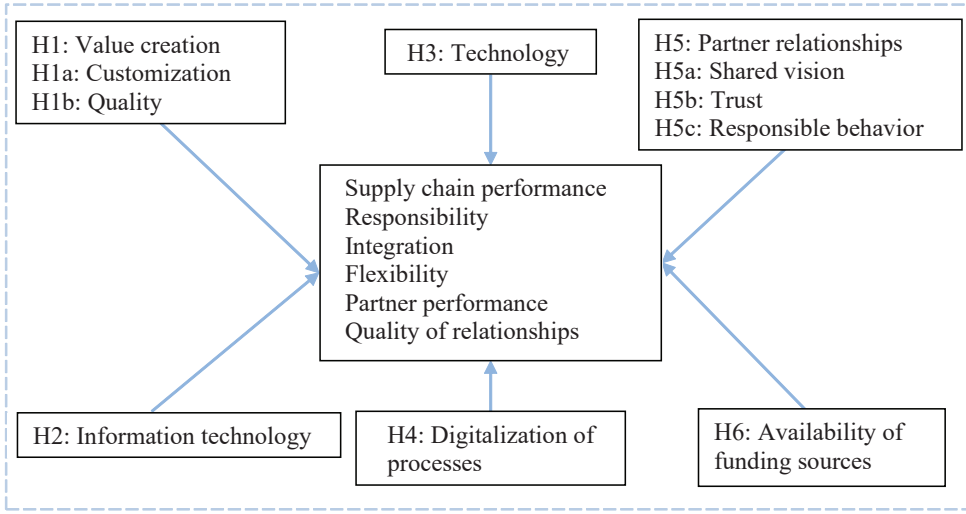
strategic objectives to ensure operational efficiency. Relationship quality is about trust, commitment and collaboration, which are essential for strong partnerships and long-term success.

The relevance of this research lies in the increasing competition among dental service providers (Mazzei et al., 2009) and the limited empirical investigation of SCM factors and their impact on performance within the dental industry (Deshpande, 2012).

## 3. Research model and hypotheses

The research model used to determine the relationship between six SCM factors: availability of funding sources, partner relationships, value creation, digitalization of processes, information technology, and supply chain performance is presented in Figure 1. Additionally, Figure 1 illustrates the relationship between the dependent variable (supply chain performance) and the independent factors (value creation, information technology, technology, digitalization of processes, availability of funding sources, and partner relationships).

Figure 1: Research model




Source: Author's illustration

***Research Hypothesis 1 (Value creation and SCM performance)***

According to Bowersox et al. (2010), value creation has a strong positive impact on supply chain performance by increasing market share, enabling product customization and achieving economies of scale. This study examines the connection between the value-creation process and supply chain performance in the dental industry. Considering that the dental industry is characterized by a process-oriented supply chain where raw materials are transformed into final products, this hypothesis aims to determine the strength of the link in supply chains in the dental industry.

To obtain accurate results, the individual contributions of customization and process quality to supply chain performance factors are also tested. Based on this rationale, the hypotheses of the model are:

H1: *Value creation contributes significantly to SCM performance.*

H1a: *Customization contributes significantly to SCM performance*.

H1b: *Quality contributes significantly to SCM performance.*

***Research Hypothesis 2 (Information technology and SCM performance)***

The strong positive relationship between information technology and supply chain performance has been demonstrated several times in prior research (Chen & Paulraj, 2004a). The present research aims to examine this relationship in the dental industry, focusing on both small and large clinics as integral parts of complex business systems. Since the functioning of any modern supply chain is impossible without information technology, its presence is not in question. What remains to be assessed is the extent of its impact on specific factors of supply chain performance.

H2: *Information technology contributes significantly to SCM performance.*

***Research Hypothesis 3 (Technology and SCM performance)***

Technology has radically changed the dental sector and enhanced the performance of the entire supply chain. Given the multiple players involved in dental supply chains, the introduction of advanced technological solutions, such as artificial intelligence, digital impressions and 3D printing, can significantly improve supply chain performance. Research shows that the integration of progressive technologies not only streamlines operations but also increases efficiency and has a strong positive impact on overall performance (Chen & Paulraj, 2004b). The third hypothesis therefore examines how technology affects different supply chain performance indicators:

H3: *Technology contributes significantly to SCM performance.*

***Research Hypothesis 4 (Digitalization and SCM performance)***

Over the past decade, business processes in the dental industry have become highly digitized, transforming nearly every aspect of the value chain, including patient diagnosis, prosthetic design, surgical planning and execution, and data sharing and archiving. Digitalization has streamlined operations, increased service quality and improved information flow to ensure compliance with various administrative requirements (e.g. GDPR). Therefore, the fourth hypothesis of the model is:

H4: *Digitalization contributes significantly to SCM performance.*

***Research Hypothesis 5 (Partner relationships and SCM performance)***

Since a supply chain is a system of interdependent organizations by nature, meeting customer needs requires that all participants, suppliers and customers work toward the same business objectives. For this reason, partner relationships form the backbone of effective SCM (Burgess, 1998). This implies that in order to effectively provide the final service, suppliers and consumers within the supply chain must be systematically interconnected in the dental industry. Meeting long-term customer needs also depends on creating a common vision with the other supply chain participants.

As partner relationships are crucial for the success of the supply chain, mutual trust among members is also required. The operational functioning of the supply chain involves numerous daily transactions between members, and for long-term sustainability of the chain, members must behave responsibly towards each other. In order to accurately determine the connection between partner relations and SCM performance, the following hypotheses are proposed:

H5: *Partner relationships contribute significantly to SCM performance.*

H5a: *Shared vision contributes significantly to SCM performance.*

H5b: *Trust contributes significantly to SCM performance*.

H5c: *Responsible behavior contributes significantly to SCM performance.*

***Research Hypothesis 6 (Availability of funding sources and SCM performance)***

Financing plays a critical role in enhancing supply chain performance. Its impact is multifaceted; it can be used to finance new technologies that lead to greater flexibility and/or integration between supply chain members. It is also possible to finance different parts of the supply chain to improve different business metrics. Therefore, the sixth hypothesis is:

H6: *Availability of funding sources contributes significantly to supply chain performance.*

In summary, the proposed model aims to identify the individual contribution of each SCM factor in order to determine the intensity of their implementation and the impact they have on the supply chain performance.

## 4. Research design and methods

This chapter outlines the design of the survey instrument, the data collection procedure, and the analytical method used in the study.

### 4.1. Survey instrument design

A questionnaire was employed as the primary research tool for the empirical investigation. Taking into account the objectives of the study and the specificity of the required data, it was essential to collect detailed information on work processes in different dental organizations. Accordingly, the questionnaire was designed for completion by managers from various dental organizations.

The questionnaire consisted of three sets of questions. The first set of questions focused on constructs related to value creation, technology, information technology, digital process design, partner relationships, and the availability of funding sources. These constructs were considered as key SCM factors. The second set of questions addressed the construct of SCM performance, capturing the effectiveness of supply chain implementation through indicators such as the degree of flexibility, integration, responsiveness, partner performance and quality of relationships. The third set of questions collected socio-demographic information about respondents, including age, overall work experience, gender, education level, work experience in the current organization, and the respondent's position within the observed organization. This set also included questions about the characteristics of the dental organization under study, including the number of employees and the organizational structure.

The degree of agreement with particular statements was assessed using a 5-point Likert scale (1 to 5), where 1 represented *strongly disagree*, 2 represented *somewhat disagree*, 3 represented *neither agree nor disagree*, 4 represented *somewhat agree*, and 5 represented *strongly agree*.

To ensure the validity and reliability of the questionnaire, analyses were conducted both before and after data collection. First, all English statements were translated into Croatian and then back-translated into English to ensure linguistic accuracy. Second, a pilot study involving five professionals was conducted to identify and correct ambiguities in wording and terminology. This pilot study was carried out in the first half of February 2021, and out of the five professionals, three experts were engaged in a scientific study on dental supply chain phenomena, and two experts were managers of dental organizations.

### 4.2. Data and analytical methods

The survey was conducted from March 1, 2021 to January 31, 2022. Owners, directors, clinic managers and/or managers of the largest dental organizations in the Republic of Croatia were contacted, as they, as top management, have the best insight into all supply chain processes and can accurately evaluate the variables analyzed at the organizational level. The research sample included all dental organizations in Croatia.

A purposive sampling method was employed, allowing for available individuals who are also experts in their field to be included. Owners, directors, clinic managers and/or managers of the largest dental organizations in Croatia were contacted to answer questions about the supply chain in which their organizations are involved. Ultimately, the sample included 102 dental clinics/organizations in the Republic of Croatia. Table 1 provides the descriptive characteristics of the sample.

Table 1: The sample's descriptive characteristics

| Characteristic | Number | Share (percentage) |
|---|---|---|
| Education | | |
| Secondary education | 2 | 1.96 |
| Undergraduate education | 2 | 1.96 |
| Graduate education | 69 | 67.65 |
| Postgraduate education | 29 | 28.43 |
| Gender | | |
| Male | 56 | 54.90 |
| Female | 46 | 45.10 |
| Number of permanent employees | | |
| 1-4 | 49 | 48.04 |
| 5-9 | 19 | 18.63 |
| 10-19 | 7 | 6.86 |
| 20-59 | 16 | 15.69 |
| 50-100 | 2 | 1.96 |
| 100 + | 9 | 8.82 |
| Change in the number of users | | |
| Increased | 67 | 65.69 |
| Stagnant | 22 | 21.57 |
| Decreased | 13 | 12.75 |

Source: Author's calculations

The majority of respondents holds a higher education degree (67.65%) and are male (54.90%). Experience in the current role ranges from 1 to 32 years, with an average of 12 years ($\bar{x}$=11.92), whereas overall work experience ranges from 1 to 50 years, with an average of 19 years ($\bar{x}$ =19.19). The average respondent age is 45 years ($\bar{x}$ = 45.19), with a range of 25 to 74 years.

Regarding the size of the organization, measured by the number of employees, the sample mainly includes organizations with a small number of employees: 1 to 4 employees (48.04%), or 5 to 9 employees (18.63%). Dental organizations with 20 to 59 employees make up 15.69% of the sample. For most dental organizations, the number of users has increased (65.69%), while 12.75% report a decrease in users compared to 2019. The majority of respondents are team leaders (32.4%), followed by directors (8.8%), owners (7.8%), managers (4.9%) and other managerial roles (2%). The remaining respondents did not specify their role in the dental organization.

Data were analyzed using exploratory factor analysis (EFA) to identify factor structures, followed by the creation of summated scales by calculating the arithmetic means of the respective items. Multiple linear regression based on the ordinary least squares (OLS) method was then conducted using the Enter procedure, with all independent variables entered simultaneously. Five separate regression models were estimated, each with a different dimension of supply chain performance (flexibility, integration, responsiveness, partner performance, and relationship quality) as the dependent variable. Assumptions of OLS regression were tested prior to analysis. All analyses were performed using the SPSS program.

## 5. Research results and discussion

To test the hypotheses, summated scales were created for the individual constructs used in the study. These summated scales were derived from items (statements) that were loaded onto specific factors following exploratory factor analyses. The arithmetic mean of the items contained for each factor was used to calculate the scales. A multiple regression analysis was conducted using supply chain performance (flexibility, integration, responsiveness, partner performance and quality of partner relationships) as dependent variables. The independent variables of the model included process digitalization, technology, information technology, value creation (quality and customization), availability of finance and relationships between stakeholders (trust, shared vision and responsible behavior). The Enter method was utilized to incorporate independent variables into the model for every regression analysis. Next, flexibility, as a SCM performance indicator, was used as the dependent variable in a multiple regression analysis. The model explained 54.8% of the variance in the results. The results of this analysis are presented in Table 2.

Table 2: Results for SCM performance – flexibility

| Variable | B | β | t–value |
|---|---|---|---|
| Constant | 0.379<br>(0.619) | | 0.612 |
| Digitalization of processes | 0.073<br>(0.078) | 0.103 | 0.932 |
| Technology | 0.117<br>(0.142) | 0.073 | 0.822 |
| Information technology | 0.091<br>(0.078) | 0.109 | 1.170 |
| Value creation – quality | -0.040<br>(0.039) | -0.088 | -1.032 |
| Value creation – customization | 0.205<br>(0.075) | 0.229 | 2.729** |
| Availability of funding sources | -0.071<br>(-0.071) | -0.101 | -1.143 |
| Partner relationships – shared vision | -0.250<br>(0.103) | -0.234 | -2.415** |
| Partner relationships – responsible behavior | 0.201<br>(0.101) | 0.250 | 1.993** |
| Partner relationships – trust | 0.574<br>(0.105) | 0.531 | 5.466*** |
| Multiple regression coefficient $R^2$ | 0.548<br>(0.430) | | |
| R2 (corrected) | 0.500 | | |
| F-value | 11.322*** | | |

Note: *** $p < 0.001$, ** $p < 0.05$, * $p < 0.10$; standard error and standard error of the R2 estimate are in brackets.

Source: Author's calculations

Not all examined independent variables had a statistically significant impact on the dependent variable, as can be seen in Table 2. Customization (β=0.229), responsible behavior toward partners (β=0.250), and trust (β=0.531) are the statistically significant beneficial effects on flexibility. On the other hand, shared vision has a statistically significant negative impact (β= -0.234).

A multiple regression analysis was then conducted with supply chain performance, specifically integration, as the dependent variable. This model explained 61.2% of the variance in the results. The results of this analysis are shown in Table 3.

Table 3: Results for SCM performance – integration

| Variable | B | β | t–value |
|---|---|---|---|
| Constant | 0.222<br>(0.668) | | 0.333 |
| Digitalization | 0.142<br>(0.085) | 0.172 | 1.681 |
| Technology | -0.123<br>(0.153) | -0.066 | -0.804 |
| Information technology | 0.313<br>(0.084) | 0.323 | 3.732*** |
| Value creation – quality | -0.013<br>(0.042) | -0.024 | -0.310 |
| Value creation – customization | 0.064<br>(0.081) | 0.061 | 0.788 |
| Availability of funding sources | -0.121<br>(0.067) | -0.161 | -1.817* |
| Partner relationships – shared vision | -0.012<br>(0.111) | -0.009 | -.104 |
| Partner relationships – responsible behavior | 0.398<br>(0.109) | 0.425 | 3.660*** |
| Partner relationships – trust | 0.289<br>(0.113) | 0.230 | 2.553** |
| Multiple regression coefficient $R^2$ | 0.612<br>(0.463) | | |
| R2 (corrected) | 0.571 | | |
| F-value | 14.736*** | | |

Note: *** $p < 0.001$, ** $p < 0.05$, * $p < 0.10$; standard error and standard error of the R2 estimate are in brackets.

Source: Author's calculations

As the data in Table 3 demonstrate, not every independent variable under analysis has a statistically strong and positive impact on the dependent variable. Information technology (β=0.323), trust (β=0.230), and responsible behavior (β=0.425) all have statistically positive and significant effects on integration.

Next, a multiple regression analysis was conducted with supply chain performance – specifically responsiveness – as the dependent variable. This model explained 35.7% of the variance in the results. The results of this analysis are outlined in Table 4.

Table 4: Results for SCM performance – responsiveness

| Variable | B | β | t–value |
|---|---|---|---|
| Constant | 2.191<br>(0.496) | | 4.421*** |
| Digitalization | -0.154<br>(0.063) | -0.323 | -2.454** |
| Technology | 0.278<br>(0.114) | 0.260 | 2.450** |
| Information technology | 0.057<br>(0.062) | 0.101 | 0.909 |
| Value creation – quality | -0.019<br>(0.031) | -0.063 | -0.622 |
| Value creation – customization | 0.123<br>(0.060) | 0.205 | 2.045** |
| Availability of funding sources | -0.099<br>(0.049) | -0.230 | -2.008** |
| Partner relationships – shared vision | -0.023<br>(0.083) | -0.033 | -0.284 |
| Partner relationships – responsible behavior | 0.182<br>(0.081) | 0.338 | 2.258** |
| Partner relationships – trust | 0.182<br>(0.084) | 0.251 | 2.163** |
| Multiple regression coefficient $R^2$ | 0.357<br>(0.344) | | |
| R2 (corrected) | 0.288 | | |
| F-value | 5.180*** | | |

Note: ***p<0.001, **p<0.05, *p<0.10; standard error and standard error of the R2 estimate are in brackets.

Source: Author's calculations

The data in Table 4 show that not all analyzed independent variables have a statistically significant influence on the dependent variable. The statistically significant positive effects on supply chain responsiveness include: responsible behavior (β=0.338), technology (β=0.260), trust (β=0.251) and customization (β=0.205). The independent variables of process digitalization (β=-0.323) and availability of financial resources (β=-0.230) have a negative, but statistically significant influence on responsiveness.

Additionally, a multiple regression analysis was performed, with dependent variable SCM performance – partner performance. This model explained 68.3% of the variation in the results. The results of this analysis are presented in Table 5.

Table 5: Results for SCM performance – partner performance

| Variable | B | β | t–value |
|---|---|---|---|
| Constant | -0.112<br>(0.490) | | -0.229 |
| Digitalization | -0.039<br>(0.062) | -0.058 | -0.629 |
| Technology | 0.422<br>(0.116) | 0.278 | 3.636*** |
| Information technology | -0.072<br>(0.062) | -0.092 | -1.156 |
| Value creation – quality | -0.064<br>(0.031) | -0.147 | -2.061** |
| Value creation – customization | 0.046<br>(0.059) | 0.054 | 0.773 |
| Availability of funding sources | -0.111<br>(0.049) | -0.185 | -2.292** |
| Partner relationships – shared vision | 0.099<br>(0.082) | 0.098 | 1.211 |
| Partner relationships – responsible behavior | -0.026<br>(0.079) | -0.034 | -0.324 |
| Partner relationships – trust | 0.704<br>(0.083) | 0.693 | 8.513*** |
| Multiple regression coefficient $R^2$ | 0.683<br>(0.338) | | |
| R2 (corrected) | 0.649 | | |
| F-value | 19.905*** | | |

Note: *** $p < 0.001$, ** $p < 0.05$, * $p < 0.10$; standard error and standard error of the R2 estimate are in brackets.

Source: Author's calculations

After analyzing the correlations between the variables, it was shown that the relationship with technology (β=0.278) and partner relationship – trust (β=0.693) had a statistically significant positive impact on partner performance. Furthermore, partner performance is negatively but statistically significantly impacted by the availability of financial resources (β=-0.185) and quality (β=-0.147).

Additionally, the dependent variable, SCM performance – quality of relationship, was subjected to a multiple regression analysis. This model explained 51.8% of the variation in the outcomes. The results of this analysis are displayed in Table 6.

Table 6: Results for SCM performance – quality of relationships

| Variable | B | β | t–value |
|---|---|---|---|
| Constant | 0.478<br>(0.628) | | 0.761 |
| Digitalization | 0.125<br>(0.079) | 0.180 | 1.571 |
| Technology | -0.037<br>(0.149) | -0.023 | -0.246 |
| Information technology | -0.056<br>(0.080) | -0.069 | -0.703 |
| Value creation – quality | 0.032<br>(0.040) | 0.071 | 0.808 |
| Value creation – customization | 0.096<br>(0.076) | 0.110 | 1.265 |
| Availability of funding sources | -0.068<br>(0.062) | -0.108 | -1.085 |
| Partner relationships – shared vision | 0.179<br>(0.105) | 0.172 | 1.712 |
| Partner relationships – responsible behavior | 0.228<br>(0.102) | 0.291 | 2.237** |
| Partner relationships – trust | 0.332<br>(0.106) | 0.314 | 3.126** |
| Multiple regression coefficient $R^2$ | 0.518<br>(0.434) | | |
| R2 (corrected) | 0.466 | | |
| F-value | 9.913*** | | |

Note: *** $p < 0.001$, ** $p < 0.05$, * $p < 0.10$; standard error and standard error of the R2 estimate are in brackets.

Source: Author's calculations

Not every independent variable tested has a statistically significant impact on the quality of associations, as demonstrated in Table 6. The relationship with partners – trust (β=0.314) and responsible behavior (β=0.291) are accountable for the statistically significant positive influence on relationship quality.

Table 7 provides a summarized overview of the multiple regression analyses between the dependent variables of supply chain performance (flexibility, integration, responsiveness, partner performance and relationship quality) and the independent variables of SCM (digitalization of processes, technology, information technology, value creation, availability of funding sources and relationships with partners). Only those regression coefficients that are statistically significant are displayed.

Table 7: Summarized overview of multiple regression analyses on the variables of supply chain performance

| Variable | Flexibility | Integration | Respon-sivity | Partner performance | Relationship quality |
|---|---|---|---|---|---|
| | β | β | β | β | β |
| Digitalization of processes | | | -0.323** | | |
| Technology | | | 0.260** | 0.278*** | |
| Information technology | | 0.323*** | | | |
| Value creation – quality | | | | -0.147** | |
| Value creation – customization | 0.229** | | 0.205** | | |
| Availability of funding sources | | -0.161* | -0.230** | -0.185** | |
| Partner relationships – shared vision | -0.234** | | | | |
| Partner relationships – responsible behavior | 0.250** | 0.425*** | 0.338** | | 0.291** |
| Partner Relationships – trust | 0.531*** | 0.230** | 0.251** | 0.693*** | 0.314** |

Note: *** $p < 0.001$, ** $p < 0.05$, * $p < 0.10$; standard error and standard error of the R2 estimate are in brackets.

Source: Author's calculations

The results of the empirical analysis indicate that the concept of SCM in dentistry comprises the following factors: digitalization of processes, technology, information technology, availability of funding sources and value creation (quality and customization). All factors demonstrated a high level of reliability, ranging from α=0.627 for the availability of funding sources to α=0.906 for process digitalization, confirming their suitability for further analysis.

The construct of partner relationships was found to consist of three dimensions: trust between participants, responsible behavior towards partners and shared vision. These three factors also demonstrated high reliability ranging from α=0.822 for trust between participants to α=0.844 for responsible behavior towards customers, indicating that they are reliable measures of relationship quality among supply chain participants.

Following statistical data processing, the results revealed that quality significantly affects SCM performance, particularly partner performance (β=-0.147). However, this construct was not further examined in the analysis of hypothesis H1, since the regression coefficient, despite being statistically significant, points in the opposite

direction of the hypothesis H1. Further research is necessary to determine the reasons for this unexpected result. As for flexibility (β=0.229) and responsible partner behavior (β=0.205), they are significantly impacted by the second factor, customisation. These results corroborate the findings of Esper et al. (2010), who highlight that effective value creation enhances communication and integration among supply chain participants. Similarly, Al-Mudimigh et al. (2004) argue that businesses are increasingly focusing on value creation for all stakeholders. While the process of value creation should aim to reduce activities that do not increase the value of the final product or service, it remains unclear why quality negatively affects SCM performance. One possible explanation is that certain quality certifications contribute to the standardization of processes, thereby increasing pressure on employees, or that the processes of service delivery become too complex, which is why employees can no longer perceive their contribution to value creation. Based on these findings, value creation is found to partially contribute to the SCM performance, which leads to a partial acceptance of H1.

The findings further show that technology significantly affects partner performance (β=0.278) and partnership quality (β=0.260), indicating that technology enhances SCM performance. Dental organizations which implement appropriate technologies strengthen their partnerships and improve overall SCM performance. This is in line with the findings of Patterson et al. (2003), who highlight the role of technology in improving supply chain partner networking. Based on these findings, hypothesis H2 is accepted.

The statistical analysis also revealed that digitalization of processes has a negative impact on the quality of relationships with partners (β=-0.323). As this regression coefficient is statistically significant, but contradicts the expected direction, it was not considered further in the analysis of hypothesis H3. This finding contrasts the results of DHL Customer Solutions & Innovation (2016), who reported a positive correlation between process digitalization and supply chain performance. A plausible explanation is that lower digital literacy among certain employees in dental organizations may lead to resistance to the implementation of process digitalization, complicating short-term processes despite long-term benefits. Consequently, H3 is rejected.

Information technology has a significant impact on supply chain performance integration (β=0.323). This result aligns with the findings of DHL Customer Solutions & Innovation (2016) and Mahamood et al. (2016), who emphasize the positive relationship between information technology and supply chain performance in dental organizations. Thus, information technology contributes positively to supply chain performance, which leads to the acceptance of hypothesis H4.

The results of this study also show that the relationship between participants in supply chain consists of shared vision, responsible behavior towards customers

and mutual trust. The analysis showed that shared vision significantly influences flexibility (β=-0.234). However, due to the regression coefficient being negative and contradicting the hypothesis, it was not further considered in the evaluation of H5. Regarding responsible behavior towards partners, it has a significant influence on flexibility (β=0.250), integration (β=0.425), responsiveness (β=0.338) and relationship quality (β=0.291). As for trust between supply chain members, it significantly influences all performance factors, including flexibility (β=0.531), integration (β=0.230), responsiveness (β=0.251), partner performance (β=0.693) and relationship quality (β=0.314). These findings reinforce the conclusions of Langelier et al. (2017) and Guay & Wall (2016), who found that interpersonal relationships between supply chain participants are essential for the overall functioning of the supply chain and influence its performance to deliver services at the level of quality expected by customers. Consequently, it can be concluded that the relationships among supply chain members positively influence the chain's performance, which leads to the acceptance of H5.

The examination of H6 revealed that the availability of funding sources significantly affects supply chain performance, but in a negative direction. Specifically, the availability of funding sources has a significant negative effect on integration (β=-0.161), responsiveness (β=-0.230) and partner performance (β=-0.185). Although the hypothesis was formulated positively, it was rejected due to the direction of the construct which contradicts expectations and is not aligned with previous research. Voinea-Griffin et al. (2010) emphasize that supply chains develop depending on the financial capabilities of the participants. Therefore, an increase in the availability of funding sources should enhance SCM performance. One explanation for this negative effect may be that dental organizations often make substantial initial investments in technology and infrastructure, reducing the need for additional financing in the short term, which has a negative impact on SCM performance. Furthermore, the connection can be insignificant due to the complex system of interrelated factors that mediate between the financial capital and the actual operational efficiency. Although it might be expected that greater access to capital leads to improved performance, financial resources alone do not guarantee more efficient processes; their effectiveness depends on the organization's ability to allocate and align them strategically with its business goals. In situations where firms lack developed managerial competencies or planning systems, additional capital is often used to cover short-term operating costs, rather than to strengthen key supply chain functions, thereby minimizing its potential impact on overall performance.

Overall, the findings presented in this paper indicate that Croatia's private dental sector meets European standards in terms of service quality, professional competence, and the implementation of modern technologies. However, at the macro level, it is still not fully integrated into the corporate dental medicine model that prevails in Western

and Northern Europe. The most significant developmental challenges remain the uneven accessibility of care, limited opportunities for financing development projects, and investments in process digitalization. Nevertheless, Croatia's competitive advantages lie in its lower prices and rapid adaptability to market demands. In summary, Croatia's private dental sector demonstrates strong potential for alignment with best European practices. Continued investments in technology, human resource development, and integration with EU health frameworks could allow the country to achieve both organizational and structural maturity comparable to that of the most advanced dental systems in Europe.

## 6. Conclusion

This research demonstrates that companies in the dental industry collaborate successfully through the concept of SCM. Key SCM factors in dentistry were identified, including SCM performance, relationships among participants, availability of funding sources, technology, information technology, value creation, and process digitalization. Statistical analysis revealed a positive impact of technology and stakeholder relationships on supply chain performance, while information technology and value creation only partially contribute to supply chain performance. Finally, the availability of funding sources and the digitalization of processes were found to have no influence on supply chain performance.

The development of a conceptual model tailored to dental organizations represents the study's methodological contribution. This study can be used as a reference model for future research examining the effects of SCM on the effectiveness of complex business systems, particularly since existing SCM factors in dentistry have not been sufficiently explored. The study also enhances the understanding of SCM factors in dental businesses by comparing business systems of different sizes and incorporating perspectives from multiple dental managers.

Although the study offers important insights into dental SCM, several limitations should be considered when interpreting the results. The first limitation relates to the relatively small sample, which reflects the current state of SCM in the dental industry in the Republic of Croatia. Future research should include a larger number of dental organizations, using a bigger sample, to validate the findings. In-depth interviews are also recommended to evaluate the conceptual model in various dental organization types, given the limited number of specific dental organization types in the current sample.

A second limitation of the study is that it included only Croatian dental organizations. Similar research should be conducted in other countries with comparable organizational structures and legal regulations for dental organizations. In addition, it would be valuable to qualitatively investigate why this study identifies certain

negative relationships, although previous studies in other fields show positive correlations between the constructs of value creation (quality), process digitization, and partnership relations, such as a shared vision, with supply chain performance. Shared vision can negatively affect supply chain performance when it leads to excessive standardization and reduced flexibility among partners. When all participants pursue identical goals without considering their diverse business interests and market conditions, the supply chain's ability to adapt quickly and innovate is diminished. Overalignment often benefits larger partners who impose their priorities, reducing the autonomy and motivation of smaller participants. The implementation of a common vision increases coordination and communication demands, which can cause delays, miscommunication, and inefficiencies.

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# Analiza ključnih čimbenika upravljanja opskrbnim lancem u dentalnoj industriji u Republici Hrvatskoj

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***Sažetak***

*Brz napredak medicinskog znanja i tehnologija u stomatologiji transformirao je estetiku i otpornost ovog sektora na brojne načine. Kao rezultat toga, opskrbni lanci postaju sve složeniji, a sve veći broj čimbenika utječe na njihovu učinkovitost. Glavni je cilj ovog rada utvrditi pojedinačni utjecaj čimbenika upravljanja opskrbnim lancem na performanse opskrbnog lanca u dentalnoj industriji Republike Hrvatske. Istraživanje ispituje povezanost između čimbenika upravljanja opskrbnim lancem (tehnologija, digitalizacija procesa, informacijska tehnologija, partnerski odnosi, dostupnost izvora financiranja i stvaranje vrijednosti) i čimbenika performansi opskrbnog lanca. Za testiranje hipoteza istraživačkog modela korištena je višestruka regresijska analiza, dok je za provjeru valjanosti i pouzdanosti istraživačkih varijabli korištena eksploratorna faktorska analiza. Utvrđeno je da tehnologija i partnerski odnosi među sudionicima opskrbnog lanca imaju snažan i pozitivan utjecaj na performanse opskrbnog lanca. Također, stvaranje vrijednosti i informacijska tehnologija imaju samo djelomično pozitivan utjecaj na performanse opskrbnog lanca. Nadalje, rezultati ovog istraživanja potvrdili su da dostupnost izvora financiranja i digitalizacija procesa nemaju snažan pozitivan utjecaj na performanse opskrbnog lanca.*

***Ključne riječi:*** *dentalna industrija, upravljanje opskrbnim lancem, čimbenici UOL-a*

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