

THE ROLE OF TECHNOLOGICAL INNOVATIONS IN SHAPING THE QUALITY OF DENTAL SERVICES

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Purpose: The aim of the article is to identify the role of technological innovations in shaping the quality of dental services and to determine their impact on the functioning of dental enterprises.

Design/methodology/approach: The study was based on a qualitative in-depth interview conducted with the owner of a dental enterprise and an analysis of documentation related to implemented technological solutions and digitalization processes.

Findings: The results indicate that technological innovations contribute to improving diagnostic precision, increasing service quality, enhancing organizational efficiency, and strengthening the competitive position of dental enterprises.

Research limitations/implications: The main limitation of the study results from its qualitative character and the inclusion of only one dental enterprise, which may limit the possibility of generalizing the findings to the entire sector.

Practical implications: The obtained results may support dental enterprises in planning technological investments and implementing digital solutions aimed at improving service quality and organizational effectiveness.

Social implications: The development of technological innovations in dentistry may contribute to improving patient comfort, increasing access to modern diagnostic methods, and enhancing the overall quality of healthcare services.

Originality/value: The added value of the article lies in combining technological, organizational, and quality-related perspectives in the analysis of the functioning of contemporary dental enterprises.

Keywords: technological innovations; dental services; service quality; digital dentistry; healthcare management.

Category of the paper: research paper.

1. Introduction

Modern dental companies are facing the conditions of dynamic technological changes. They have to face increasing competition and increasing patient expectations regarding the quality of the services provided. The development of modern diagnostic technologies, digital medical records management systems and advanced treatment methods makes technological innovations one of the important factors of competitiveness of enterprises in this industry. They affect the efficient functioning of dental facilities. The speed of service delivery, patient comfort, diagnostic precision and the level of organization of the company's work are also becoming increasingly important. The scientific literature emphasizes that the technological development of modern dentistry affects the quality of services provided, as well as building the competitive advantage of enterprises operating on the medical services market.

The issues raised are of significant importance both in the scientific and practical dimensions. The continuous development of digital medical technologies, process automation and solutions based on artificial intelligence even forces the need to conduct an analysis of the impact of technological innovations on the quality of dental services and on the organization of the functioning of companies in the medical industry. Despite the growing importance of modern technologies, there is still a noticeable shortage of research relating to the practical impact of implemented technological solutions on the quality of patient service and the efficiency of dental facilities. Therefore, it seems reasonable to undertake research that allows for the identification of the relationship between the level of technological innovation and the quality of dental services provided.

The aim of the article is to identify the importance of technological innovations in the process of shaping the quality of dental services and to determine the impact of modern technological solutions on the functioning of a company operating in the dental industry. In the first part of the study, theoretical aspects related to the quality of dental services and the role of technological innovations in modern dentistry were presented. Next, the methodological assumptions of our own research were presented. The results of a qualitative in-depth interview conducted with the owner of a dental company were presented. In the next part, the results obtained were analyzed. Then, conclusions, practical recommendations, limitations of research and future research directions were formulated. The added value of the article is an attempt to combine technological, organizational and qualitative perspectives in the analysis of the functioning of modern dental enterprises.

1.1. Shaping the quality of dental services

Care for the high quality of dental services can be considered one of the important areas of functioning of modern medical enterprises. In times of growing health awareness of society and increasing patient expectations, the effectiveness of treatment is becoming extremely important.

At the same time, the way the process of providing services is organized becomes equally important. For this reason, the availability of modern diagnostic methods and a high level of patient service are extremely important. The quality of dental services remains a complex category. It covers both the clinical, organizational and social dimensions. In the scientific literature, opinions can be found indicating that the level of quality of dental care has a direct impact on the quality of life of patients, their sense of security and the regularity of use of medical services (Goettems et al., 2012; Perazzo et al., 2017; Do, Spencer, 2007). At the same time, effective prevention and an appropriate level of dental care can reduce the occurrence of health problems among children and adolescents (Herndon et al., 2015; Paula et al., 2016). However, there are still barriers that make it much more difficult to use dental services. This becomes a consequence of the limited availability of services, the level of health awareness and the social situation of patients (Farlina, Maharani, 2018; Mouradian et al., 2000; Curi et al., 2018; Bastani et al., 2021; Mousa et al., 2026).

Modern dental companies are increasingly basing the development of service quality on the implementation of modern technologies. They provide organizational solutions that support the process of treatment and patient service. The development of digital diagnostics, electronic medical record systems and tools supporting the management of medical processes increases the efficiency of dental facilities. However, at the same time, the assessment of the quality of dental services may refer to both the results of treatment and the level of organization of health services. It can also be a consequence of the availability of services for patients (Mahrous et al., 2016; Righolt et al., 2019; Choi et al., 2022). The spatial accessibility of dental facilities is also of significant importance. It affects the perceived quality of care. It affects the ability of different social groups to use medical services (Chung, Chan, 2021). The need to take into account the needs of groups particularly vulnerable to health exclusion is also increasingly emphasized. Such a group includes m.in children requiring specialized dental care (Bastani et al., 2021).

Shaping the quality of dental services should be considered as a process that requires continuous adaptation of enterprises' operations to technological, organizational and social changes. High quality of services is also increasingly identified with the effectiveness of communication, the time-of-service delivery, patient comfort and the company's ability to implement innovative solutions. It is important that modern models of assessing the quality of medical services increasingly take into account the patient's perspective. They must also take into account the level of satisfaction resulting from contact with a medical facility (Dopeykar et al., 2018; Reich et al., 2018). This means that modern dental companies, which operate in the conditions of the modern economy, should treat the quality of services as one of the basic elements of building a competitive advantage and long-term organizational development.

1.2. Technological innovations in dental services

The development of technological innovations should keep up with the directions of changes that are taking place in modern dental services. Technological progress includes both the development of modern diagnostic and therapeutic methods. It is also important to implement digital solutions that support the organization of the work of medical facilities. The literature emphasizes that modern dentistry is increasingly based on advanced imaging technologies, digital treatment design, and automation of selected clinical processes (DaSilva et al., 2022; Zimmermann, Seitz, 2023). It is also noted that technological innovations are groundbreaking. They have an impact on changing the existing models of providing dental services (Edelstein, 2020; Joda et al., 2021). Particular importance is attached to the development of digital technologies. They increase the precision of treatment, shorten the time of service delivery and improve the quality of diagnostics (Alqahtani, 2024; Khojimurodov, 2021). It is also indicated that the development of innovative dental technologies is important in the context of an ageing population and the growing health needs of the elderly (Hartshorn, Nair, 2023).

Solutions based on digital technology, artificial intelligence and computerization of medical processes are becoming increasingly important in dental services. The implementation of digital dental technologies is determined by both economic and organizational conditions. It also depends on the competence of medical staff (Stakhanskyy, 2025; Alotaibi, Kassim, 2023). The development of artificial intelligence and analytical tools improves diagnostics. In addition, it supports clinical decision-making (Reis et al., 2023). At the same time, it is pointed out that the process of digitization of dental services faces certain barriers. These are related to, among other things, the costs of implementations, the need for staff training and the level of acceptance of new technologies by dentists (van der Zande et al., 2013). Modern dentistry is increasingly using solutions related to the Internet of Things (IoT). Thanks to their use, it is possible to integrate medical devices. IoT also allows for monitoring treatment and diagnostic processes (Balaji Ganesh, Sugumar, 2021). It also highlights the growing role of digital technologies in public health and improving the accessibility of dental services (Srivastava et al., 2023).

Technological innovations currently affect both the course of the treatment process, but also the functioning and development of the market for the entire medical services. The literature indicates that modern dentistry is becoming one of the most dynamically developing fields of medicine. It offers a wide range of opportunities for professional development. It also contributes to cooperation with the technological and industrial sectors (Seif et al., 2024). At the same time, it is emphasized that the development of modern technologies forces the need to adapt dental facility management models to new market conditions and growing patient expectations (Manalili, Swanson, 2025). Certainly, therefore, the future of dental services will be increasingly associated with the development of digital treatment methods and the automation of clinical processes. It will also depend on the integration of modern diagnostic

and communication systems (Blum, 2024). This means that the ability to implement technological innovations is now becoming one of the key factors affecting the competitiveness and quality of functioning of companies operating in the dental industry.

2. Methods

The aim of this study was to identify the importance of technological innovations in the process of shaping the quality of dental services and to determine the impact of modern technological solutions on the functioning of a company operating in the dental industry. Efforts were made to determine the role of modern diagnostic technologies, digitization of processes and work organization in improving the quality of services provided.

The paper adopts a research hypothesis. It assumed that the implementation of technological innovations increases the quality of dental services and increases the competitiveness of the company operating in the dental industry. In order to verify the hypothesis, the following research questions were formulated: (1) Do technological innovations affect the quality of dental services? (2) What is the importance of modern diagnostic technologies in the process of treating patients? (3) Does the digitization of organizational processes affect the efficiency of the company's operation? (4) How do technological innovations affect patient satisfaction? (5) Do technological investments affect the competitiveness of a dental company?

The study used the method of qualitative in-depth interview. It was carried out with the owner of a company that operates in the dental industry. The interview took on a partially structured character. It was carried out on the basis of a prepared research scenario. He referred to issues related to the implementation of modern technologies, the organization of processes and the quality of services provided. In addition, an analysis of the company's documentation was carried out. It concerned the implemented technological solutions, the scope of services provided, the diagnostic methods used and the processes of digitization of the facility.

The obtained results were subjected to qualitative analysis. Then they were presented in the form of a funnel chart. This chart allowed to illustrate the assessment of the impact of technological innovations on selected areas of the dental company's operation.

3. Results

In accordance with the purpose of this article, a qualitative in-depth interview was conducted with the owner of a company operating in the dental industry. The aim of the study was to identify the importance of technological innovations in the process of shaping the quality of dental services and to learn opinions on the impact of modern technological solutions on the functioning of the company. The interview was partially structured. It was carried out on the basis of a prepared research scenario.

First, the respondent was asked about the reasons for the implementation of modern technologies in a dental company. The answer was primarily indicated by the growing expectations of patients, the need to increase the precision of diagnostics and the need to build a competitive advantage on the medical services market.

Next, they were asked about the impact of innovative diagnostic devices on the quality of services provided. The respondent emphasized that the implementation of modern computed tomography and digital imaging methods has significantly increased the accuracy of diagnosis. It also enabled faster therapeutic decision-making.

Another issue concerned the impact of technology on the level of patient satisfaction. The response indicated that patients pay special attention to the modernity of the office. But also important is the comfort of treatment and the ability to perform comprehensive diagnostics in one place, which increases their trust in the company.

In the further part of the interview, they were asked about the importance of digitization of medical records and computerization of the facility. The answer was emphasized that the implementation of electronic patient records improved the organization of work, the flow of information and the management of the treatment process.

Next, the problem of the impact of technological innovations on the organizational efficiency of the company was raised. The respondent stated that modern technological solutions have contributed to shortening the time of service delivery, reducing the number of organizational errors and improving communication between staff.

Another issue concerned the impact of technological investments on the competitiveness of the company. In response, it was stated that the implementation of innovative technologies makes it possible to acquire new patients. It also allows you to build the image of a modern and professional dental facility.

Later in the interview, they were asked about the changing expectations of patients towards dental services. In response, the respondent stated that modern patients expect high quality treatment above all. However, they also expect quick diagnostics, comfort of use and access to modern medical technologies.

In the last part of the interview, the importance of continuous technological development for the future of the company was asked. The respondent emphasized that systematic investment in innovative solutions is a condition for maintaining the high quality of services and further development of the company operating in the dental industry. Table 1 presents the results of an interview on the role of technological innovations in shaping the quality of dental services.

Table 1.

Results of a qualitative interview on the role of technological innovations in shaping the quality of dental services

Question	Answer	Importance for service quality
What influenced the implementation of new technologies?	Growing patient expectations	Increasing the competitiveness of the facility
How does modern diagnostics affect treatment?	Improves the accuracy of diagnosis	Improved service efficiency
How do patients rate innovative solutions?	They positively evaluate comfort	Increase patient satisfaction
What is the importance of digitization of documentation?	Improves work organization	Faster flow of information
Do technologies affect work efficiency?	Reduce service delivery time	Better organization of processes
How do technology investments affect a company?	They build a competitive advantage	Recruiting new patients
How are patient expectations changing?	They expect modern services	The need for continuous development
What is the importance of further investments?	They condition the development of the company	Maintaining high quality services

Source: Own study.

Figure 1 presents an assessment of the importance of technological innovations in the process of shaping the quality of dental services. The results obtained indicate that the impact of modern technological solutions on the quality of services provided and diagnostic precision was rated the highest. High values were also attributed to the importance of technology in building the company's competitive advantage. This proves the growing importance of innovation in the functioning of entities operating in the dental industry. The respondent also drew attention to the importance of technology for improving the organization of processes and increasing patient satisfaction. A relatively lower rating was given to the area related to the flow of information. Despite this, the positive impact of the implemented solutions is also noticeable in this case. The results obtained confirm that technological development is one of the important factors influencing the improvement of the standard of dental services and increasing the efficiency of the company's operation.

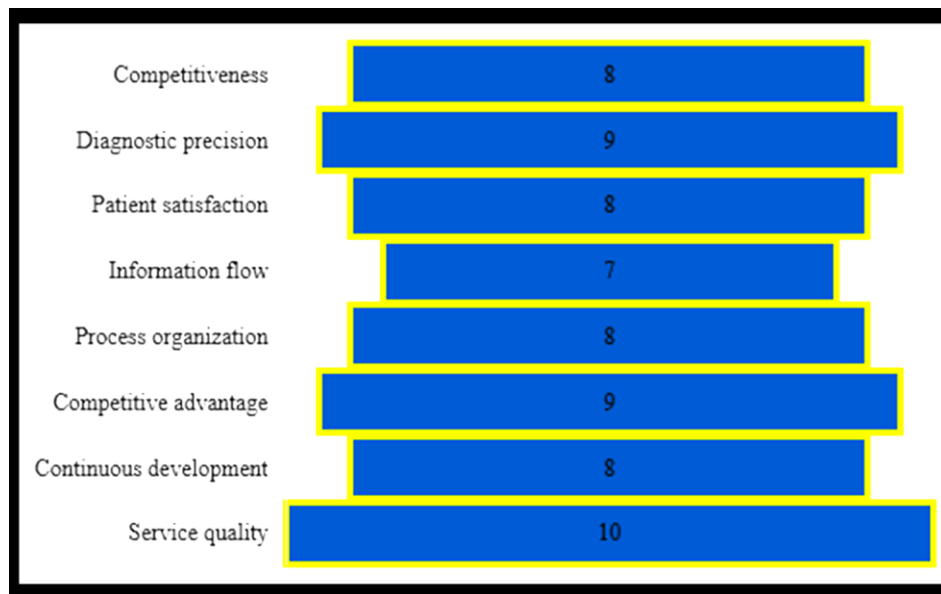


Figure 1. Assessment of the importance of technological innovations for the quality of dental services.
Source: Own study.

Figure 1 presents the assessment scores on the horizontal axis and the analyzed areas of technological impact on the vertical axis. Figure 1 indicates that technological innovations play a significant role in improving the quality of dental services. The highest ratings were assigned to the impact of modern technologies on service quality, diagnostic precision, and building the competitive advantage of the company. The results also show that technological solutions contribute to better work organization, increased patient satisfaction, and improved efficiency of the dental facility.

4. Discussion

On the basis of the conducted research, several important conclusions can be drawn concerning the role of technological innovations in the operations of enterprises operating in the dental industry. Based on the results obtained, it can be indicated that modern technological solutions primarily improve the quality of services provided. They also increase diagnostic precision. Particular importance was given to modern imaging methods and digital solutions. These technologies strongly support the treatment process. The implementation of advanced technologies allows for more accurate treatment planning, as well as shortening the time of service delivery and reducing the risk of diagnostic errors.

The conducted research also allows us to notice that technological development affects the entire organization of the functioning of a dental company. The computerization of processes and the implementation of electronic medical records contribute to the improvement of the flow of information. In addition, its implementation leads to improved work organization and

increased efficiency of the activities carried out. Attention was also paid to the growing expectations of patients towards modern medical facilities. Currently, the quality of services is increasingly determined not only by the undoubted effectiveness of treatment, but also by the level of technological advancement of the company, the comfort of service and the availability of comprehensive diagnostics in one place.

In conclusion, it can be stated that investing in technological innovations is decisive for building a company's competitive position on the dental services market. The dynamic development of medical technologies makes it necessary to systematically adapt operations to changing market conditions and patient expectations. Therefore, it can be said that modern technologies are currently one of the basic factors supporting the development of dental companies and raising the standard of services provided.

The results of the conducted research are consistent with the findings of other researchers. They indicate that technological innovations improve the quality of dental services, increase diagnostic precision and improve the organization of the work of medical facilities. In its own study, the importance of technology for the quality of services provided, the accuracy of diagnostics and building the company's competitive advantage were rated the highest. Similar conclusions were presented by DaSilva et al. (2022). These researchers have shown that the development of digital dentistry, modern imaging methods and advanced diagnostic technologies improves the effectiveness of treatment and the organization of the therapeutic process. Also, Joda et al. (2021) highlight that technological innovation is leading to the transformation of modern dentistry. They affect both clinical practice and the functioning of medical enterprises. In turn, Zimmermann and Seitz (2023) point out that the development of digital medical technologies increases the efficiency of service provision and changes the way of communicating with patients.

The results obtained also coincide with research that deals with the role of digitization of organizational processes and concerns the implementation of electronic medical records. In our own study, it was indicated that the computerization of processes improves the flow of information. It also improves the organization of the company's work. A similar position is presented by van der Zande, Gorter and Wismeijer (2013). They point out that the implementation of digital technologies in dentistry can contribute to improving the efficiency of the functioning of facilities. However, this process is also associated with the need to overcome organizational and competence barriers. Also, Reis et al. (2023) highlight the growing importance of artificial intelligence and digital tools in diagnostic and organizational processes. The results obtained are also partially in line with the findings of Alotaibi and Kassim (2023). They point out that the effectiveness of the implementation of modern technologies depends on the level of technological advancement of the company, as well as on the competence of the staff and the organizational readiness of the facility to adapt new solutions.

The study identified that technological investments may support competitive advantage and patient acquisition. However, no quantitative evidence concerning increases in patient numbers or market performance after the implementation of technological innovations was included. Future studies should therefore incorporate measurable economic and organizational indicators.

The lower assessment of information flow may indicate that, despite the implementation of digital technologies, some organizational and communication processes still require further integration and optimization within the dental facility.

5. Conclusions

On the basis of the conclusions obtained, recommendations can be formulated for enterprises operating in the dental industry. They concern the need for systematic implementation of technological innovations. Because it is these innovations that support the process of diagnosis and treatment of patients. Particular importance should be given to investments in modern diagnostic devices, digital solutions and IT systems improving the organization of the facility's work. The implementation of modern technologies can contribute to increasing the precision of the services provided. This results in improved efficiency of the company's operation and shortened patient service time. The development of electronic medical records and tools supporting the flow of information within the company is also important.

On the basis of the conducted research, it can also be concluded that companies from the dental industry should treat technological development as an element of a long-term strategy to build a competitive advantage. Constant changes that are constantly and dynamically taking place in the medical services sector make it necessary to constantly adapt the offer to the growing expectations of patients. They are increasingly paying attention to the level of modernity of the facility and the availability of advanced diagnostic methods. It also seems reasonable to systematically improve the competences of staff in the use of new technologies. It is also necessary to monitor changes in the dental services market. Such activities can be conducive to maintaining the high quality of services. They are also conducive to strengthening the company's position on the competitive medical market.

Future research directions may focus on an in-depth analysis of the impact of individual medical technologies on the efficiency of dental companies and on the level of patient satisfaction. It also seems reasonable to expand the research to a larger number of entities operating in the dental industry. This would allow for comparative analyses between companies with different levels of technological advancement. An interesting research area may also be the assessment of the impact of artificial intelligence, digital diagnostic systems and process automation on the quality of medical services and the organization of staff work. In the future, it is also worth taking into account the perspective of patients. It is also worth conducting

quantitative research. This would make it possible to identify the relationship between the level of innovation of the company and the perceived quality of the dental services provided.

Future research could incorporate measurable indicators related to service quality and organizational efficiency, such as patient satisfaction level, service delivery time, diagnostic accuracy, or effectiveness of information flow. This would allow for broader quantitative verification of the impact of technological innovations on dental enterprises.

The limitation of the conducted research was primarily the qualitative nature of the analysis. Restrictions may also include the inclusion of one company operating in the dental industry in the examination. The results obtained therefore reflect the experience and perspective of a particular entity. This may limit the possibility of their full generalization to the entire industry. A certain limitation is also the subjective nature of assessments relating to the impact of technological innovations on the quality of services and on the functioning of the company. The continuous development of medical technologies is also important. It means that some of the analyzed solutions may change or develop in a relatively short time. Despite the indicated limitations, the conducted research allowed to identify significant relationships related to the role of technological innovations in the operations of dental enterprises.

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