

# **Technological context of healthcare entity intangible asset management**

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## **Abstract**

*This paper presents results of research aimed at presenting the opinion of hospital managers about the influence of information and communication technologies development level (referred to as technological context) on the increase of health care entity intangible assets. Hospital intangible assets include knowledge, personnel skills, organizational structures and procedures, hospital reputation (i.e. hospital perception by patients and other stakeholders – such as sponsors, investors etc.). The paper presents the results of the case study type research in selected Polish hospitals that differ in size, location and development level of information and communication technologies utilized. The respondents included hospital board representatives, who confirmed the positive impact of the information technology level on the increase of hospital intangible assets. The results from this qualitative research can provide a starting point for more specific quantitative studies.*

**Keywords:** Information technology, Intangible assets, Healthcare management, Information systems of health care entity.

## **Introduction**

Intangible factors, such as: goodwill, image of the hospital and confidence of the patients, and the knowledge and competencies of workers have a significant influence on the competitiveness and the efficiency of healthcare unit's functionality. The efficient and effective management of intangible assets demands its identification, estimation and reporting. This is not possible without the utilization of appropriate information technologies.

In this article a case study type is presented with the objective is to study the opinions of selected hospital managers about the impact of the technological context (level of modern information technology) on the intangible asset value of these hospitals. A model of the quantitative research will be developed based upon the first phase which includes a pilot. Literature review and further analysis of the results presented in the paper will help to identify appropriate elements of the model and quantitative measurement tools for the existing relationships between them. This particularly applies to the choice of survey questions so that the proposed construct could be measured with the appropriate reliability and validity.

## **Tangible and intangible assets in the economic organization**

The growing gap between the book value and the trading value of economic organizations is the reason for greater interest in the conception of intellectual capital which by many researchers identifies with the notion of intangible assets. Methods of attaining advantages from intangible assets differ from methods concerning tangible assets in several essential areas (Surma, 2008). Intangible assets in most cases do not directly influence the financial performance of the enterprise. The value (utility) of intangible assets has potential character, (Molodchik, Shakina,

& Bykova, 2012) which means that they can be used for building the value of the firm, but investment alone in intangible assets does not guarantee the increase in value of the organization. Other substantial differences concerning intangible values include (Głuszek, 2004, p. 64):

- The possibility of simultaneous and various utilization;
- The depreciation in progress of utilization;
- The way of realizing intangible assets by people.

In the literature immaterial resources are identified as the notion of intellectual capital which create not only intangible assets having structural character, but also skills of developing and coordinating all resources, both material as and immaterial in the enterprise (Grajkowska, 2011). The intellectual capital embraces all categories of immaterial resources and potential abilities of its management (Ross, Ross, Dragonetti, & Edvinsson, 1997). Kaplan and Norton (2004) divided immaterial resources on three basic components (Kaplan & Norton, 2004) :

- The human capital - the knowledge, skills, abilities and competencies of workers;
- The organizational capital - the type and the quality of leadership, the organizational culture;
- The information capital - the combination of information resources and systems of the enterprise.

Due to the lack of a universally accepted definition of the intellectual capital and intangible assets, these notions are often used interchangeably (Choong, 2008). Many industries, including health care, have specific types of intangible assets that are common to that industry. Often, those individual intangible assets are specific examples of the more general categories of intangible assets. Reilly (2012) noted that some common health care industry intangible assets are as follows:

- Medical, dental, and other professional licenses;
- Certificates of need;
- Patient relationships;
- Patent files and records (manual and electronic);
- Electronic medical records computer software;
- Medical and administrative assembled workforce;
- Office systems, procedures, and manuals;
- Position or “station” procedures and manuals;
- Facility operating licenses and permits;
- Physician (and other professional) employment agreements;
- Physician (and other professional) noncompetition agreements;
- Executive (and other administrator) employment agreements;
- Executive (and other administrator) noncompetition agreements;
- Administrative service agreements;
- Medical (and other professional) service agreements;
- Facility or function management agreements;
- Equipment and other supplier purchase agreements;
- Service marks and service names;
- Joint venture agreements;

- A professional's personal goodwill;
- An entity's institutional goodwill;
- Equipment use or license agreements;
- Medical (other professional) staff privileges; and
- Joint development or promotion agreements.

This list of healthcare industry intangible assets is not comprehensive, but is representative of the many types of individual intangible assets common to this industry.

### **Chosen IT systems supporting the management of intangible assets of the healthcare unit**

The organizational structure of the healthcare unit can be separated into two basic components: medical and administrative. The medical component serves medical activities. The administrative component is deals with the business activities of the whole organization. Information Technology (IT) systems of the organization must be related to its organizational structure. The administrative component of the healthcare unit uses IT systems dealing with business data processing concerning realized services and basic financial and accounting data concerning all activity of the healthcare subject. These types of IT systems realize certain subset of functions supporting management processes typical for transactional ERP systems.

The second group of IT systems is connected with the medical component of the healthcare subject and most often contains the following (depending on the size and the scope of activity):

IT systems recording medical data of patients;

Transactional IT systems recording basic business transactions;

IT systems supporting medicine supply chain management, delivery of medical resources and other medical equipment inside the hospital;

Archiving systems and image transmission systems of which the main task is the storage and making images available;

Systems of remote identification of objects (patients, equipment, tools and the medical apparatus, medicines);

- Telemedicine systems, supporting remote and mobile forms of medical service provision among which can be distinguished;
  - Telediagnosics is the systems, enabling remote access to the diagnostic apparatus, remote control of the examination, and remote access to results;
  - Teleconsultation - remote, multimedia, quick and comparatively cheap access to the best consultants of world medicine;
  - Other remote medical services - telemonitoring, medical telerobotics etc.;
- Systems supporting patient relationship management (PRM) - related to traditional CRM systems (Bal, Dwivedi, & Naguib, 2005).

The primary activity of the operational level of healthcare units (depending on the size) is realized with the support of transactional IT systems with different level of integration with other domain systems of the unit. They are modular systems defined generally as Integrated Management Information Systems of ERP types (used with a success in business organizations).

The development of the human capital has access to modern medical technologies. It especially concerns technological support of the diagnostics (including imagery diagnostics) and medical robotics. The use of telemedicine also contributes to the development of human capital, increasing the possibilities of professional and scientific development of employees. The relational capital management of hospitals use patient relationship management (PRM) systems based on commercial CRM systems (Jelonek & Chluski 2010). Also the utilization of the Internet, social media and virtual communities is important to strengthen the relationship with patients (Jelonek, 2013).

The development of Communication and Information Technologies and elaborated standards connected with growth of interoperability allow for integration of mentioned IT systems. The integration of the medical and administrative components of the systems is one of the essential conditions of efficient management, and consequent development of the healthcare unit.

### **The purpose of the research and research sample**

The qualitative research presented in this paper aim to assess the impact of the *technological context* (information and communication technologies) on the level of development of the healthcare entity's intangible assets. The assessment was conducted based upon the managers' opinions of surveyed hospitals.

The main research question for this research study is: are hospital managers' opinions concerning the creation and development of hospital intangible assets sensitive to the development level of information technology (*technological context*)? The research should also provide an answer to the question whether conducting further research using quantitative methods on a large sample preceded by the precise conceptualization of basic IT level defining and of hospital intangible assets level development concepts is justified.

Context is a very important element of qualitative research, which can be assigned to idiographic research approach that concentrates on a specific description of a unique phenomenon. Context is some kind of environment of a phenomena that interests the researcher (Czabanowska, 2007). Czabanowska (2007) defined context as a larger area or a bigger picture of the phenomenon. More specific definitions describe context as a specific aspect of the situation, e.g. physical, historical or social location, of person, firm or studied phenomenon (Czabanowska, 2007). The fundamental objectives of a case study method is prediction, explanation and comprehension of specific phenomena develop from the use of context (Silverman, 2013). The attention that is given to the context can range from none to overuse – of course each can cause severe consequences for research results.

In the case study presented in this paper, a special context that can be referred to as a *technological context* was taken into account. Questions about the stages of hospital intangible asset development were asked after having presented suitable *technological context*, that defined levels of IT solutions advancement used in the hospital and in the paper are referred to as

"information technologies profile." Respondents were asked to give an answer after taking into account the context.

Three hospitals that are characterized by different information and communication technologies development level were chosen for the research. Preliminary IT level analysis was based on online sources and documentation available in health care facilities. The final technological contexts of hospitals were determined through interviews with IT services managers of each hospital. Health care facilities were ordered by information technology advance level that was likewise linked up to the size and position of each hospital. The results of research conducted by one of the authors for the need of his doctoral thesis (Chluski, 2012) were partially used in the paper.

The first health care facility is SP ZOZ Miejski Szpital Zespólny (hospital no.1), whose owner is a local government that is Municipality of Częstochowa. It is the smallest out of the surveyed hospitals, located in a county city with a fairly wide range of medical services (corresponding to local needs). The second health care facility is Wojewódzki Szpital Specjalistyczny im. NMP w Częstochowie (hospital no.2), which is owned by the voivodship's local government – Sejmik of Silesia voivodship. This is the second hospital in terms of the size, scope of services and the level of IT services. The third health care facility is Szpital Specjalistyczny im. Jana Pawła II w Krakowie (hospital no.3), whose owner is the local government of Małopolskie voivodship. This is one of the largest hospitals in the voivodship with a highly qualified and experienced group of specialists. It is highly ranked in various contests assessing the quality of medical services (best Health Care Centre type rankings) and additionally is a three-time winner of the "*Informatics Leader*" contest, organized by Computerworld magazine.

- The selection of hospitals was chosen in a specific sequence according to the following criteria defining different information technology development levels in these hospitals; Network and telecommunications infrastructure, the number of personal computers in relation to employees;
- Type, function range and integration degree of basic hospital information system (HIS);
- Type, function range and integration degree of computerized medical systems in the medical component that include:
  - Information systems for supply chain management of medication, medical supplies and other medical equipment;
  - Systems for archiving and transmitting images that accumulate and share results of graphical type research and other biochemical studies;
  - Information systems for collecting and processing patients medical data;
  - Information systems for diagnostic equipment service;
- The degree and range of remote medicine usage in hospital that include:
  - Telediagnosis - remote access to diagnostic equipment, remote control over research, remote access to the results;
  - Teleconsultation - remote access to world's best medicine consultants;
  - Other remote medical services – telemonitoring, telerobotics etc.

For each hospital an adequate characteristic of IT level development that is the technological context was developed. After having read this characteristic respondent gave an interview in accordance with the relevant questionnaire.

### **Research methods and tools**

In order to develop the questionnaire for this case study research, an analysis of the documentation and other sources (including hospitals websites and the Public Information Office website) for each hospital were previously conducted. They were followed by interviews with IT department managers about the information technology level of each health care facility. Based upon the findings, a presentation of the basic interview technological context used in case study research was created. Before giving answers to four questions groups respondents were asked to watch the presentation and consider the information included there.

The first group of questions was related to the managerial opinion about intangible assets in general terms, it was related to:

- The impact of intangible assets on the hospital activities competitiveness and efficiency;
- The necessity of taking into account intangible assets in hospital strategy creation;
- The need for intangible asset identification, measurement and report to stakeholders;
- The usage degree of computer techniques for intangible assets identification and measurement; and
- The possibility of use (usability) of data collected in its systems supporting current hospital activities for the intangible assets identification and report.

The second group of questions was related to intangible assets connected with healthcare human resources that included the following:

- Usability and utilization of technical infrastructure for knowledge sharing;
- Usability and utilization of information technology for diagnosis and consultation teamwork;
- Usability and utilization of information technology for professional and scientific employees development support; and
- Extent and ways of professional and scientific development support from management and of employees knowledge sharing.

The third group of questions was related to intangible assets resulting from hospital relation capital that included the following:

- Hospital management plans and strategies for modern ICT usage in PR and positive image creation;
- The necessity of mass media (traditional and online) usage in PR and hospital positive image creation;
- Organizational procedures for health care entities cooperation in the field of medical consultations and other assistance forms (even patient's transfer in order to continue treatment); and

- Utilization of stakeholders management and patient relationship management (PRM).

The fourth group of questions was related to intangible assets connected with structural capital and knowledge formalization in the hospital that included the following:

- Data gathered from registration system's usability and utilization in managerial decision-making processes;
- Business intelligence systems necessity and possibility of implementation in the hospital;
- The possibility and formalization degree of acquiring, collecting, organizing and structuring of knowledge (hidden from the employees' minds and explicit from other sources) using appropriate information technology;
- The availability and utilization of medical knowledge bases (medical cases, scientific literature, medical libraries - both traditional and on-line);
- Personnel management formalization and professionalization necessity (recruitment forms, employee training, formalized knowledge sharing support, etc.).

Each group included questions regarding whether the use of *appropriate IT* (in accordance with the technological context) is a *necessity* for creation and development of *appropriate test elements* constituting hospital intangible assets. Words *necessity* and *sufficiency* are characteristic for formal terminology in logic and mathematics. The managerial science often interchangeably uses expressions such as *a key factor*, *a necessary condition*, and *a precondition* etc. The use of these expressions in the survey questions aims to highlight the importance and significance of the relationship between certain phenomena (this is of particular importance if the methodological paradigms of a particular scientific discipline allow for the assumption of the deterministic nature of certain phenomena types processes). Respondents were asked to answer rating questions with a five point Likert's scale (1 – strongly disagree, 2 – disagree, 3 - no opinion, 4 – agree, 5 – strongly agree). The scale was used to set managers answers in order. For each hospital and for each group of questions an aggregated indicator was calculated as an arithmetic mean of individual responses encoded with Likert's scale. For each group of questions *a set of three indicators* presents answers from each hospital. For example: answers from the hospital No. 1: *3 points*, answers from the hospital No. 2: *3 and 1/3 points* and answers from the hospital No. 3: *5 points* – briefly: **(3, 3 and 1/3,5)**. Such type of notation can reveal the general level of agreement and differences between the managers' opinions of the individual hospitals.

### **Discussion and conclusions from the analysis of findings**

Figure 1 presents a conceptual diagram of the research model with arrays of the results of studied hospital managers' opinion. Arithmetic means of responses are provided in the tables. The results from each group of questions are indicated in the rows of the table with the columns corresponding to the order of hospitals.

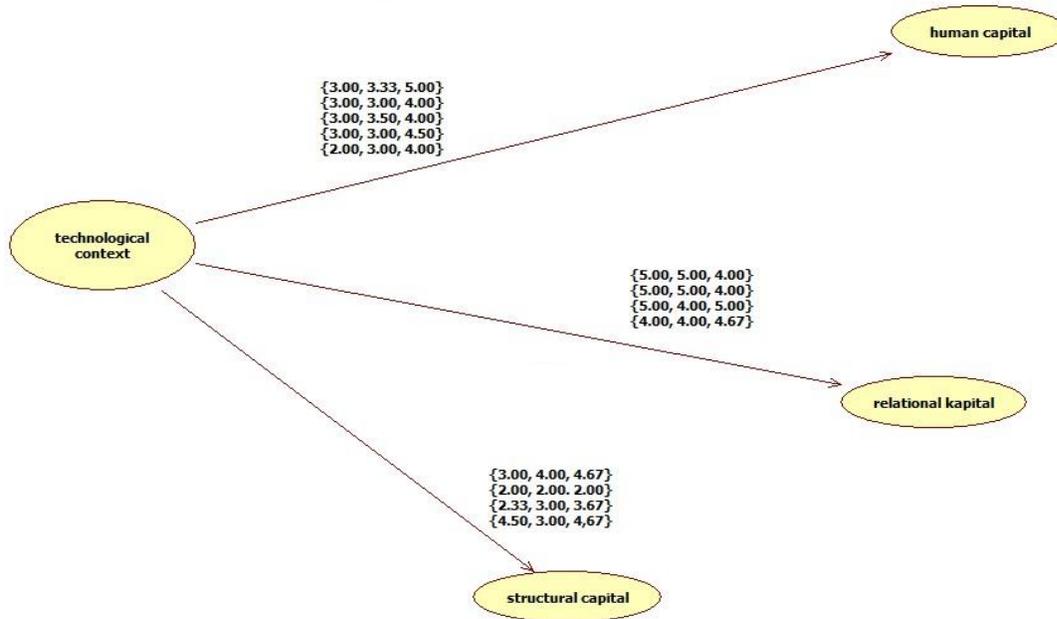


Figure 1. A conceptual diagram of the general research model with arrays of results

The results of the managers' opinion study regarding the impact of the technological context on the intellectual capital of hospitals are also presented in figures 2, 3 and 4.

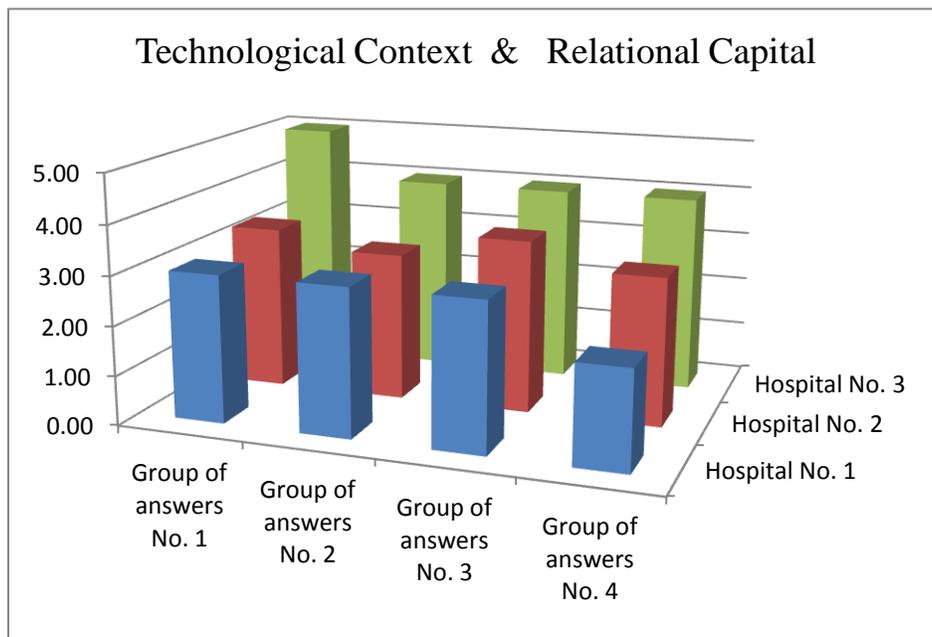


Figure 2. Assessment of technological context impact on the human capital

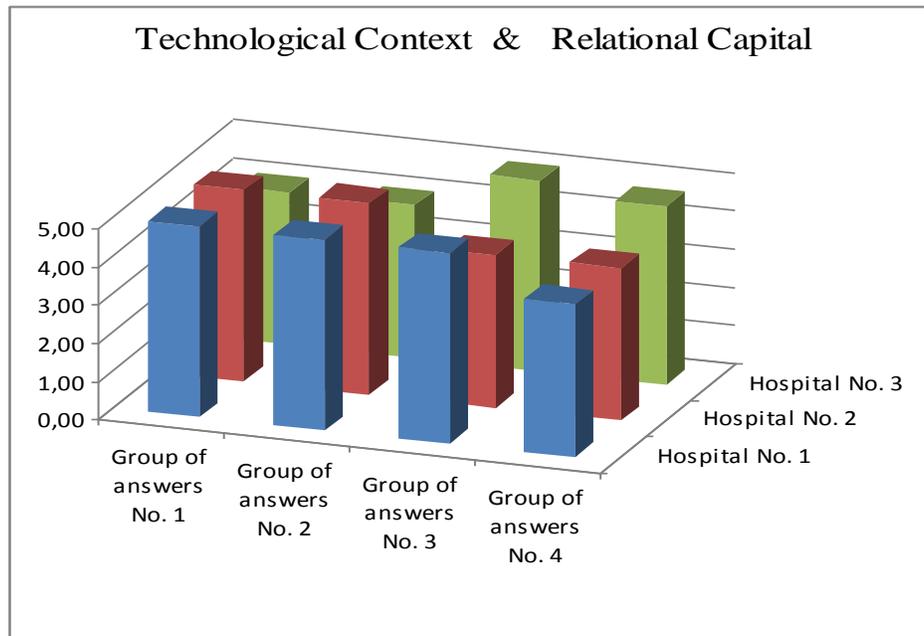


Figure 3. Assessment of technological context impact on the relational capital

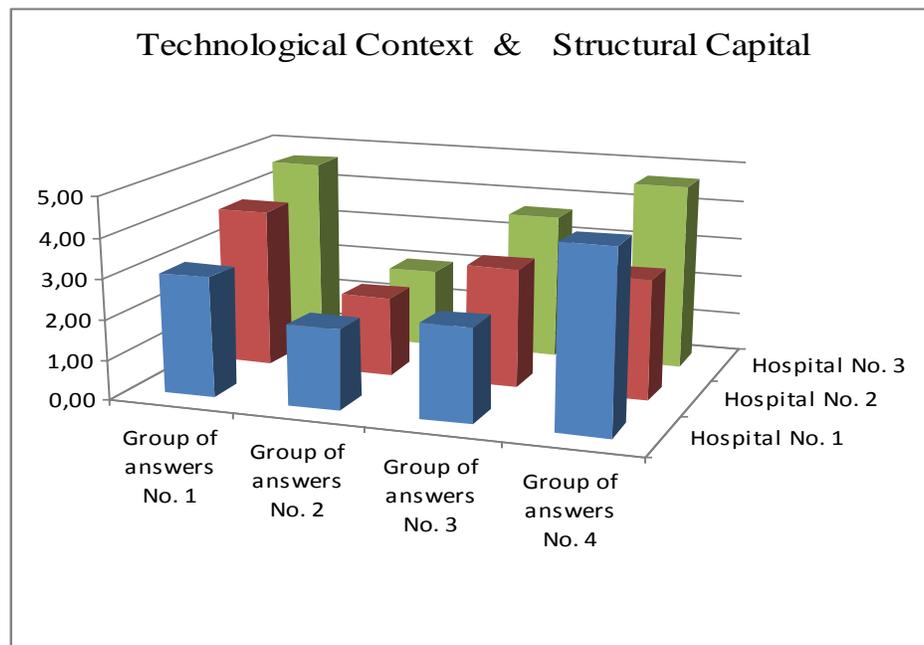


Figure 4. Assessment of technological context impact on the structural capital

Managers of surveyed hospitals consider the knowledge and competencies of workers are on the level compared with other public hospitals of similar size, scope of services and the location (3, 3 and 1/3, 5). The support level by the chief management of knowledge sharing processes and the experience of workers was evaluated on neutral level (3, 3, 4). The respondents indicated that the technical infrastructure responsible for the professional and scientific development of hospital

workers is not sufficiently useful (3, 3 and 1/2, 4). In all surveyed hospitals the suitable utilization of communication and information technologies is a necessary condition for the effective professional and scientific development of hospital's employees.

The utility and the utilization factor of ICT for the purpose of supporting teamwork within the range the consultation and diagnostics is evaluated by representatives of the management highly in the case of the third hospital (3, 3, 4 and 1/2). Similarly, the state of the technical infrastructure was evaluated contributing to the teamwork of telediagnosics and teleconsultation (2, 3, 4). The utilization of information technologies is considered necessary for the condition of the effective teamwork in the scope of diagnostics and medical consultations.

According to the managers of surveyed hospitals the treatment location selected by the patient contributes to the positive image of the hospital, including confidence of the patient in concrete doctors (5, 5, 4). The management of patient relations is a very important element of the management strategy of the hospital, for prospective of future reforms of the healthcare system in Poland and in the world and should have the technological support.

The hospital management is convinced that a necessary condition for the creation of the positive image and good public relations of the hospital is the use of traditional public media (television, radio, press) to modern social communication media available on the Internet (5, 4, 5). Managers of surveyed hospitals are convinced that intangible factors (goodwill, the role of the hospital's image and the confidence of patients, the knowledge and competences of workers) can have significant influence on the efficiency of hospital's activity (4, 5, 5). The intangible factors should be considered during the creation and realization of the hospital's strategy (4, 4, 4 and 2/3). Operations targeting valuation and suitable reporting (3, 4, 4 and 2/3) of intangible values are important to the management and others o such as patients, forming subjects, owners, and potential investors.

Management representatives of the surveyed hospitals consider that it is practically impossible to costs the valuation, visualization and reporting of intangible values without the use of computer techniques (2, 2, 2). The historical data of economic events obtained from the transactional IT system (2 and 1/3, 3, 3 2/3) is not as useful. In addition, the results for managers of the surveyed hospitals indicated that a system of this type does not supply useful data that can be used for identification and reporting of intangible values. However, management representatives indicated that the usage of IT systems (4 and 1/2, 3, 4 and 2/3) is necessary f for identification and reporting of material values of the hospital. .

In most cases, managers of surveyed hospitals reported a positive effect on the level of information technology development on the growth of the hospital's intangible assets. In order to define connections more precisely a quantitative research model and a sufficiently large study sample are necessary. The results can be used in the constructs creation of a theoretical quantitative model and the selection of survey questions as measurement tools (with the appropriate degree of accuracy and reliability) of the relationships between these constructs.

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## **Summary, methodological limitations and further research opportunities**

In compliance with the opinion of managers of hospitals, depending on the level of information technology development (the technological context in surveyed hospitals), the growth of the meaning and participation of intangible values in the entire value of the healthcare unit have been observed. According to respondents the higher level of development of used information technologies the greater participation of intangible values in the entire value of healthcare unit. The value of healthcare unit is understood in this instance widely - not only as the financial value, but also as the value and advantages perceived by other inquiries of hospital (patients, social and political organizations, payer).

Every research methodology has some drawbacks such as measurement, generalization or deduction limitations. A significant problem of a case study method is the restriction related to the purpose of its use. It assumes that this method is oriented to the description and analysis of individual objects and phenomena connected with it. In the case of managerial science case study based research are often an initial step, a fundament for hypotheses testing using quantitative methods.

Basing on the presented results it can be argued that further studies on the information technology and health care entity intangible asset connection are justified and recommended.

The authors intend to conduct a research on a larger sample with the use of quantitative methods, which constitute a better methodological basis for drawing more general conclusions from the studied phenomena. In such a case a more precise definition and measurement is required. With the use of quantitative methods many statistical methods can be also applied. These methods impose a certain methodological discipline that additionally validates the research results.

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