

## POLISH HOSPITALS IN SEARCH OF WAYS LEADING TO EXCELLENCE THROUGH NEW TECHNOLOGIES

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**Objective:** The paper presents the challenge of creating an excellent hospital in the context of adaptations to the conditions offered by new technologies. This task was guided by the goal of recognizing technologies, their perception and attempting to determine the maturity level of hospitals in the context of understood pro-innovation activities. A survey was conducted among management personnel of hospital facilities. It consisted of an attempt to identify the maturity level of hospitals in terms of innovation. In addition, the survey aimed to show the attributes of the future hospital. Some of them, according to the authors' supposition, referred to new technologies.

**Project/methodology/approach:** Achieving such an objective required a literature review as well as conducting a survey among management personnel of hospitals. The research method allowed to illustrate the problem analyzed. The diagnostic survey (in which respondents used an ordinal scale) allowed estimating the maturity level in the context of innovation. In addition, an open-ended question was posed in the questionnaire, which encouraged respondents to determine the characteristics of the future hospital. This allowed the set limits of cognition to be adequately achieved. The conceptualization elements included a diagnostic formulation (how is it?), while symptomatic insights: (why is it so?) and intervention insights: (what to do?), form the basis for the next research stage.

**Findings:** It was found that the challenge of today's world is the duty of continuous improvement, as the period of continuity and high predictability of the environment has come to an end. The importance of technological, social and environmental determinants was recognized, as well as their impact on the development of Polish hospitals. The analysis revealed a number of solutions that can be implemented. The study confirms that management personnel are aware of the need to invest in innovation, and their level of maturity is different in different types of hospitals (its level of reference).

**Research limitations/implications:** Further studies are justifiable, which would provide a new light on the opportunities that technology brings and the risks associated with them. In addition, it is reasonable to show the level of hospitals' efforts to improve technological excellence. In the future, it is expedient to explore the performative dimension of technological solutions on employees, patients and hospital stakeholders. The aspect of the potential for technology to influence health promotion, prevention, treatment and rehabilitation in the context of hospital activities seems interesting but unexplored.

**Practical implications:** Particularly worthy is the continuation of observations on changes of a technological nature, which allow the maximization of the benefits of their implementation not only in the financial terms, but also in the qualitative (services provided) or social (people's health, life well-being) terms.

**Originality/value:** The paper highlighted the need to identify the unique characteristics of an excellent hospital in the context of technology (which the highest form of excellence will be the creation of a Polish smart hospital). It provides a starting point for further exploration. The analysis of the paper's content may be helpful to other healthcare service organizations operating in a dynamically changing environment.

**Keywords:** new technologies, hospital improvement, hospital of the future, smart hospital.

**Paper category:** scientific paper.

## 1. Introduction

In the era of nuanced phenomena and reality riddled with uncertainties, the organization's managers tend to design and implement changes that lead them towards excellence. They achieve this goal by possessing a number of specific skills (Wolniak, 2017; Stańczyk 2018; Szczepańska-Woszczyzna, 2016; Kozuch, 2004). The disasters that have befallen society in recent years (the Covid pandemic, Russia's aggression against Ukraine) make this thesis even more difficult (Wolniak, 2022; Orzeł, Wolniak, 2021; Pytlak, 2022; Diokpa et al., 2021). All conditions are probabilistic, which causes the creation of development visions to become even more challenging (Chojnacka, 2021). Circumstances provoke the promotion of leadership and business strategy synchronization with disruptions generated by the environment (Fuller, Theofilou, 2021). New information and communication technologies (ICT) become an accelerant for improvement, opening the cyberspace operation perspective (Althoff et al., 2022; Temelkova, 2020) and creating a new model for the operation and management of organizations (Chomiak-Orsa, Greńczuk, 2022; Adamik, Sikora-Fernandez, 2021; Khafaji et al., 2019; Grębosz-Krawczyki et al., 2021; Zakrzewska-Bielawska, 2021). ICT technologies in hospitals support the managers' work, as well as physicians or other employees of the medical institution. However, the level of their implementation in Polish health care facilities falls short of global standards (Kautsch, 2015). Thanks to ICT, heads and presidents are supported in carrying out daily tasks and shaping future solutions. The hospital managers can optimize time and resources in the facility by improving operational efficiency. Medical services gain access to medical devices that improve the diagnosis and treatment of patients. This allows them to meet the growing demands of patients. Medical professionals engaged in science, thanks to the ability to collect a huge amount of data, its processing and analysis, conduct tests of new therapies or prepare innovative therapeutic solutions. The hospitalized patients also gain from the development of smart technologies. For example, they can count on faster and more accurate diagnosis (among others, diagnostic technologies such as MRI scanner, CT scanner,

telemedicine tools supporting preventive measures of society contribute to this). Also, the monitoring of patients' health status, after or during treatment, becomes much easier (Krittanawong et al., 2021; Bayoumy et al., 2021). Patients, thanks to the development of telemedicine, can provide such monitoring remotely, which, according to research findings, is much more convenient and effective (Busso, Gonzalez, Scartascini, 2022). According to researchers, the electronic registration system being implemented also has a positive impact on waiting times for service, which is perceived as valuable by all hospital stakeholders (Lulejian et al., 2014). In addition, there is a perceived benefit from the coordination of care between specialists and facilities (Skowron, 2023), as well as the availability of more effective and less invasive therapies and technologies. It is an undeniable fact that innovations used in hospitals can contribute to raising the level of healthcare.

Although modern solutions bring many benefits, it is important not to forget the risks associated with them. Devices, machines, systems or software are not free from defects. Blind trust in them can lead to mistakes (e.g. errors in diagnosing patients or inappropriate selection or dosage of drugs). Also noteworthy is the aspect of the possibility of technical failures, which could result in the inability to access a patient's health information, thus disrupting the treatment process. Another significant threat is the risk associated with loss of data privacy, or the possibility of cyber-attacks (Makuch, Guziak, 2020). Not insignificant is the possibility of weakening physician-patient interaction. Focusing on the disease entity (guided by the need to obtain an accurate diagnosis) to the exclusion of empathy shown to the patient can be detrimental to the entire treatment process and deprive it of an essential element, such as humanity. And yet, according to research, patients expect from a physician not only professionalism, but also inspiring trust, caring, kindness, tenderness or empathy (Moczyłowska et al., 2014). Another threat is the possibility of employees becoming disruptive, frustrated, overworked leading to technostress (La Torre et al., 2019; Brod, 1984; Ayyagarii et al., 2011; Suh, Lee, 2017; Tarafdar et al., 2015) or staff dependence on technology. For hospital managers, significant difficulties are the troubles arising from the limited resources for implementing and maintaining systems, or the high cost of purchasing medical equipment. To this set should be added the lack of time for technology training or the possibility of employee resistance to planned innovative changes. An extremely important aspect that cannot be overlooked is the difference in accessibility to technology by different social groups. People who use hospital services should be able to have equal access to health care services (Constitution of the Republic of Poland Article 68), regardless of whether they find themselves or not in the virtual world.

The conditions presented provoke reflection on the aspect of technology in the context of improving activities undertaken in hospitals. The aspect of improvement and implementation of pro-quality solutions gains momentum, facilitated by the Act on Quality in Health Care and Patient Safety, which was passed on June 16, 2023. It defines the rules for the operation of a quality management system in healthcare providers. The healthcare quality system includes:

authorization, an internal quality and safety management system, accreditation and medical registries of adverse events. Quality will be studied using indicators relating to four areas: clinical (level and effects of services provided), consumer (patient opinion), management (efficiency of resource use and implementation of management systems). The entity that monitors healthcare quality indicators is the National Health Fund (NHF).

Managers of healthcare providers are required to meet the requirements of the Act, otherwise they will not be contracted with the National Health Fund to provide healthcare services, and thus will not receive public funding for this purpose. This fact causes hospital managers to cooperate with prominent specialists who are highly experienced in developing system documentation or auditing hospitals (such as UEP Prof. Monika Dobska, PhD), or external organizations that have been preparing various entities and institutions to implement quality management systems for compliance with ISO standards for many years (such as TÜV Rheinland Poland or the ProQualita Quality Center). Assistance in implementing the internal system is particularly needed by entities that do not have experience in implementing accreditation standards for hospitals or those that have not yet applied for ISO 9001 certification. Hospitals at every stage of their activities to adapt the services they provide to the requirements of the Act can be supported by new technology. Quality improvement is supported by innovative products offered by many commercial companies. Many of them are established as a result of public-private partnerships aimed at building a system to support the healthcare sector's development. Clusters are being formed (such as InnoStar) associated with the European Institute of Innovation and Technology (EIT) Health unit, in which the Silesian University of Technology is involved. EIT Health partners include the Medical University of Łódź, the Medical University of Gdańsk, the University of Warsaw, the Technical University of Łódź and the Łukasiewicz Research Network. Many Polish research centers take the lead in innovation for health and this makes the number of products dedicated to health care increase. An innovative and quality-focused hospital today can use operational models, high computing power, and artificial intelligence, but it should not forget about the organizational, functional, technical and behavioral design of hospital space, as reminded by Prof. Anna Szewczenko of the Department of Design and Quality Research in Architecture, Silesian University of Technology.

## **2. Literature review**

The circumstances in which organizations operate make planning difficult (which assumes a high degree of continuity). Managers of Polish hospitals face such a situation every day. Peter F. Drucker, one of the most prominent management thinkers, recognizes that managers customarily started planning from yesterday's trends and made projections of the future based

on them in various possible combinations, but with a great number of the same elements and the same configuration. Even since the 1980s, he states, it has become impossible to plan this way. It is possible to assume or predict the occurrence of an exceptional event, but it is impossible to plan it. Drucker suggests implementing strategies that anticipate the likelihood and content of the biggest changes (Drucker, 1995). New realities and disruptions should be transformed into opportunities, and this raises the need to reformat the existing mindset of managers. Their "blissful mediocrity" augurs relegation to the margins. Drucker expects a commitment to honest calculation and intellectual honesty from managers to face the real results of their actions. Meeting such a challenge prompts investment in data, data platforms, software, disruptive technologies and security systems to improve analytical competence (Koratkiewicz, Kabalska, 2021). It becomes quite a challenge to refine information architecture in an orderly and systematic manner. Routine is replaced by inquisitiveness, the ability to ask questions and seek answers. This challenge is fostered by the development of technology, with passionate and committed people behind it.

Extrapolation and anticipation of the future is possible, not only thanks to the expertise of managers or their experience, but also intuition (Janasz, K., Janasz, W., 2014). Proactively creating a path towards excellence can trigger the need to redefine the organization's mission and position (Shoemaker et al., 2018; Brown, Eisenhardt, 1998; Huy et al., 2014; Martinsuo et al., 2022; Hamid et al., 2019). This process of construction is referred to by the term "organizational renewal" (Janasz, K., Janasz, W., 2014). The COVID-19 pandemic has led to a management boom in which the "command and control" scheme has been replaced by "listen and lead" (Choi, 2020). Work is increasingly based on the collective action of many people (Doughert, Dune, 2011; Klessova et al., 2020), welding together people, capabilities and resources (Moczydłowska, 2010), and provoking the inclusion of a set of data collection and analysis tools (Santos et al., 2021; Tambare et al., 2021).

Pro-quality changes intensify after the Senate passed the new Health Care Quality and Patient Safety Act of June 16, 2023. It will generate new insights into an old daily routine. The legal guidelines will make hospitals not only pro-quality, but also pro-innovation.

The need to absorb scientific and technological knowledge is considered an urgent challenge (Fjelstad et al., 2012). In the conditions of digital transformation, shaping the organization of the future, it is difficult to imagine it without the support of technology. It has become, so to speak, a builder erecting a bridge between the unknown and the expected (Chojnacka, 2023).

An accelerator of technology implementation in Polish hospitals became the COVID-19 pandemic, although its earlier implementation is an undeniable fact. The inventions of technicians and technologists systematically infiltrated the hospital space and provided service to patients, physicians, and society as a whole. What has become possible thanks to digitization and informatization has contributed to the creation of radical qualitative changes that benefit both recipients and providers. The benefits of the information civilization's development are

also being reaped by control and supervisory bodies (including: the State Sanitary Inspectorate, the Ombudsman for Patients' Rights, Governors), the health insurance institution acting as payer (the National Health Fund), or the Ministry of Health. The new reality is that society as a whole also reaps the benefits of technological innovations in saving health and lives. An indirect expression of this is the World Health Organization's (WHO) commitment to strengthening the capacity of member states to collect, collate, analyze, use and manage health data. Noteworthy is the SCORE for Health Data package, launched in 2020. Its goal is to strengthen national health information systems. SCORE allows improving the availability of up-to-date, reliable and comparable health data to track progress toward sustainable development goals related to saving the health and lives of the entire population.

Hospital managers are close to modern technologies, which are used in the areas of surgical medicine, diagnostic imaging, medical statistics, patient data retention, patient health monitoring, application of artificial intelligence algorithms in medical diagnoses.

The pressure to improve quality or rationalize costs at the same time prompts the use of digital technologies. Research studies unequivocally show that ICTs allow new value to be achieved in hospitals (Kordel, 2022). Among others, they enable research to be undertaken into innovative ways of providing healthcare services, as a result of the possibility of making changes to existing procedures. These initiatives are in both administrative and clinical areas. Still required are updated studies indicating improvements in efficiency through the introduction of a broad electronic infrastructure into healthcare facilities.

Among ICT-based solutions, it is important to distinguish the ones that relate to: digitization, and internal as well as external integration, or those related to analytics. Their representation is shown in Table 1.

**Table 1.**  
*Technology-based solutions adopted by hospitals*

<b>Digitization</b>	<b>Internal integration</b>
1. Tools providing support in the process of patient admissions, their flow and communication with potential patients (pending services).	1. Administrative management systems – ICT-based solutions for managing accounting, financial flows or logistics.
2. ICT security, understood as solutions that guarantee protection of access to the data produced, to unauthorized persons.	2. Human resource management systems – solutions used to manage personnel including legal, economic or social aspects.
3. Virtualization – this includes IT hardware and software necessary for storing and retrieving data (from desktop servers, local servers and from virtual clouds).	3. Electronic medical records – solutions that provide support for computerized single, up-to-date and integrated management of patient's personal and clinical data throughout the medical assistance cycle.
4. Digitization of clinical documents – solutions which eliminate paper documents, as well as image documents, and convert them into electronic documents.	
5. Dematerialization systems for administrative documents (conversion of documents used in administration to electronic versions).	

Cont. table 1.

External integration	Analytics
<ol style="list-style-type: none"> <li>1. Digital patient services – enabling the provision of services to patients through digital channels (including services that support patient interaction).</li> <li>2. Digital services for external stakeholders – enabling creation of integrations between the hospital and regional services, physicians, primary care.</li> <li>3. Integration with electronic health record – ICT solutions that provide integrations with Electronic Medical Record (EMR) platforms, understood as a format for recording health data from various treatment providers.</li> </ol>	<ol style="list-style-type: none"> <li>1. Computerized medication management – solutions that support the prescription, preparation and administration of medications.</li> <li>2. Clinical management tools – support clinical decisions to improve the quality of services offered and achieve/maintain increased standards of care (e.g., incident reporting systems).</li> <li>3. Management panels – solutions that support management and administrative decisions aimed at improving the quality of administrative processes (for example, tools adopted to balance service demands).</li> </ol>

Source: Gastaldi, Corso, 2012.

A review of current research directions indicates a growing interest in the smart concept (Mikucki, 2021; Miller, 2015). This is due to the need for adaptation to operating conditions in a smart future, referred to as a smart world (Ning et al., 2016). The idea achieves many benefits mainly due to a trait known as resilience, which is defined as "the organizational ability to develop in a complex and unpredictable environment" (Khan, Halem, 2012). Smart concepts gain recognition in the field of public management (Samih, 2019), but also in cultural institutions (Augustym et al., 2018; Ćwikła, 2021; Wójcik, Juszczak, 2022), tourism enterprises (Czernek-Marszałek, Piotrowski, 2022), or health care (Kordel, 2022). The benefits of adapting medical service institutions to the realities and possibilities of the modern world are unlimited and touch every area of its operations (including monitoring patients' vital signs, analyzing medical diagnostic images, making clinical decisions or planning resource utilization or tracking bed occupancy) (Kerpedzhiev et al., 2019). It is worth noting that before implementing new, innovative technologies, a diagnosis of needs should be made, both among managers and expectations of medical staff. At the same time, the requirements of patients must not be overlooked (Gimpela et al., 2021). Only after a thorough analysis and prioritization can one successfully begin to implement solutions. A facility that uses modern technologies has a functional infrastructure as well as is effectively and efficiently managed, prevents risks, responds to crises, and on top of that also takes care of patients and employees, deserves to be called a smart hospital. In such a smart hospital, hospitalized patients can expect higher quality services and personalized care, medics can expect to be relieved of routine tasks and assisted in their clinical work. In a smart facility, managers can expect the created system of hardware and software solutions to promote the optimization of available resources (from scheduling and coordinating staff to controlling heating and lighting). The literature review shows that further development of the idea of smart organizations will require proactivity, innovation and creativity on the one hand (Kordel, 2018) and, on the other hand, extracting the essence from digital technology (Wolniak, Gajdzik, 2021) including: big data, artificial intelligence, machine learning, Internet of things, Internet of services, cloud computing, mechatronics, advanced robotics, machine-to-machine communication, digital twins and improved cybersecurity.

### 3. Research method

The study presents part of a survey that constitutes the entirety of a larger project. The aim of this study was to find out the opinions of managers on the characteristics of the future hospital. The results presented in the paper will relate to aspects of technology. Other attributes not related to them will be presented in subsequent studies. The research concerned perceptions, i.e. insights and views of respondents, and therefore it was decided, in this part of the study, to use a qualitative method. The research procedure included three stages. The first stage involved preparation for the study proper (including a literature review, construction of a preliminary research questionnaire and conducting preliminary research). At the second stage, a questionnaire was developed, a pilot study was conducted, and finally the questionnaire was created and the survey was conducted. The collection of research material (information from respondents) lasted from October to December 2022. The questionnaires were sent by post, then by e-mail. Another way to increase the returnability of survey forms was through telephone and personal contact. Once the expected sample size was achieved, the final (third) stage of the research was undertaken. This consisted of analyzing the results. Respondents were asked to write a short response presenting their own thoughts or reflections relating to the characteristics (attributes) of the future hospital.

The research sample was a purposive sample. The survey was addressed to respondents, holding the position of managers (directors) of facilities qualified for the system of basic hospital provision of health care services. The National Health Fund list included 585 hospitals. Responses were obtained from 124 respondents. The weaknesses of the presented research methodology were the high cost of reaching the respondents, the longtime of survey implementation, the long questionnaire, and the possibility of "interviewer effect".

The respondents belonged to a group of health care entities providing inpatient services (named hospitals). The vast majority of them have a form of ownership – public hospital. Respondents belonged to the group of Level I (55%), Level II (10%), Level III (20%) and other (15%) hospitals, including: specialized (oncology or pulmonology), pediatric, as well as clinical and clinical research institute. Some are listed as a surgical, multi-specialty or non-surgical hospital. Most of the respondents are ISO 9001 certified, and most often these entities have several buildings located in one space. There are also some that have several buildings located in several spaces, rare are those with a single building. The respondents have a number of laboratories, including radiology, ultrasound, CT scanner, endoscopic diagnostics, laboratory diagnostics and microbiological diagnostics. In addition, they have operating rooms, archives, drug supply, blood bank, sterilization room, emergency room or ED unit and other units.



## 4. Results

An immanent feature of hospitals is their permanent development. Innovation is one of the pillars of medical service providers belonging to the Polish health care system. The values followed by hospitals are centered around people and quality of treatment. The Act on Quality in Health Care and Patient Safety dynamizes pro-quality activities. The implementation of new technologies can support hospitals' stated values and the need for quality improvement, as long as the implementation of solutions is accompanied by decency (the well-being of people) and not by greed seen as a desire for excessive cost minimization. The overriding principle of responsible implementation should be the safety of patients, employees, bystanders, the facility and institutions belonging to the health care system. The risks posed by the possibility of excluding some patients unfamiliar with technology or the aspect of cybersecurity deserve special attention. Technology can support hospitals in adhering to values such as economy, professionalism, cooperation, respect, and transparency.

Among the respondents' statements relating to the attributes of future hospitals were statements relating to new technology. Some of the opinions were repeated or similar in their expression. According to respondents, the hospital of the future is, among others:

1. A facility that uses new technologies.
2. Innovative, safe, cutting-edge and environmentally friendly.
3. Modern and friendly (equipment, rooms, therapies, etc.).
4. Focused on innovation in management, treatment, diagnostics.
5. Takes advantage of the potential in strong informatization.
6. Features digitization.
7. Provides medical services using telemedicine.
8. Undertakes activities including digitalization in health care.
9. Collects and processes data in a secure manner, ensuring its anonymization.
10. Has LAN and WLAN installations in all hospital wards.
11. Uses biotechnology in treatment and diagnosis, with full electronization of medical records.
12. Uses all kinds of technology to improve the health of patients.
13. Open to new medical ideas and technologies for quality improvement.
14. Uses the latest technologies including robotics.
15. Relies on artificial intelligence to improve the patient care process; seeks to expand AI participation in hospital operating systems.
16. Can flexibly adapt to changing environment, attitudes, technology, etc.
17. A place where medical personnel have access to the most advanced technologies and tools.

18. Purchases modern equipment for patient diagnosis, as well as medical apparatus and computer equipment.
19. Optimally secures the budget for infrastructure that directly affects the medical services performed, among others, for the IT system.
20. Focuses its goals on various directions of activity by implementing multi-profile diagnostic and therapeutic activities, as well as scientific, research and teaching activities, and provides comprehensive, modern health care services based on the highest medical standards, while promoting innovation and creativity of employees by undertaking multi-directional activities to support their personal development.

The statements presented by the respondents clearly prove the importance of technology in the perception of future hospitals. A great deal of attention was paid to new technologies and innovations, which are perceived as opportunities, but there are also statements indicating awareness of the need for data security.

Reinforcing qualitative research with quantitative research not only enriches its value, but is often necessary, hence the authors suggested taking a look at the evaluation of the innovation level vs. the type of hospital. As representatives of the innovation evaluation, variables from the section that asked to estimate the maturity level of the hospital in the context of innovation (management, organizational, technological, service, social) were taken into account. Evaluation of the innovation level was measured on a five-point ordinal scale (from an evaluation of 1 – Practice is not established, has not been undertaken at all, up to 5 – Practice is implemented throughout the hospital, with basically no exceptions).

**Table 2.**

*Evaluation of the variables that make up the level of innovation*

Variable	Position scale summary				
	1	2	3	4	5
The hospital manager knows what innovation is for the hospital and what it can achieve with it	1,6%	1,6%	3,3%	23,0%	70,5%
The hospital manager set goals and objectives for new technologies	3,3%	0,0%	16,4%	37,7%	42,6%
The hospital manager has prioritized efforts to develop technology	3,3%	3,3%	18,0%	37,7%	37,7%
Employees have the right to be involved in the development and implementation of innovations	1,6%	0,0%	8,2%	44,3%	45,9%
Employees are given the necessary skills and competencies to be creative and open to new solutions	1,6%	1,6%	18,0%	42,6%	36,1%
Hospital constantly generates and collects monitored creative ideas from employees, patients and suppliers	1,6%	8,2%	27,9%	29,5%	32,8%
The hospital manager seeks trends to implement innovations	1,6%	3,3%	9,8%	41,0%	44,3%
The hospital manager creates multidisciplinary innovation teams	4,9%	8,2%	24,6%	39,3%	23,0%
The hospital manager implements solutions to capture and share experiences, ideas, insights and lessons learned	1,6%	1,6%	24,6%	49,2%	23,0%
The hospital manager fosters innovation in relation to environmental social, ethical activities	1,6%	4,9%	16,4%	37,7%	39,3%
The hospital manager assesses opportunities and risks associated with creative ideas and innovative activities	1,6%	1,6%	21,3%	34,4%	41,0%

Cont. table 2.

The hospital manager uses tools and techniques to develop innovative solutions aimed at improving service offerings	3,3%	4,9%	18,0%	34,4%	39,3%
The hospital manager allocates resources, people, finances, IT to support innovation	1,6%	3,3%	19,7%	36,1%	39,3%
The hospital manager measures the effectiveness and efficiency of implemented innovations	3,3%	6,7%	23,3%	33,3%	33,3%
The hospital manager measures employees' level of commitment to innovation	4,9%	11,5%	26,2%	31,1%	26,2%
Hospital measures patient satisfaction with new services and solutions	3,3%	4,9%	14,8%	36,1%	41,0%
Hospital uses health technology evaluation methods to identify effective and cost-effective technologies for clinical practice applications	4,9%	13,1%	23,0%	31,1%	27,9%

Source: Own elaboration.

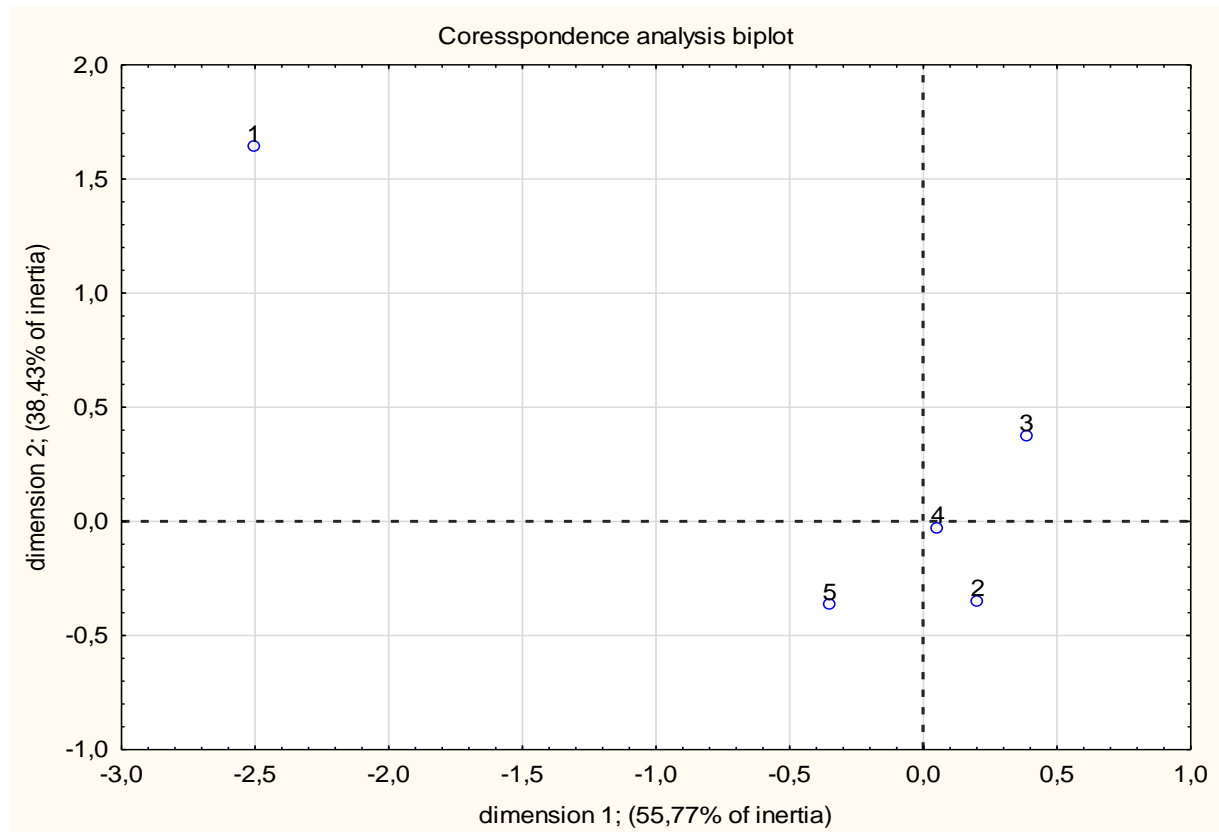
Taking a look at the above table, it is possible to observe a certain consistency. Namely, low evaluations are characterized by a small percentage of indications and the percentages increase as the evaluation increases. It can also be noted that, with only a few exceptions, the percentages for each scale item for the variables considered are similar – consistent. Thanks to such a conclusion, it was decided to average the scores of all the variables and then recode them again on a five-point scale. This, in turn, allowed the use of correspondence analysis. Correspondence analysis is a descriptive technique for analyzing bivariate and multivariate tables that contain some related measures between columns and rows. The results thus obtained allow analysis of the structure of qualitative variables that create the table. At the same time, it should be clarified that the type other, included the following hospitals: specialized (oncology or pulmonology) pediatric, as well as clinical and research institute.

To analyze the configuration of points representing the innovation level in the factor space, it is necessary to look at figure 1.

The distances of points representing the innovation level of hospitals from the center of the coordinate system vary considerably. The furthest from the beginning of the coordinate system is the point representing the hospital's failure to establish such practices. It differentiates the hospitals relatively most strongly in terms of innovation level and thus has the greatest contribution to the formation of factor space. This is confirmed by the obtained result of the relative inertia value for this variable.

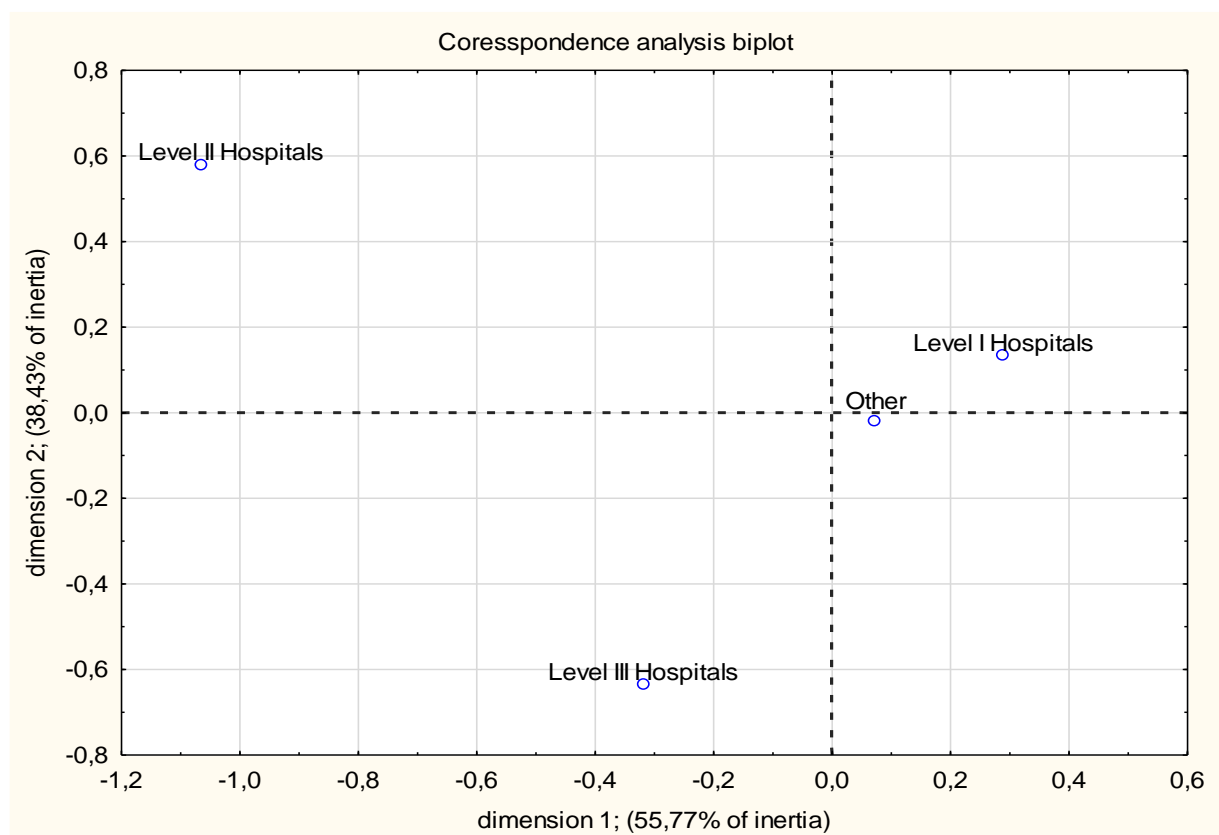
The points representing the evaluation of the highest (5) – the practice is implemented and average (3) – the practice is widely established, but not most of the areas are relatively far from each other. This means that the listed innovation evaluations differentiate the surveyed hospitals in different ways.

Figure 2 shows a plot of point configurations representing hospitals in a two-dimensional factor space.



**Figure 1.** Configuration of points representing the innovation level in the factor space.

Source: Own elaboration.

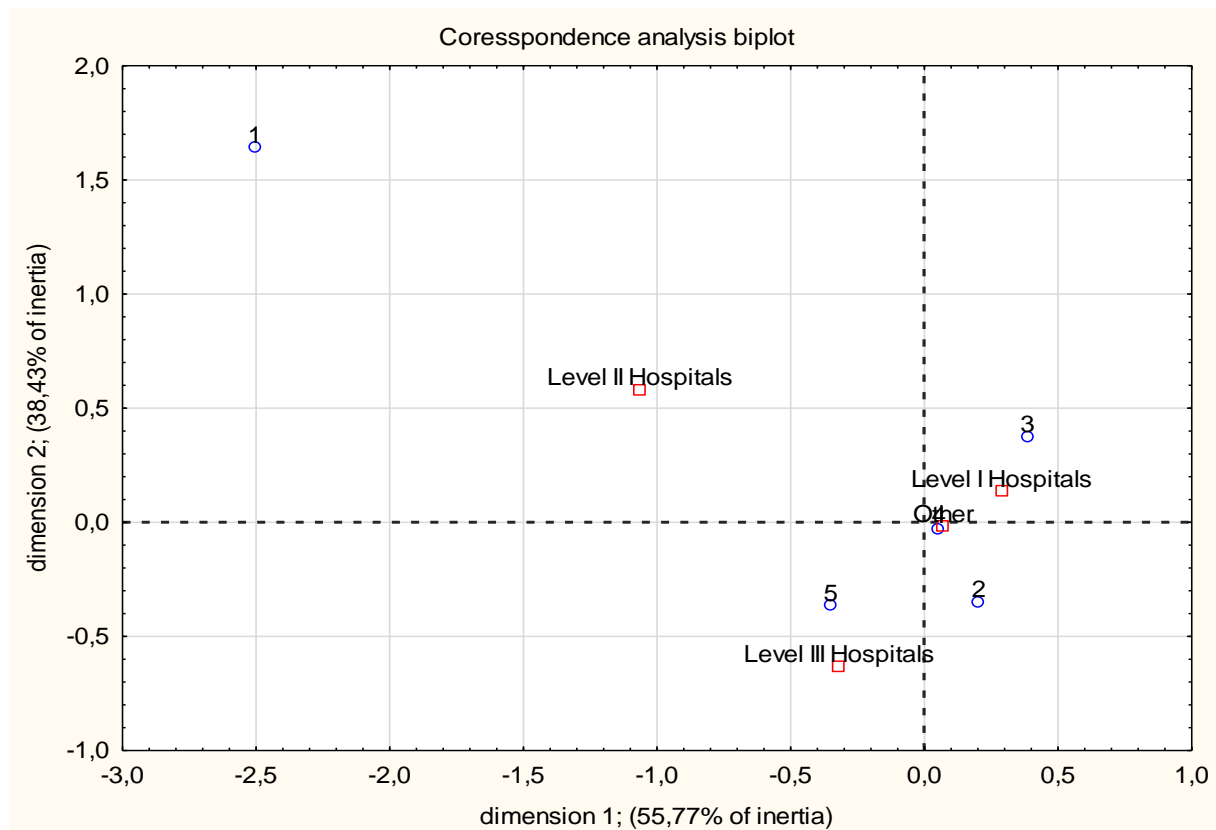


**Figure 2.** Configuration of points representing hospital types in two-dimensional factor space.

Source: Own elaboration.

Hospitals with the most typical innovation evaluation structure (closest to the average structure) are Level I Hospitals and those in the Other category – the corresponding points are relatively closest to the center of the coordinate system. They also form a group of facilities with a similar innovation evaluation structure. On the other hand, the hospitals with the most unusual structure of innovation evaluation values include Level II Hospitals and, to a much lesser extent, Level III Hospitals.

Finally, take a look at figure 3, representing the configuration of points for hospital types (factor 2) and innovation evaluations (factor 1) in a two-dimensional factor space.



**Figure 3.** Configuration of points for hospital types and innovation evaluations in two-dimensional factor space.

Source: Own elaboration.

At the outset, it is explained that the first factor allows to reproduce 55.77% of the variation of elements in the input data matrix, i.e., total inertia, and the second factor the remaining 38.43%.

The close proximity of points representing evaluations of 4 and 3, i.e., practice is very typical (evidence of sustained improvement) and practice is widely established, but not in most areas only with some exceptions, to hospitals in the categories of Other (value 4) and Level I Hospitals (both value 4 and 3) indicates that it is because of these evaluations that the discussed group of Hospitals stands out from the rest. At the same time, these two groups of hospitals are the most similar to each other in terms of innovation evaluation. Another group characterized by different values of innovation evaluations from other facilities (relatively) are Level III Hospitals and Level II Hospitals. These facilities approach innovation evaluations in

different ways. Accordingly, Level III Hospitals are closest to an evaluation of 5: the practice is implemented throughout the hospital, with basically no exceptions, while Level II Hospitals are closest of the other facility types to an evaluation of 1: the practice is not established, has not been undertaken at all.

## 5. Conclusion

Managers should refer with particular caution to demands for which routine is the mother, and established patterns and mechanisms of action are the father. In a changing environment, it is important not to fall prey to cognitive inertia. Much attention is being paid to new technologies and innovations, which are seen as opportunities to improve the organization. Among the solutions being proposed and implemented are electronic patient records, hospital information systems, medical databases, expert systems, telemedicine systems, advanced analytical tools, futuristic systems: nanomedical, medical instruments and robots.

Hospital improvement is a challenge. A significant difficulty for those involved in shaping a picture of future hospitals is the conditions in which they operate, particularly the multifaceted and multidimensional circumstances in which they operate. As a number of authors point out, "today it is increasingly necessary to use qualitative research methods to a greater extent in order to describe and explain the changes taking place in economic life" (Dylewski, Marek, 2013, p. 10). Hence the need to present the development, anticipating the future hospitals using the open question contained in this paper.

It seems justified to carry out further explorations allowing to:

1. Study the strength of the impact of a dynamically changing environment (including the Quality Act) on the priorities of implemented innovation solutions.
2. Show the performative impact of technology on employees and patients.
3. Identify the biggest challenges and difficulties in the implementation of new technologies.

The proposed research suggestions can apply to hospitals, but also to other organizations.

This paper is a prelude to further in-depth research on the shape of relations and links between innovations implemented in hospitals and their type or capacity of management.

From the results obtained, it is possible to draw conclusions that Level III Hospitals and the Other category perform best with innovation, Level I Hospitals perform well, and Level II Hospitals perform worst. Although it should be noted that the distances of all evaluated hospitals do not significantly approach the weakest evaluation of 1, by which is meant the lowest level of maturity with regard to pro-innovation activities. The results shown in the survey are a positive prediction for the future.

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