

**An Evaluation of the Management of the Information
Systems (IS) and Technologies (IT) in Hospitals:
The Region of the Technical University of Košice,
Slovakia**

(Research report of the GESITI Project)



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**RELATÓRIO TÉCNICO DE PESQUISAS DO PROJETO GESITI
HOSPITALAR.
PROJETO GESITI/HOSPITALAR.**

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List of Symbols and Abbreviations

ASD	Association of Suppliers of Drugs and Medical Devices
AMD	(Advanced Micro Devices) Processor producer
B2A	Business – to – Administration
B2B	Business – to Business
B2C	Business – to – Consumer
BI	Business Intelligence
BPM	Business Process Management
C2B	Consumer – to – Business
C2C	Consumer – to – Consumer
CIS	Clinical Information System
CPR	Client's Patient Report
CRM	Customer Relation Management
CSF	Critical Success Factors
DHE	Distributed Healthcare Environment
DRG	Diagnosis Related Groups
DWH	Data Warehouse
EAD	Education at Distance
EAM	Enterprise Asset Management
EEG	Electroencephalogram
EKG	Electrocardiogram
EpSOS	Smart Open Services for European Patients
ERP	Enterprise Resource Planning
eSO1	National project – Electronic Services in a Health Care
EU	European Union
GDP	Gross Domestic Product

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GENAS	Association of Generic Producers
HCP	Health Consumer Powerhouse
HCSA	Health Care Surveillance Authority
HIC	health Insurance Company
HIS	Hospital Information System
HTA	Health Technology Assessment
IBM	(International Business Machines Corporation) American multinational technology and consulting corporation
ICT	Information and Communication Technologies
ISO	International Organization for Standardization
KNIS	Complex Hospital Information System
KPI	Key Performance Indicators
LAN	Local Area Network
LIS	Laboratory Information System
MIS	Medical Information System
NATO	North Atlantic Treaty Organization
NCHI	National Center for Health Information
NFC	Non-repayable Financial Contribution
NHP	National Health Portal
OECD	Organization for Economic Cooperation and Development
OLAP	Online Analytical Processing (a category of software tools that provides analysis of data stored in a database)
OPIS	Operation Program – Informatization of Society
PASC	Picture Archiving Communication System
PC	Personal Computer
PHA	Public Health Authority
R&D	Research and Development

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RAID	Redundant Array of Independent Disks
RIS	Radiology Information System
ROI	Return on Investment
RTG	Radioisotope Thermoelectric Generator
SAPS	Slovak Association of Pharmaceutical Societies
SAN	Storage Area Network
SIDC	State Institute for Drug Control
SK-MED	Slovak Association of Medical Device Suppliers
SO SR	Statistical Office of the Slovak Republic
SQL	Structured Query Language
SWOT	SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats)
USG	Ultrasonography
VPN	Virtual Private Network
WAP	Wireless Application Protocol
WHO	World Health Organization

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Introduction

Continuous increase in health care expenditures puts pressure on the new organizational structure of health care system, as well as on optimal use of technology and human resources. The main key to the functioning hospital organization is the promotion of its strategic plans, quality information processing and development of knowledge base. These objectives can be achieved by information system. Information system in hospitals is created by people who process medical data and create an information and knowledge base through available technological resources. The base is used for effective management of hospital processes, managerial decision-making and hospital management agenda.

Answer to principal question has to be defined: How to use ICT to achieve maximum output? Hospitals use various types of software applications at different management levels in order to perform different specific functions. Each hospital is unique; the differences result from the various ownership forms and different founders. Every hospital has particular hospital processes and is influenced by unique factors. At each level of management, different requirements connected to various applications are concentrated. Determining factor is their integration enabling interconnected management of hospital processes and administration of managerial information for managing the hospital as a complex. Hospital managers must decide what level of integration is the best one and how individual applications are to be implemented in order to support the mission of hospital information system. Hospitals can effectively fulfill their mission only if their managers dispose of relevant information for the decision-making.

The importance of this issue justifies the fact that currently the most discussed topic is the area of cost reduction in hospitals. Issues of hospital efficiency, costs of outpatient care, excessive costs of medicaments and medical material and low labor productivity have been becoming more and more important. An "ideal" hospital should be primarily focused on its patients, should have coordinated processes, operate in an environment with a minimum degree of risk, employ top specialists and focus on the

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quality in all activities. The path to achieve those objectives is an effective strategic management of hospitals, which is a base for all strategic decisions and a thorough knowledge of the internal and external environment of the organization. Through the instruments of strategy implementation, other managerial components supported by ICT (human resource management, marketing, financial management etc.) are put into practice. Continuous evaluation of achieving strategic objectives ensures properly set monitoring strategies with an effective feedback.

The above presented aspects are reflected in presented research report which is aimed at analysis of existing management information systems and information technology in hospitals in the region of Eastern Slovakia. Obtained data collected by the questionnaire and personal visits in designated hospitals provide insight into specific aspects of their activities. Comparison of data allows for finding interesting relations between various determinants and monitored values and as such for deepening of scientific knowledge that may contribute to further development of health care system. Primary objective of the research was to obtain information about the current state of information technology in the hospitals. **The initial impulse to carry out this so far unique project with a title "An Evaluation of the Management of the Information Systems (IS) and Technologies (IT) in Hospitals" (GESITI/Hospitals) came from the Center for Information Technology Renato Archer in Brazil. The Coordinator of the research was José Antonio Balloni (author of the questionnaire).**

Obtained results might turn interesting to the researchers dealing with these issues and to hospitals managers. Those could become more capable identify their weaknesses, to conduct subsequent benchmarking and formulate main issues and problems to be discussed. This process could subsequently allow revision of strategy and strategic objectives in order to increase the competitiveness of hospitals.

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1 Data and methodology

The following section presents data and methodology applied within the study.

Research activities were realized in between December 2011 - March 2012. Data were gathered through the personal interviews and structured interview conducted during personal visits in healthcare facilities. To process the acquired data, we used the apparatus of selected statistical methods stated in cross-sectional subchapter 1.1.

1.1 Data

We have applied the questionnaire in randomly selected 20 medical institutions – hospitals¹ of the above mentioned regions in a period of December 2011 – March 2012. Our sample represents approximately 50 % of all hospitals in the area (SO SR, 2009). 12 of them are situated in the Košice region while remaining eight are located in the Prešov region.

Among analyzed institutions 17 hospitals are general and three are specialized. Moreover, they vary in their ownership, legal form and size (Figure 1, 2, 4, 5).

The majority of analyzed hospitals are non-profit organizations, followed by the joint stock companies (See Figure 1). However, contributory organizations and private limited companies are also included in the sample.

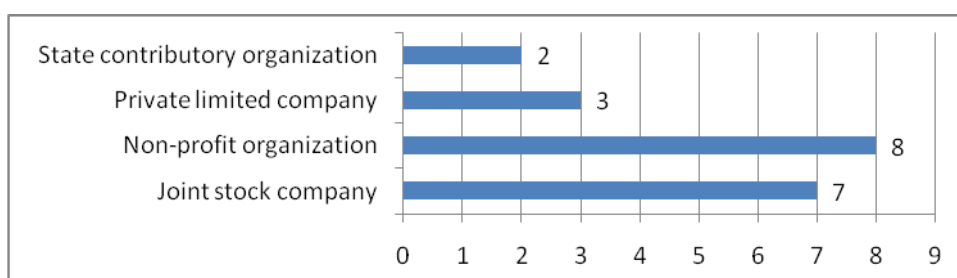


Figure 1 Analyzed medical institutions (hospitals) according to their legal form

¹ Hospitals are divided according to specialization on general and specialized hospitals. There are also included medical institutions, hospices, home care services, natural health spas, Spa sanatoria, biomedical research facilities.

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Regarding the ownership issue (See Figure 2), none of the hospital types dominates. The number of private hospitals in the sample exceeds the amount of public hospitals only by two. Furthermore, two university hospitals complete the sample.

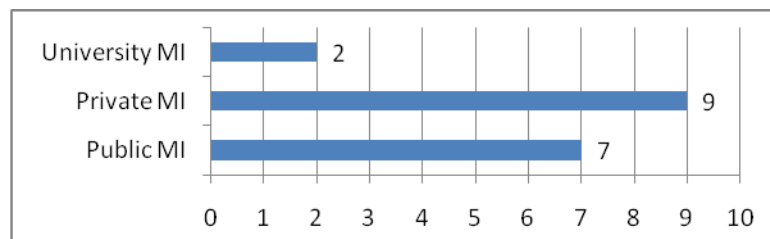


Figure 2 Analyzed medical institutions (hospitals) according to their ownership

Moreover, with respect to the geographical division of the health care provision (See Figure 3), a majority of analyzed hospitals operates in their regions, while four of them also focus on the city of their location to a certain extent. Six hospitals provide their services in the whole Slovak Republic, two of which are exclusively specialized to the whole country and another one to the extent of 80 %. Only three hospitals also operate in foreign countries. However, the number of foreign patients is relatively low ($< 2\%$).

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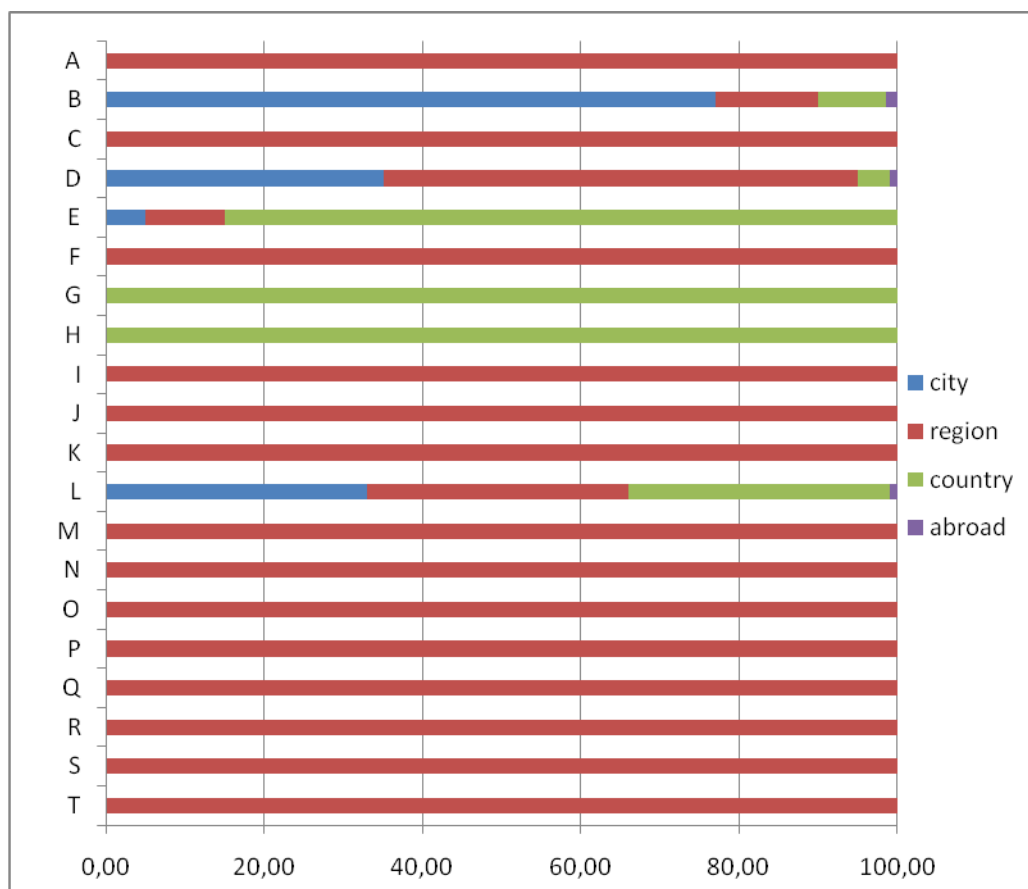


Figure 3 Provision of a health care with respect to geographical units

Concerning the number of beds (See Figure 4), it has been submitted to a bed reduction plan of the Ministry of Health of Slovakia in 2002. Since its adoption, the amount of all three types of beds in hospitals (acute, psychiatric, and long-term) has decreased. (Szalay et al., 2011)

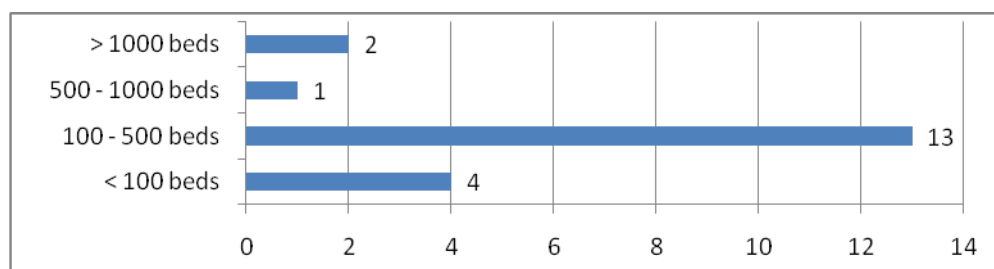


Figure 4 Analyzed medical institutions (hospitals) according to the number of beds

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Considering the number of employees (See Figure 5), the hospitals involved in the sample vary. Nine of them employ from 100 to 500 employees, eight of them from 500 to 1000 employees and extreme cases of less than 100 employees and more than 1000 employees are represented by one and two hospitals, respectively. Moreover, all hospitals have specified their number of physicians as more than 11 except for 2 smaller hospitals (according to total numbers of employees) with 4-6 physicians.

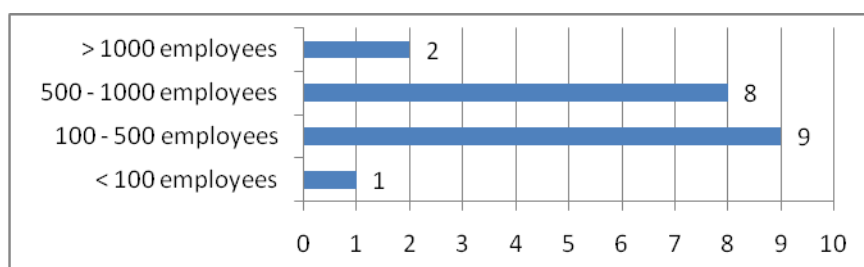


Figure 5 Analyzed medical institutions (hospitals) according to the number of employees

1.2 Methodology

In order to obtain data we have applied a **Prospective Questionnaire (PQ)**, (BALLONI, 2011). The PQ is copyrighted of the Center for Information Technology Renato Archer (CTI), located at Campinas/SP/Br, a unit of the Ministry of Science, Technology and Innovation (MCTI) and, a Cooperation Agreement has been signed between Faculty of Economics, Technical University of Košice, Slovakia and CTI.

The research project “Management of System and Information Technology in Hospitals” (GESITI/Hospitals) has the purpose of mapping out the management of Information Systems (IS) and Information Technology (IT) in hospitals, in order to identify their needs and demands, prospecting for unfolding, perform publication and, mainly, generate a Integrated Research Report (IRR) for free access, and should be used as decision making support by public and/or private managers (Balloni, 2011). It is focused on the use of information technologies in hospitals. More than 200 open and closed questions are divided into several strategic areas: Human resources, Strategic

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management, Research and Development and Technological innovation, Competitiveness of Hospitals and their cooperation for a strategic advantage, Information technology availability, E-Business, Telemedicine, Approach to clients, Quick prototyping of health and Waste management in a health-care.

Finally, This “PQ”, original and innovative, has been in creation since 2004 by the GESITI Project and, it is not known, up to this date, the existence of a similar PQ which had had the focus or object proposed: the exploration of the management of IS and IT in hospitals and the look for unfolding. The methodology we have used is fully described in reference (BALLONI, 2011).

As the questionnaire was originally developed in Portuguese, translation to Slovak language with subsequent testing of its validity and reliability was necessary. This task was performed in cooperation with professional translating agency and designated professionals from IT (information technologies) and medical practice.

Besides descriptive statistics and graphics we have used several statistical methods for data analysis.

In order to compare particularities of various types of hospitals according to their legal form, we have applied **Analysis of Variance** (ANOVA). The purpose of ANOVA (Penny and Henson, 2006) is to test significant difference between means of several samples. The tested hypothesis has the following form:

$$H_0: \mu_1 = \mu_2 = \dots = \mu_r$$

$$H_1: \exists i, j, \mu_i \neq \mu_j, i, j = 1, 2, \dots, r$$

where μ_i is mean of group (sample) i and r is total number of groups.

The essence of ANOVA is partitioning of total sum of deviation squares (SS) into two components – sum of squares of errors (SSE) and sum of squares of treatments (SST), what can be expressed as follows:

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$$SS = SSE + SST = \sum_{i=1}^r \sum_{j=1}^{n_i} \left(x_{ij} - \bar{x} \right)^2 = \sum_{i=1}^r \sum_{j=1}^{n_i} \left(x_{ij} - \bar{x}_i \right)^2 + \sum_{i=1}^r n_i \left(\bar{x}_i - \bar{x} \right)^2, \quad (1)$$

where SSE expresses the variability within groups and SST the variability between groups, i stands for a group, j for an observation within a group and n for the number of observations within each group, \bar{x}_i is the mean of the group i and \bar{x} is total mean. The decision is made upon the F-statistics calculated by:

$$F_{n-r, r-1} = \frac{MSE}{MST}, \quad (2)$$

where MSE represents Mean Square Error and MST Mean Square Treatment. They can be computed by equations:

$$MSE = \frac{SSE}{n-r}, MST = \frac{SST}{r-1}. \quad (3)$$

The post-ANOVA analysis has been realized by the **Bonferroni Test** (Tkáč, 2001). It is based on the following assumptions:

- Sample means \bar{X}_i are unbiased estimators of the population means μ_i ,
- MSE is unbiased estimator of the variance of the population σ^2 .

For the null hypothesis (samples equality), following formula is used:

$$\left| \bar{x}_i - \bar{x}_{i'} \right| > t_{1-\varepsilon, n-r} \sqrt{MSE \left(\frac{1}{n_i} + \frac{1}{n_{i'}} \right)}. \quad (4)$$

$\varepsilon = \alpha / (r(r-1)/2)$ and $t_{1-\varepsilon, n-r}$ is a quantile of the t -distribution for $n-r$ degrees of freedom.

To analyze qualitative variables, contingency tables were used and **Fisher exact test** (suitable for small samples) and **Pearson contingency coefficient** were applied.

The Fisher exact test (Fisher, 1922) tests the validity of the null hypothesis which says the treatments do not affect outcomes. The calculation of the p-value in case of two variables X, Y is based on the conditional possibility given by the equation:

$$P = \frac{(R_1! R_2! \dots R_m!)(C_1! C_2! \dots C_m!)}{N! \prod_{i,j} a_{ij}!} . \quad (5)$$

R_i and C_j represent row sums and column sums, respectively, in a matrix $m \times n$, in which the entries a_{ij} stand for the observations while $x=j$ and $y=i$. The total sum N can be calculated as follows:

$$N = \sum_i R_i = \sum_j C_j . \quad (6)$$

The Pearson contingency coefficient measures strength of dependence of two variables and is calculated by the following equation: (Tkáč, 2001)

$$C_p = \sqrt{\frac{G}{G + n}} . \quad (7)$$

Its values are from the interval $\langle 0,1 \rangle$. n stands for the total sample size and G is a χ -square statistics given by the equation:

$$G = \sum_{i=1}^r \sum_{j=1}^s \frac{(n_{ij} - \psi_{ij})^2}{\psi_{ij}} . \quad (8)$$

The equation is based on comparison of associated frequencies n_{ij} and hypohetic associated frequencies ψ_{ij} . r is the number of rows and s number of columns in the contingency table. G gains the values from the interval $\langle 0, n.h \rangle$ where h is smaller number from $r-1$ and $s-1$.

If $C_p > 0.3$, the variables are medium dependant. In case of $C_p > 0.6$, the strength of dependence is high.

2 Results

This chapter contains evaluation of collected data applying the methodology presented in Chapter 1. The subsections copy the structure of the questionnaire.

2.1 Human resources

In the field of human resources, several aspects were investigated through the questionnaire. Firstly, we were interested in level of education of the employees. Secondly, we asked about training and educational courses provided by the hospital. Thirdly, we intended to know if there are some other possibilities to increase the qualification of employees. And finally, it was considered important to find out if employees' performance is evaluated.

Considering the educational level of hospitals' employees, the majority of them (more than 50% of total number of employees on average) completed secondary education. Employees with tertiary education, among whom the physicians dominate, also cover a significant percentage of all employees. However, there are big differences between hospitals according to their size. (See Table 1):

Table 1 Descriptive statistics of number of employees with respect to their education

	Mean	Standard deviation	Minimum	Maximum
Number of employees	667	829.77	23	3677
Primary education	44	48.42	0	179
Secondary education	387	460.80	10	1963
Tertiary education	244	348.65	8	1535

60 % of hospitals provide qualification courses to their employees (See Table 2). There is no significant difference between hospitals of different legal form. However, the relationship between the ownership of hospitals and the provision of qualification

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courses can be considered medium-strong (according to the contingency coefficient). Both university hospitals provided qualification courses, while other types of hospitals (medical institutions) were equally divided into both possibilities.

Moreover, 60 % of hospitals also had a formal educational and training plan. Out of these 12 hospitals, 45 % have provided professional trainings for their medical personnel and 25 % training for management during the past two years. Moreover, 35 % of hospitals had focused on improving PC knowledge and 20 % of hospitals had offered courses on communication abilities, foreign languages or team work. 30 % of hospitals use internal educational modules with external inspectors and 40 % of them use courses provided on the market (two of them use the EAD method – Education at Distance). 20 % of questioned hospitals did not provide any of the educational opportunities.

Table 2 Qualification courses provided in a hospital

		Yes	No	Total
Legal form	Joint stock	5	2	7
	Non-profit	4	4	8
	Private limited	2	1	3
	Contributory	1	1	2
	Contingency coefficient = 0.2023			
Owner-ship	Private	6	3	9
	Public	4	5	9
	University	2	0	2
	Contingency coefficient = 0.3278			

Regarding the other forms of improving qualifications (See Figure 6), the Internet is accessible in each of the hospitals (in 80 % of them the availability is not limited). The hospitals also support interest in the newest trends and information investing in specialized publications and subscribing to the specialized journals, as well as a master study or post gradual courses of their employees. Furthermore, they also participate in both national and international professional events (at least 65 % hospitals for each of the mentioned cases).

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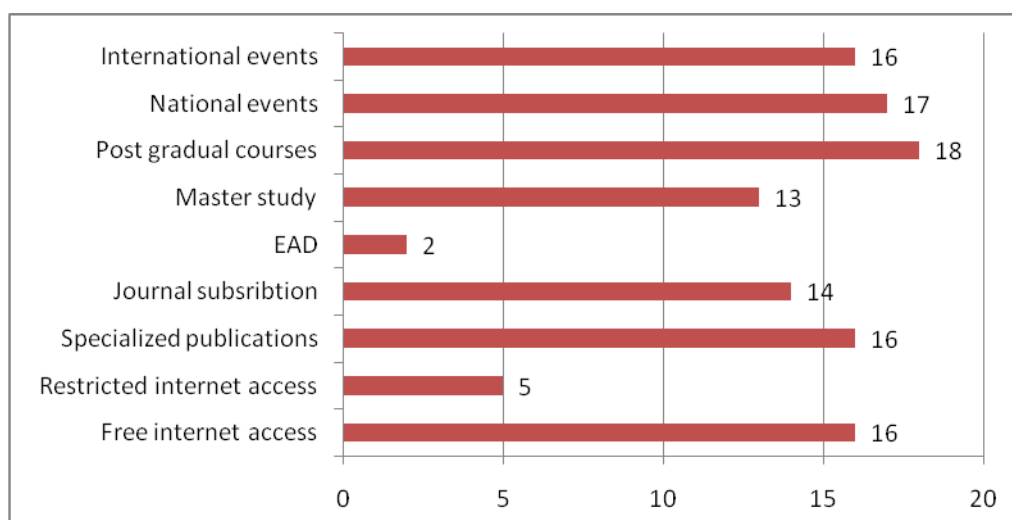


Figure 6 Additional forms of employees' qualification improvement

Considering the position of employees involved in further trainings, the emphasis is on the executors of main processes. These have participated in educational courses of any form during the past two years in 85 % of analyzed hospitals. Other groups of employees (managers, supervisors and administration staff) have taken part on the qualification improvement during the past two years only in 55 % and less hospitals. (See Table 3)

Table 3 Number of trained employees in the past two years

	None	> 20%	> 50%
Top management	10	1	9
Control processes	10	1	9
Supervision	15	1	4
Administration	9	3	8
Main processes	3	13	4

The feedback in a form of evaluating employees' performance is provided in 95 % of analyzed hospitals, although only in 25 % of them on a regular basis.

2.2 Strategic management of a medical institution

Slovak medical institutions are forced to operate in still more and more demanding environment. Patients' requirements are increasing; a competition in a health-care sector is becoming more intensive and fast development of the medical sciences is pressing on the prompt implementation of new knowledge into practice. As a consequence, management of each medical institution requires a strategy. Among 20 analyzed hospitals, 95 % institutions dispose with a strategic plan.

The strategic plan is essential for a successful existence of an institution as it involves its vision, strategic goals and strategic operations. The vision forms a picture of a medical institution in the future. Strategic goals represent state of certain variables which the organization intends to achieve. Strategic operations are activities leading to the strategic goals and common vision. A medical institution without a qualified formulated strategy cannot succeed and cannot develop in a present the current highly competitive environment.

Several mutually compatible variants of a strategy should be prepared. Their compatibility enables continuous change of one strategy to another one without problems. Such flexible strategies provide fast, effective and efficient reactions of an organization to changes of strategy determinants. The flexibility can be achieved by:

- Accelerating of a decision-making process and of an information transfer,
- Shortening the time of strategic operations,
- High qualification and creativity of employees,
- Motivation to create difficult strategies and to execute them,
- Sufficient source concentration,
- Responsible management organization and style supporting realization of changes.

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Following table declares who is in charge of strategic planning in analyzed hospitals (See Table 4).

Table 4 Who knows a strategic plan?

Strategic plan is known to:	Number of hospitals
Director	11
Management	19
Operational level	2

It is obvious, that the strategic plan is mostly known among the top and middle managers. The most probable explanation is the complexity of the issue caused by the following reasons: (Souček and Burian, 2006)

1. Disharmony between the level of medical science and available resources,
2. Significant difficulty of medical acts' standardization,
3. Unwillingness of many physicians to deal with the economic, financial and managerial issues,
4. Emphasis on the economical principles – the goal is not to minimize costs, but to use available sources to provide optimal care to as many patients as possible,
5. Large influence of patients' lobby,
6. Significant influence of central institutions (limited competences of the hospitals management within a process of decision-making),
7. Issues concerning financing health insurance operations,
8. Very low ability of demand prediction,
9. Instability of hospital efficiency indicators serving as hospital performance measures.

Medical institutions are not isolated organizations submitted to different regimes from those of other companies. They form an integral part of society for which they provide health care services. The health care services are highly appreciated in a society and they have a specific human character. However, they remain subject to strict economic rules. Therefore, the efficient managerial tools of non-medical institutions

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which are in accordance with an essence of medical activities are necessary to be applied. A high quality strategic management process enables to realize a high quality benchmarking – to compare own results with those in more developed countries. The analyzed hospitals reevaluate their strategic plan from one to eight times in two years, which is connected to the fact that both executive management and process owners participate in strategic planning (It is not exclusively a task of the executive management). (See Figure 7 and Table 5)

Table 5 Participation in strategic planning

...participation on strategic planning...	Number of hospitals
Only executive management	5
All	4
Executive management and process owners	12
Planning group	1

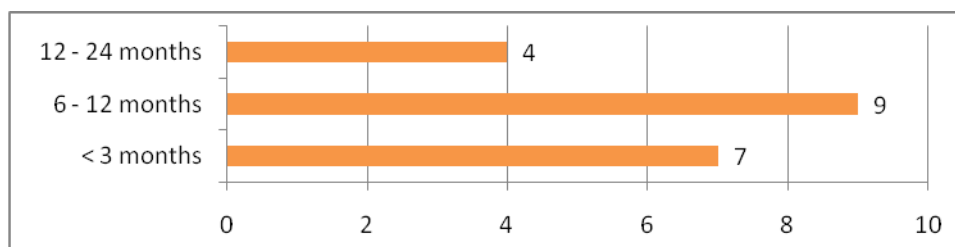


Figure 7 Frequency of reevaluation of the strategic plan

Closer look at the reevaluation of the strategic plan with respect to the type of analyzed hospitals has brought following results: (Table 6)

Table 6 Reevaluation of strategic plan in hospitals according their legal form and ownership

		<3 months	3 – 6 months	6 – 12 months	12 – 24 months	> 24 months	Total
Legal	Joint stock	2	0	3	2	0	7

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form	Non-profit	4	0	3	1	0	8
	Private limited	1	0	1	1	0	3
	Contributory	0	0	2	0	0	2
	Contingency coefficient = 0.4078						
Owner -ship	Private	4	0	3	2	0	9
	Public	3	0	4	2	0	9
	University	0	0	2	0	0	2
	Contingency coefficient = 0.3872						

According to the contingency coefficients, there is medium-strong relationship between the frequency of strategy plan reevaluation and both legal form and ownership of analyzed hospitals. Contributory and university hospitals reevaluate the plan every 6-12 months, while other types of hospitals are rather equally divided between “less than three months” up to 24 months.

Executive management should be a creator of basic ideas which are essential for the strategy. Each strategy is based on many hypotheses and includes some elements of uncertainty. It influences a variability of solutions within a strategic management. Medical institutions must be prepared to handle the whole variety of the most probable situations.

An important element of a process of strategy creation is the client. The theory also meets practice here, for 75 % hospitals the client is very important (See Table 7).

Table 7 Important elements of a strategy creation

		Number of hospitals
Level of client importance within a process of strategy creation	Low	2
	Middle	3
	High	15
Level of resources importance within a process of strategy creation	Low	0
	Middle	3
	High	17

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The reason for such self-evaluation is probably lower limitations by material, personnel, capacity, financial and other resources within the process of strategy creation than within a tactical or operational management.

Furthermore, we have analyzed the elements creating a basis for a strategy. Within this issue, three lines can be distinguished: (See Figure 8)

- Importance of a mission within a strategy creation,
- Importance of clients' satisfaction assessment,
 - Satisfaction as a main attribute of a process of a strategy creation,
 - Satisfaction as a decisive indicator in a process of creation of competitive prices,
 - Satisfaction as an indicator of performance measurement and management of a hospitals,
 - Satisfaction as a determinant of current and potential development.
- Importance of strategic analysis methods (SWOT analysis, scenario analysis, benchmarking).

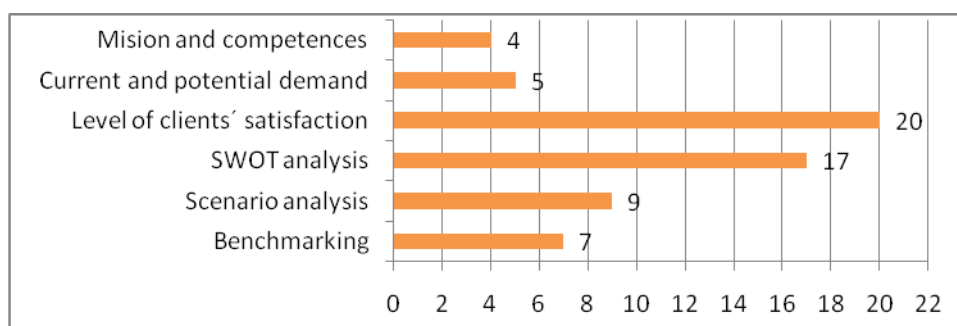


Figure 8 Elements, based on which a strategy is created

Mission

At present, the most discussed topic is a cost minimizing issue. The topics of hospital's performance, costs of outpatient care, redundant costs of medicaments and special medical material, low productivity of both medical and non-medical workers

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etc. have gained in importance. An ideal hospital must be patient-oriented, must work in an environment with minimal risks, must employ high quality workers, must focus on a quality and its processes must be coordinated. A way to achieve the mentioned aims is an efficient strategy management as an essence of all strategic decisions, thorough knowledge of its internal and external environment. Through strategy implementation tools, other management elements (human resource management, marketing, financial management etc.) are implemented into practice.

A mission of an organization represents a brief motto declaring a message to its customers and employees in order to maintain existing clients and gain potential ones. According to the research results, only 20% of analyzed hospitals believe that a mission is a basic element for a strategy. This observation can be interpreted as negative, as mission is defined by long-term validity and should be declared on all appropriate occasions, and should present characteristics firmly connected to a name of hospitals evoking a positive image. We suppose the analyzed hospitals put greater emphasis on their vision in reality as they declare it on their websites. A vision briefly expresses what kind of institution certain subject will be in a certain strategy period or what kind of institution it intends to become. The analyzed hospitals mostly present their activities (products, clients, regions etc.), declare their position, the position they plan to take and present some of their specific strengths in their vision.

An important part of a vision is a decision about the profit, revenues or a margin (contributory profit). The profit is not an essential goal of medical institutions. Although it is important to achieve an adequate profit in private hospitals, the main goal of non-profit organizations is a provision of optimal health care to their patients. A creation of a profit is influenced by various directives and ethical norms resulting from specific objectives of a health care sector. Revenues are not the most significant element of the goal; however, they are a sign of strength of hospitals. The higher the revenues, the more dominant position the hospital has and the more it can influence the whole sector. In private hospitals revenue growth is accompanied by a corresponding profit or margin growth. The margin is calculated as a difference between the price and variable costs. It includes profit and a contribution to finance fixed costs. No contributory profit creation

would have a negative impact on financial situation of an organization (Souček and Burian, 2006). The margin is deducted from the final price and the rest may be used for development of the hospital. It is a certain sum that may not be exceeded and thus evokes a pressure to minimize costs. A problematic aspect is finding prices of competitors, as they are often modified and do not reflect real prices. In addition to official prices various discounts or services can be offered. Many of our hospitals do not have an image to be able to compete with foreign companies which they must consider within a strategy creation. Prices should be mainly interesting for customers.

Strategic analysis methods

85 % of analyzed hospitals use a SWOT analysis as a basic method of strategic analysis; 45 % implement a scenario analysis and approximately 30 % use benchmarking.

Strategies based on a SWOT analysis are specific for each hospital. It is a simple tool providing review of the strategic situation in a hospital identifying its strengths, weaknesses, opportunities and threats. In a process of the SWOT creation, an analyst answers several questions: (Slávik, 2005)

- Does the hospital dispose of strengths which can become a basis for a strategy?
- Which weaknesses are significant enough to weaken the hospital and disable to follow a strategy?
- Which strategies do abilities and resources to achieve a real success exist for?
- What threats should hospital to be worried about? What strategic measures have to be implemented for efficient defense?
- What can hospital do to transform weaknesses into strengths and threats into opportunities?

The output of the SWOT analysis is a synthesis of results of external and internal environment of the hospital. The final strategy is a combination of its external threats and opportunities and internal strengths and weaknesses.

The scenario analysis is based on a premise of uncertainty and unpredictability of a future. Hence, a “right future” does not exist. The scenario method can have one of the following forms:

- Trends and impacts analysis – it deals with trends and their impacts on the market or on a population in a certain period of time. Its aim is to find unexpected situations with influence on trends.
- Interactive impacts analysis – this technology is used to analyze complex systems. It focuses on mutual influence of internal and external factors of a hospital to achieve synergic effect. This system may be successful if management of hospital is able to identify a main factor determining current state of hospitals.
- Decision scenario (Pierre Wack Intuitive Logics) – its essence is to find ways to change the way of thinking to predict the future and prepare for it. The goal is to create a coherent system of information about the future which can be used for tests of success of plans and projects over the time. (Mallya, 2007)

2.3 Research and development

Promotion of information processes and services in a hospitals

If we look at the responses about respondents' evaluation of research and development, the research and development activities have mostly been identified as "occasional" in 90 % with respect to the frequency. Moreover, importance of the executed R&D activities in the past two years has been reported as medium large by 65 % of hospitals, while gaining expert knowledge in the same period was very important for 45 % of hospitals and medium important for 40 % hospitals. Table 8 indicates predominance of occasional R&D activities of hospitals. Relationship between various kinds of R&D activities and the type of analyzed hospitals are medium-strong. Among the hospitals of various legal forms, every subject carried out the above mentioned activities occasionally, except for non-profit organizations. Considering the ownership of hospitals, both university hospitals execute the R&D activities

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occasionally, while only one of both private and public hospitals does not carry them out or does continuously, respectively.

Table 8 R&D activities conducted in a period of 2010-2012

		Does not conduct	Continues	Occasionally	Total
Legal form	Joint stock	0	0	7	7
	Non-profit	1	1	6	8
	Private limited	0	0	3	3
	Contributory	0	0	2	2
	Contingency coefficient = 0.3780				
Owner-ship	Private	1	0	8	9
	Public	0	1	8	9
	University	0	0	2	2
	Contingency coefficient = 0.3315				

In terms of obtaining additional external expert knowledge it is necessary to mention information systems focused on process management, quality and cost reduction. In general, in the Slovak hospitals top management information system (MIS) using the application software QPR is applied. It is implemented in thousands of organizations worldwide. In Slovakia, the MIS is implemented in more than 50 healthcare facilities, and in more than 10 companies operating in the medical field. The solution combines the Balanced Scorecard method to support strategic management, Activity Based Costing for cost analyses, OLAP analyses and Business Process Management (BPM) to support process management and to support the implementation of the quality system ISO 9001:2008). The MIS is recommended both because of its high flexibility consisting in a possibility of covering all areas of management and creating an integrated, compact system for management, and because of a broad variety of activities - from planning, through analyses to reporting. Selected indicators can thus be analyzed in details up to their individual attributes affecting their values. It leads to different flexible views and enables to predict their development. This would remove

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the serious deficiency in a sphere of data analysis, processing and their subsequent connection with improvement processes. Basic selected characteristics of the MIS are:

- Internet portal is an essential interface for the organization's employees, a contribution of which is mainly in access to structured data, in a mutual communication between the workers and in possibilities of data editing.
- Implemented system of automated notifications may be flexibly adjusted by each user according to his individual requirements.
- All reports are incorporated by an intranet portal of transparent managerial dashboard, which is beneficial for the individualization of the needs of individual users.
- Changes of the system are realized through the analytical (development) interface.

They have reported that innovation technologies had improved productivity in 70 %, quality in 90 % and image in 65 % and helped to minimize costs in 25 % of hospitals.

Hence, in order to be competitive in a current environment, it is also necessary to follow new technological trends. Managers of analyzed hospitals share the same opinion. They are aware of the fact that intensive use of the information technologies increase added value of the hospitals' services and their output and contribute to their competitiveness. Moreover, 75 % of analyzed hospitals monitor the current state of new technologies, strategies of competitors and customers interests. (See Table 9)

Table 9 Does a hospital use mechanisms to monitor external elements?

		Yes	No	Don't know	Total
Legal form	Joint stock	6	0	1	7
	Non-profit	6	1	1	8
	Private limited	1	1	1	3
	Contributory	2	0	0	2
Contingency coefficient = 0.4309					

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Owner -ship	Private	6	1	2	9
	Public	7	1	1	9
	University	2	0	0	2
Contingency coefficient = 0.2365					

Contingency coefficient informs us about medium-strong dependence between external elements monitoring and a legal form of a hospital. 100 % of analyzed state contributory organizations and majority of joint stock companies and non-profit organizations conduct the monitoring. Considering private limited companies, respondents are divided equally within all possibilities.

The monitoring is mostly executed through IT personnel, meetings with sector representatives and participation in congresses. (See Figure 9)

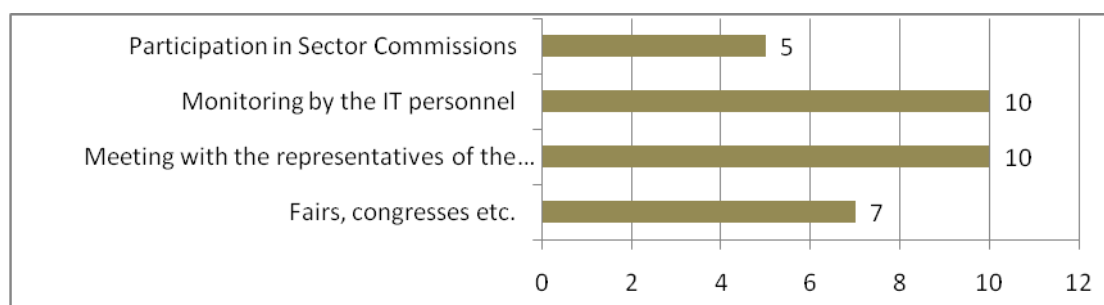


Figure 9 Mechanisms for the monitoring of external elements

Looking closer at the IT monitoring, it is applied in order to analyze activities of competitors, technologies and clients' satisfaction. (See Figure 10)

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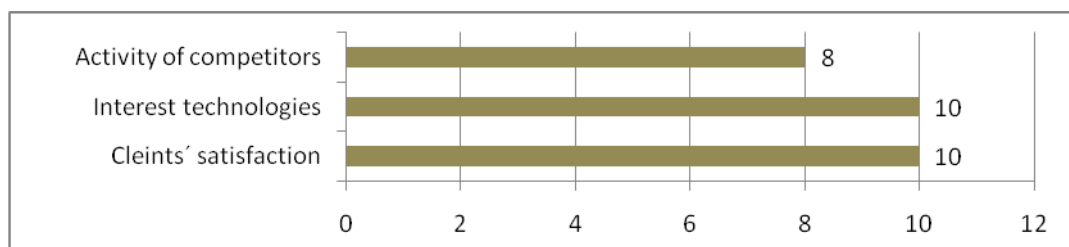


Figure 10 Elements monitored by IT

As far as hospital's readiness for technological innovation is concerned, hospitals declare lack of resources – financial and personnel to a lower extent. (See Figure 11)



Figure 11 Barriers of technological innovations

Implementation of any technology (a new IT solution, modernization or reconstruction) requires an intervention into organizational units and increase in knowledge of personnel what is financially demanding. Moreover, additional costs are connected with a need of continuous calibration and maintenance of new systems.

A more detailed analysis of factors threatening innovation activities of hospitals is depicted in Figure 12.

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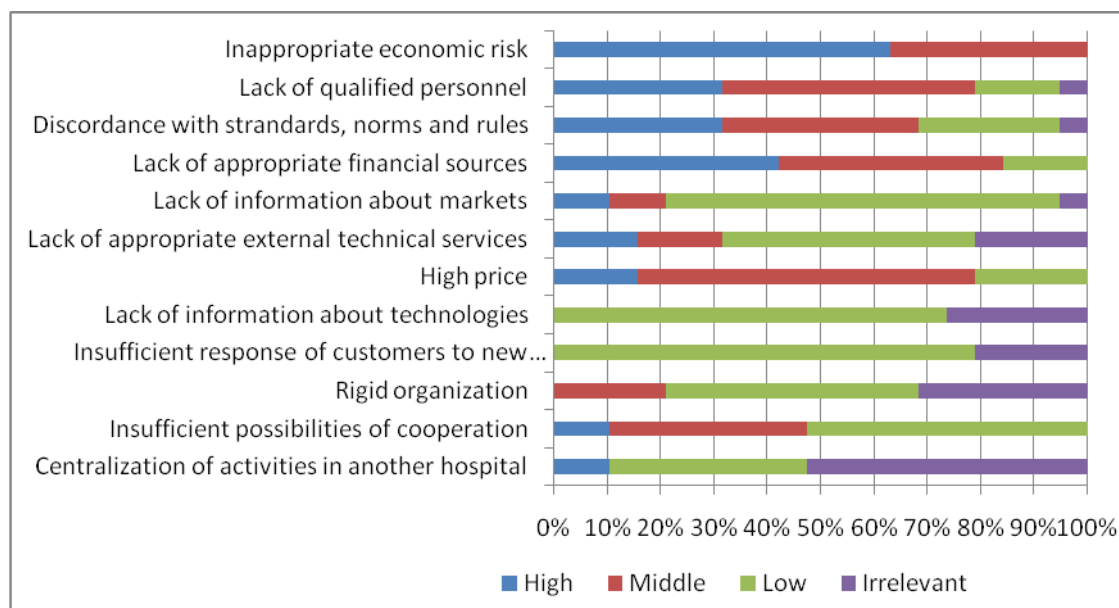


Figure 12 Factors threatening innovation activities

As the most threatening factors with respect to the technological innovations, an inappropriate economic risk (more than 60 % of hospitals) and lack of financial sources (more than 40 %) were considered (factors of high importance, blue color). Both factors are connected with a current economic crisis influencing development and utilization of the ICT in organizations.

Other important threats of innovation activities according to respondents are insufficient qualification of employees and discordance with standards and rules. Hence, a categorization of expectations of ICT innovations recipients is necessary. Lack of qualification may lead to a wrong choice of hospital when an ICT solution does not correspond to a vision and conditions of the hospital.

2.3.1 Technological innovation investments

Within the questionnaire, focus was put on the investments of hospitals into the sphere of ICT during the past three years as well as in the future. First of all, each of analyzed hospitals had included the intention to invest in innovation technologies into their strategic and business plan.

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Within the past three years, only one hospital has invested more than 4 % of revenues, 35 % of hospitals invested between 3-4 % of revenues and one hospital invested between 2-3 % and 1-2 %, and the rest of hospitals invested less than 1 %. Significant association was found by Fisher exact test ($p=0.011$) among aggregated relative volumes (up to 3 % and more than 3 %) of innovation investments and hospital legal forms (See Table 10). Cause of significance is in difference between shares of non-profit and private limited companies legal forms.

Table 10 Legal form and technological investments in % of revenues

	Joint stock company	Non-profit organization	State contributory organization	Private limited company	Total
Up to 3%	2	7	2	0	11
> 3 %	4	1	0	3	8
Total	6	8	2	3	19

No significant association ($p=0.633$) was found among relative volumes of innovation investments and hospital location regions (Košice region and Prešov region (See Table 11)

Table 11 Location and technological investments in % of revenues

	KE region	PO region	Total
Up to 3%	6	5	11
> 3 %	6	2	8
Total	12	7	19

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Considering plans for upcoming year, despite the high (eight hospitals) or at least middle (10 hospitals) importance of technological innovation in hospitals, intention is to invest unchanged sums relatively to revenues in majority of hospitals (See Figure 13). 20 % of subjects want to invest less (by 1-3 %), one hospital considers sharp increase in technological investments (from less than 1 % to more than 4 % of revenues).

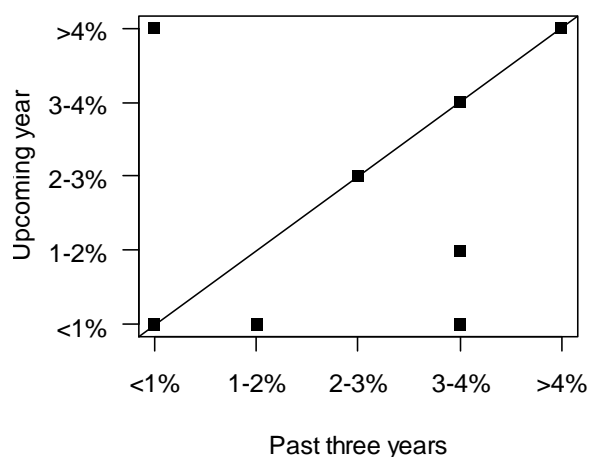


Figure 13 Technological investments in the past three years vs. plans for upcoming year

In general, the aims of hospitals investing in the technological innovations are depicted in the Figure 14.

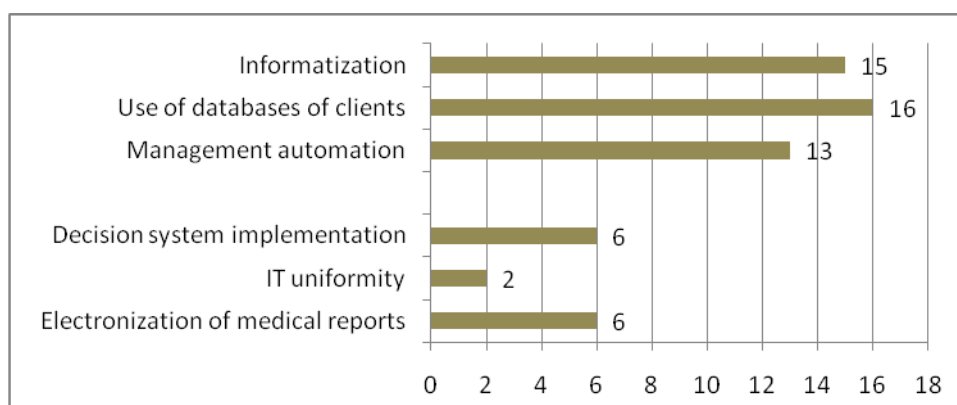


Figure 14 Priorities of hospitals with respect to technological innovations

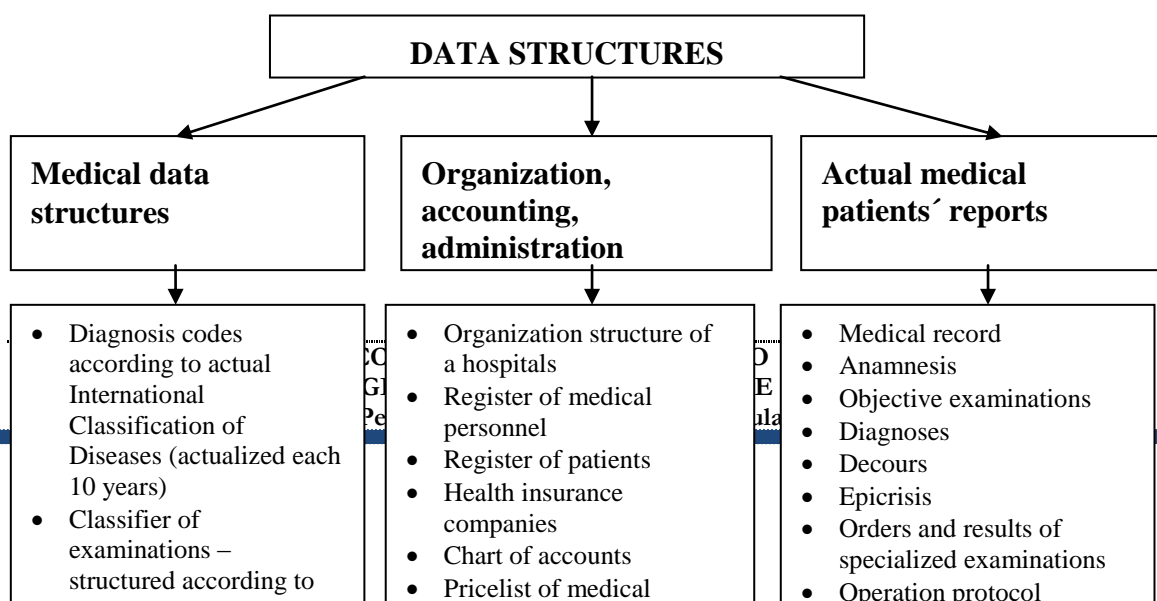
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Priorities of hospitals in the sphere of technological innovations are directed mainly towards clients' databases utilization, informatization and management automation. The reason is the fact that basic requirement for a hospital information system is to provide possibly the quickest and the most complex information within all clinical, managerial and administrative activities at each level. The hospital information system must copy functions of hospital, information flows and their links to external environment. Hence, the aim of hospital is to dispose of a managerial system which is able to improve processes, increase their reliability and optimize the ratio of revenues and costs. Users' requirements on database systems are still more and more complex. Database models and types depend on associated application, data volume and structure. Figure 15 presents the most often used data structures and program modules in hospitals.



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Figure 15 Data structures

Source: HIS (2012)

Considering particular investment objects, large investment in technological innovation is planned mainly in the sphere of ERP systems (65 %), administration

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(60 %), data storage systems (50 %) and telemedicine (40 %). (See Figure 16) Hospitals intend to automate management (65 %), improve used databases (80 %) and information base (75 %).

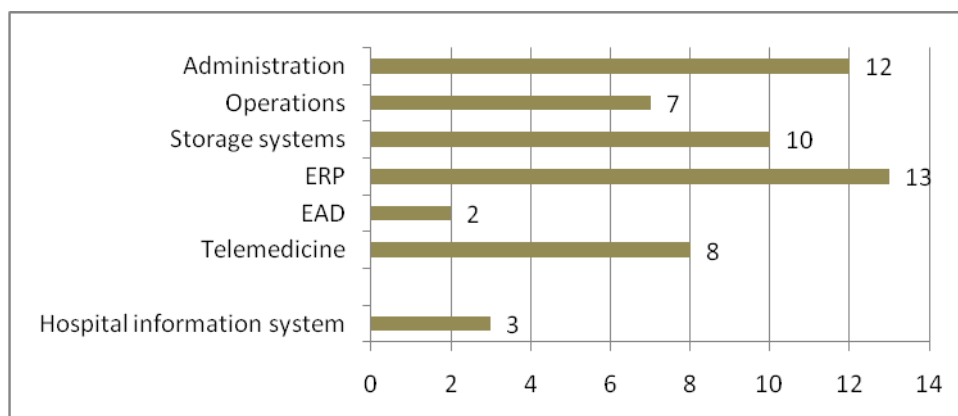


Figure 16 Investment in technological innovations

The above mentioned aspects are closely connected to the endeavor of each hospital to be flexible with respect to a rapid development of ICT. Analyzed hospitals focused mainly on two categories of technological innovations - economic and managerial processes (administration) and medical information systems.

Economic and managerial processes are linked to the medical institutions financing, to exercising the legislative (norms and regulations) about health care provision, to asset management, accounting, taxes, labor costs, social security, health insurance companies, public administration etc. Hence, information flows in hospitals' systems must enable efficient and safe support of activities of physicians and nurses within processes of both inpatient and outpatient diagnostic and treatment process, in emergency and acute care, in processes of organizational unit management etc. They must respond to all relevant information on patients' health status and conducted medical interventions following the regulations about medical reporting (including biosignals – EKG, EEG and visual information – RTG, USG).

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ICT trends also lead to expansion of telemedicine, which 40 % of analyzed hospitals intent to use (currently only one hospital has been applying telemedicine).

Considering the suppliers of technological innovations, a significant majority of analyzed hospitals have used small and middle-sized domestic companies (See Figure 17).

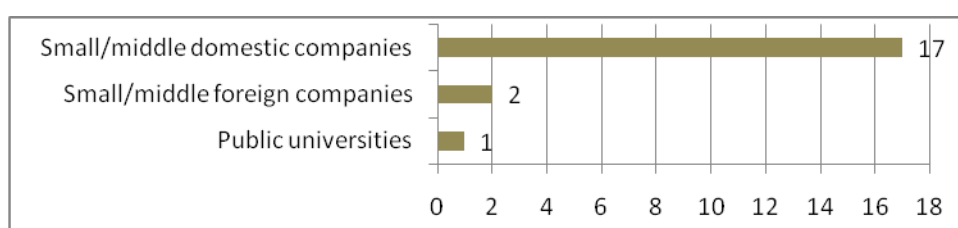


Figure 17 Suppliers of hospitals

A part of questionnaire was also focused on quality standards of hospitals. International norm EN ISO 9001 refers to a quality management and is applicable for any organization in sphere of production and services, including hospitals.

85 % of analyzed hospitals use quality management system. Those without the system are smaller hospitals from small towns. Legal form or ownership does not appear to play a role (See Table 12).

Table 12 Quality systems in hospitals

		Yes	No	Total
Legal form	Joint stock	5	2	7
	Non-profit	7	1	8
	Private limited	3	0	3
	Contributory	2	0	2
	Contingency coefficient = 0.2969			
Owner -ship	Private	8	1	9
	Public	7	2	9

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	University	2	0	2
Contingency coefficient = 0.1994				

Certification is not a requirement of the ISO 9001. Nevertheless, many hospitals in the Slovak Republic have certified their quality management system by an independent certification authority as the certificate evokes certain prestige. Among the analyzed hospitals 60 % are certified (Table 13).

Table 13 Certification of hospitals

		Yes	No	Total
Legal form	Joint stock	5	2	7
	Non-profit	7	1	8
	Private limited	1	2	3
	Contributory	1	1	2
	Contingency coefficient = 0.3847			
Owner-ship	Private	6	3	9
	Public	6	3	9
	University	2	0	2
	Contingency coefficient = 0.2132			

According to the contingency coefficient, there is a dependence of a medium strength between the legal form and certification. Majority of joint stock companies and non-profit organizations are certificated hospitals. In case of private limited companies and state contributory organizations the results are not so clear.

Moreover, analysis also focuses on the financing possibilities of hospitals. 35 % of 20 analyzed hospitals dispose of additional information bearing in mind structural funds or a possibility of leasing. 20 % of them have already tried to use those tools mainly to improve the information system.

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2.3.2 Cooperation for innovation

An important part of the questionnaire has been devoted to a cooperation of hospitals with other hospitals or other public or private institutions. Such cooperation may bring certain advantages to all involved counterparties.

45 % of analyzed hospitals have cooperated with some other organization on development of technological innovations in the past three years and 20 % of non-cooperating ones would be interested in it.

The following table (Table 14) presents cooperating partner of analyzed hospitals and the level of importance of their cooperation. Respondents cooperate with all subjects involved in the questionnaire. However, the significance of the cooperation varies from hospital to hospital.

Table 14 Importance of cooperation of analyzed hospitals

	High importance	Medium importance	Low importance	Irrelevant
Clients	3	0	6	0
Suppliers	3	4	2	0
Other hospital	0	6	3	0
Advisory companies	0	5	4	0
Universities and research institutions	4	3	0	2
Institutes of professional capacities	2	0	5	2

Furthermore, Table 15 presents the goals of cooperation of the above mentioned nine hospitals.

Table 15 Goals of cooperation

	R&D	Technical assistance	Training	Product testing	Other
Clients	5	0	0	3	0
Suppliers	0	4	5	0	0
Other hospital	5	0	0	0	7

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Advisory companies	0	9	0	0	4
Universities and research institutions	9	0	0	0	0
Institutes of professional capacities	0	6	0	0	0

An item “Research & Development” dominates and it is supported by agreement of hospitals with clients, other hospitals and mainly universities and research institutions. Technical assistance is another significant reason for cooperation of hospitals mostly with suppliers, advisory companies and professional institutes. 20 % of analyzed hospitals also cooperate with suppliers regarding training activities and 15 % of hospitals test new products in cooperation with clients.

2.4 Competitiveness of hospital & Cooperation for strategic advantage

According to the questionnaire (Figure 18) the most important factor for efficient management in Slovak hospitals is minimization cost. It is also obvious in a context of relationship between future development of hospitals and the financing issue which has been often discussed during the several past years..

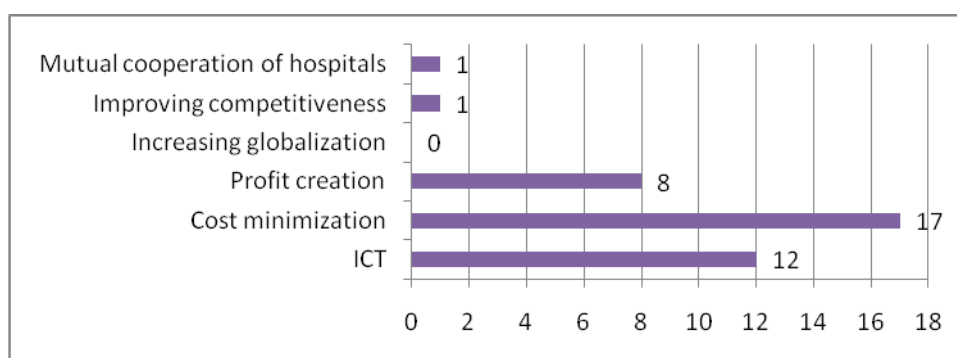


Figure 18 The most significant factors for efficient management

With respect to the expectations of hospitals for the future, they were asked what is the main challenge of hospitals in the 21st century.

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Regarding the research results, an efficient strategic management system is considered to be a challenge of the 21st century by 75 % of hospitals. (See Figure 19)

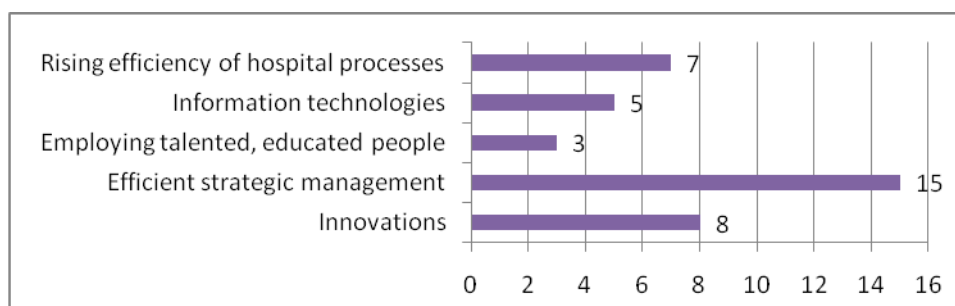


Figure 19 The most significant challenges of hospitals in the 21st century

Although considering efficient strategic management to be a main challenge of the 21st century, analyzed Slovak hospitals do not declare the accordance of project activities with the strategy (50 % of hospitals). (See Figure 20)

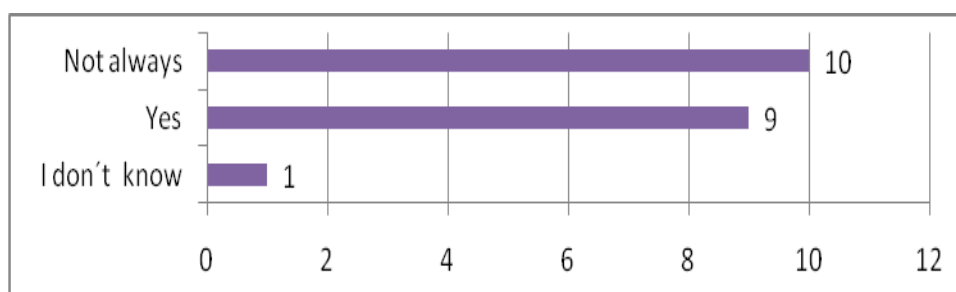


Figure 20 Are project activities in accordance with strategy?

Several factors may have an influence. Declared strategic planning indicates certain level of strategic management in analyzed hospitals. However, it is insufficiently qualified in many cases. Strategic variants, complexity, accurate specification of strategic initiatives declaring feasibility of set goals, precise strategy evaluation and its actualization are missing. Moreover, strategy is often not linked to operational level and needs to respect all principles of strategic management. Strategic management requires

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broad view and complex thinking of its creators and implementers. Its form and content significantly depends on the type and ownership of hospital.

The basis of the hospital's efficiency should be continuous improvement of activities at all levels. Cost reduction and managerial decision-making improvement is not sufficient. A long-term stable growth and competitiveness is based on systematic and long-term management of innovations. Each type of innovation has an impact on processes of the organization.

Figure 21 declares the importance of each factor.

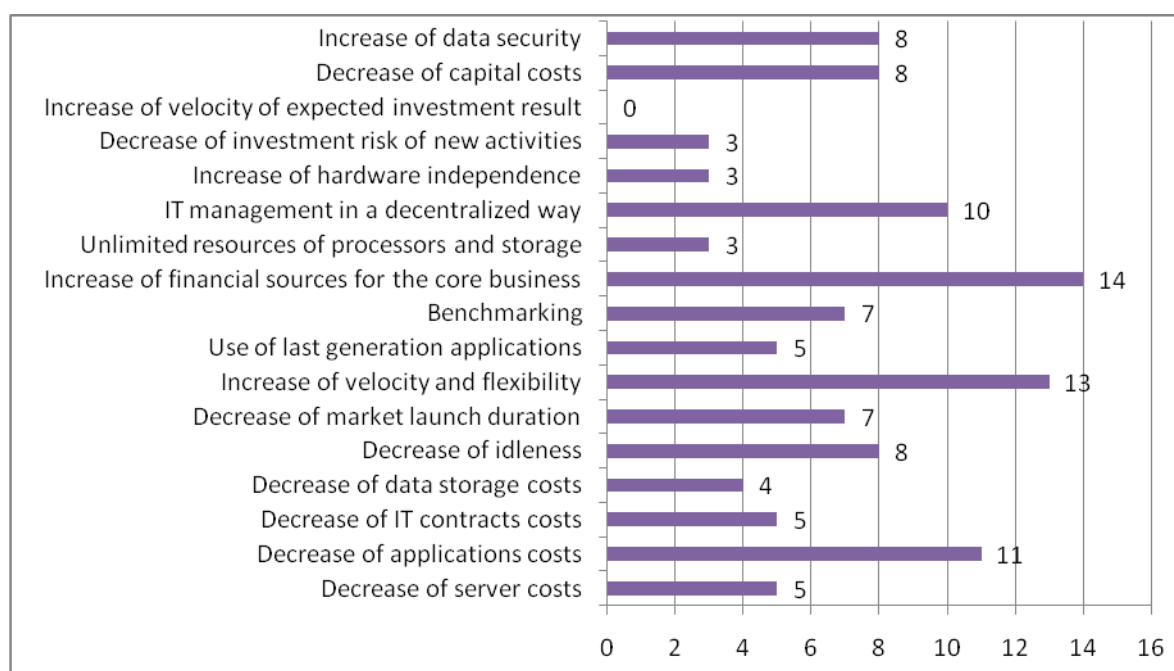


Figure 21 Important factors to increase the competitiveness

A dominant factor is the reduction of financial costs of various IT applications (e.g. purchase, lease, upgrade, maintain and support of software such as ERP, CRM, BI, Data mining, etc.). Implementation of these specialized applications is often financially difficult (reducing the price of these applications is reported as a factor of competitiveness by 55 % of hospitals). Therefore, it is suitable to measure and evaluate

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the performance of the implemented specialized applications (e.g. the CRM system is suitable to detect differences in evaluated parameters before and after the introduction of the application). The priority benefit of the specialized applications is an increase in hospital's analytical performance which leads to general quality and decision-making processes improvement for achieving optimal number and structure of indicators, for analyses, planning and other managerial activities. Main carriers of these effects are Business Intelligence applications and technologies. Financial difficulty is a reason why management demands to measure informatics effects in an annual report. It is necessary to emphasize the existence of such effects whose transformation from natural (scale) expression to the financial one requires longer period of time, broad spectrum of practical experience and statistical data (e.g. effects of users' and customers' satisfaction). In many cases, to express the effects a qualified estimation is used. All these activities significantly support competitiveness of hospitals, as hospitals are able to implement these effects and applications into their internal and external strategic analyses and decide about the further development. These aspects are closely associated with another evaluation criterion - "an increase in speed and flexibility by change implementation" referred to by 65 % of hospitals. Based on the performed strategic analysis, hospitals take action to improve its competitive position and then revise the strategy. Implementation of changes is sometimes very time-consuming process. Moreover, given the pace of change in the external environment, it is necessary to increase the speed and flexibility of efficient measures within the change management to avoid the evaluation of some parameters in which the effects of recent changes have not yet showed up. This causes prolongation of the period for review and update strategies and the appreciation of late effects, which hospitals can use. 40 % of analyzed hospitals state that a reduction of capital costs to acquire equipment and facilities necessary to carry out their activities, improvement of data security, and loss reduction of underutilized capacities (due to lack of informatization in them) are also significant factors of competitiveness.

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2.5 Information technology availability in medical institution

2.5.1 Acquisition of equipment and facilities

Considering the results of research performed in the Slovak Republic, the number of computers used in the hospitals depends on their size and structure of hospitals. Computers with Internet connection cover the majority (approximately 75 % on average) of all computers in hospitals (See Table 16) and naturally, the number of computers with access to the LAN is even higher (approximately 95 % of all computers on average). Various devices are designed for communication of user with information system. Their construction and structure is dependable on a particular architecture of each hospital, on its mission and preferred IT applications.

Table 16 Basic descriptive statistics of PCs and printers

	Mean	Standard deviation	Minimum	Maximum
Number of PC	262	334.8	5	1 350
Number of PC with access to Internet	197	197.2	4	7 70
Number of PC with access to LAN	251	287.4	0	1 100
Number of laser printers	155	149.1	5	5 50
Number of inkjet printers	13	14.6	0	50
Number of dot matrix printers	23	71.7	0	315
Number of PC with multimedia	86.2632	131.40	0	500

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Possible relationship between the number of computers and legal form and ownership of hospitals (19 hospitals provided data) was analyzed applying the ANOVA. Results are presented in the following tables. (Table 17, 18)

Table 17 Tests of homogeneity

Test	Test statistics	p-value
Levene's Test	F-value = 2.37	0.129
Brown and Forsythe's Test	F-value = 1.41	0.276
Bartlett's Test	Chi-Square = 7.64	0.054

The basic assumption of the ANOVA model is the homogeneity (equality) of variances. Results of homogeneity tests proved that zero hypotheses could be accepted. Therefore ANOVA can be used.

Table 18 ANOVA results

		df	SS	MS	F-value	p-value
Legal form and number of PCs	Model	3	1 626 422.6	542 140.9	20.77	<.0001
	Error	15	391 602.3	26 106.8		
	Total	18	2 018 024.9	542 140.9		
Ownership and number of PCs	Model	2	576 582.0	288 291.0	3.20	0.068
	Error	16	1 441 442.9	90 090.2		
	Total	18	2 018 024.9			

Results show significant difference in average number of computers between hospitals with contributory legal form versus non-profit, joint stock and private limited legal forms at the 95 % significance level ($p < 0.0001$). Concerning the ownership, no difference was confirmed at the 95 % significance level ($p = 0.068$).

To perform more thorough analysis of the differences between hospitals of different legal form, the Bonferroni Test was conducted. (See Table 19)

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Table 19 Bonferroni Test

Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		
Contributory – Joint stock	792.07	398.72	1185.42	***
Contributory – Non-profit	971.79	578.44	1365.13	***
Contributory – Private limited	1017.17	569.32	1465.01	***
Joint stock - Contributory	-792.07	-1185.42	-398.72	***
Joint stock – Non-profit	179.71	-82.52	441.95	
Joint stock – Private limited	225.10	-113.44	563.63	
Non-profit - Contributory	-971.79	-1365.13	-578.44	***
Non-profit – Joint stock	-179.71	-441.95	82.52	
Non-profit – Private limited	45.38	-293.16	383.92	
Private limited - Contributory	-1017.17	-1465.01	-569.32	***
Private limited – Joint stock	-225.10	-563.63	113.44	
Private limited – Non-profit	-45.38	-383.92	293.16	

Comparisons significant at the 95% level are indicated by ***

The Bonferroni Test has confirmed the significant difference between state contributory organizations and other legal forms. Absolute values can be observed on the following graphs (Figure 22).

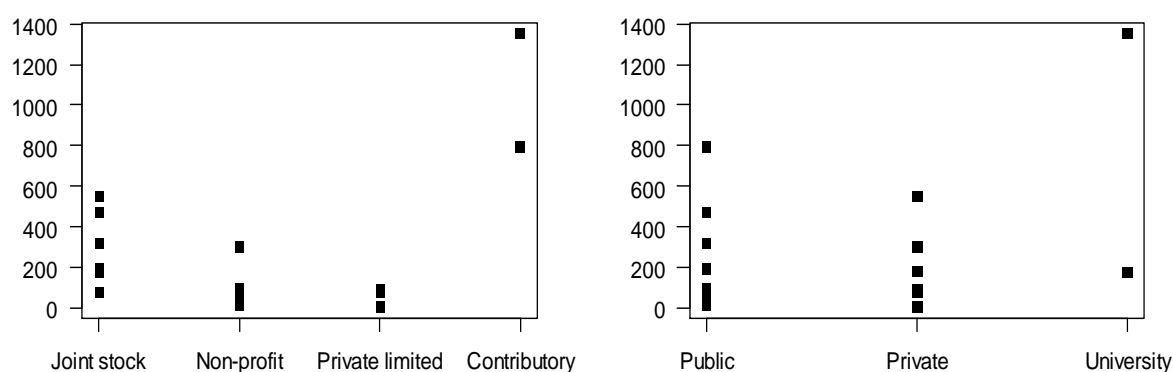


Figure 22 Legal form and number of PCs (left), ownership and number of PCs (right)

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Obviously, state contributory organizations possess more PCs than hospitals of other legal form. However, only two contributory organizations were involved in our sample. These are the largest hospitals in the Eastern-Slovak region with respect to the number of physicians and beds. Hence, the high numbers of PCs is probably mainly connected to the size of hospitals, not to their legal form.

Another important part of hardware IT architecture is printer representing a dominant device of the PC or IS outputs. The most commonly used type in the analyzed Slovak hospitals (looking at the mean and maximum values in Table 16) is laser printer.

Inkjet printers are used to a limited extent despite being the most spread printer technology in the world.

Dot matrix printers are also not commonly used. The main reason is probably the appropriateness of this kind of printers in environments with lower printed volumes and in cases of necessary combinations of color and black-and-white prints. To sum up, the use of laser printers corresponds with bureaucratic management system in the hospitals.

40 % of hospitals consider the importance of investments in devices and equipment within the upcoming two years high, 55 % of them find it medium important.

2.5.2 Application programs

Analyzed hospitals use the usual office applications (Figure 23). Almost all hospitals use the package of Microsoft Office. However, 50 % of hospitals also mention Open Office, the advantage of which is free availability. 20 % of hospitals use MS Access; most of them have other database applications (see the section 2.5.3).

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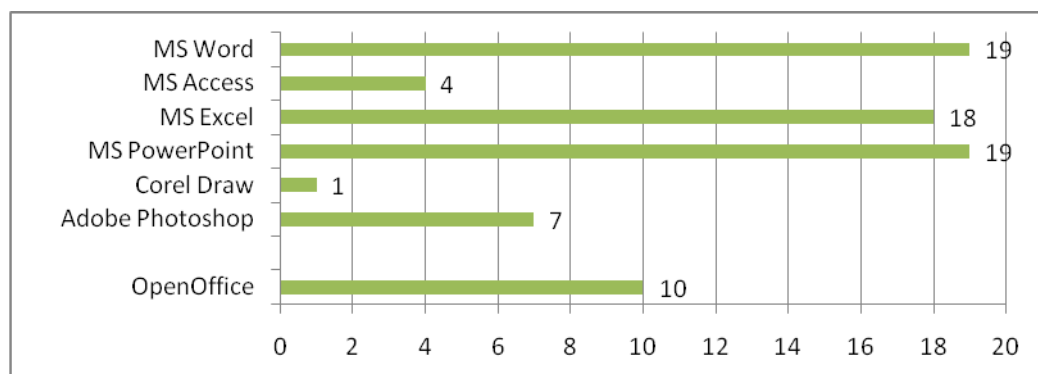


Figure 23 Application programs in hospitals

Considering the applications used within particular activities, the following table (Table 20) displays a review of various types of software. Software names in bold format refer to applications applied in most of the hospitals.

Table 20 Application software used within particular activities

	Number of hospitals	Name of software
Hospital management	12	SHPKO MEDEA, PCS*CARE, KNIS, PROMISS, LCS, HUMAN, DSS , NISCLINICON, Qlickview
Integrated management	1	-
Accounting	20	Navision , LEA-VAFALAN, DATALOCK, Helios
Human resources	12	Human , VEMA PaM
Purchases/Sales	11	Navision , DATALOCK, ARCOS, Pharmacy, WINLSS – APHOTHEKE
Inventories	11	Navision , DATALOCK, ARCOS, Pharmacy, WINLSS – APHOTHEKE, NIS PROSOFT, LCS - Noris
Asset management	7	Navision , Profit
Cost management	2	-

All respondents declare use of software tools for accounting, 60 % of hospitals apply them within a hospital management and human resources, respectively. Moreover, 55 % of hospitals use ICT programs both for purchases and sales and inventory management.

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2.5.3 Databases

For IS of hospitals and web application, a necessity to work with large data files is typical. In order to save and use them efficiently, it is useful to create logically interconnected structures - databases. The Figure 16 depicts that 40 % of 20 analyzed hospitals have been using central database on a central server (More detailed information in Table 23). The contingency coefficient has showed a medium-strong relationship between the legal form of hospital and the presence of central database. All analyzed contributory hospitals have applied the central database, while most of non-profit organizations have not.

Table 23 Central database in hospitals

		Yes	No	Total
Legal form	Joint stock	3	4	7
	Non-profit	1	5	6
	Private limited	2	3	5
	Contributory	2	0	2
	Contingency coefficient = 0.4933			
Owner -ship	Private	4	5	9
	Public	3	6	9
	University	1	1	2
	Contingency coefficient = 0.1263			

25 % of the hospitals with the central database have been using software of database administration. Among the mentioned, there were KNIS (Complex Hospital IS), SNS-DSS, Informix Dynamic, MySQL and SyBase. Other hospitals have been using distributed database based on collecting and using data stored in various distant localities and thus several mutually interconnected databases arise.

The main priorities of distributed databases are data security and database consistency and integrity.

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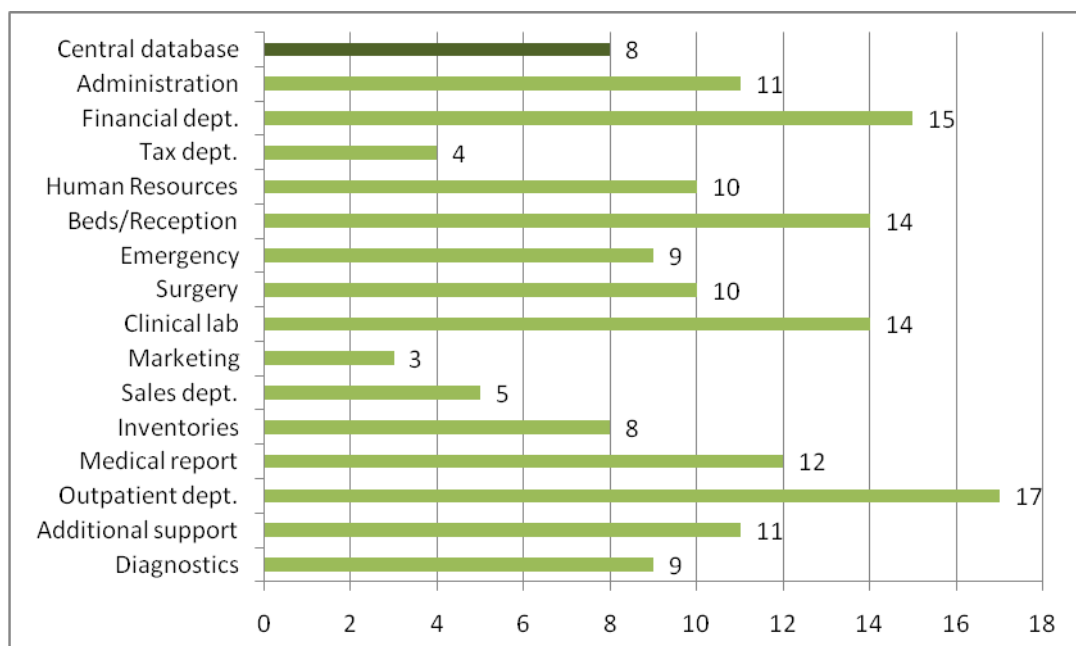


Figure 24 Databases in analyzed hospitals

The Figure 24 displays the dominance of databases of outpatient departments (85 % of hospitals), of economic departments including financial divisions (75 % of hospitals), reception department (70 % of hospitals) and clinical laboratories (70 % of hospitals).

Regarding the economic departments, they are in charge of economic and financial services connected to the activity of inpatient care departments. The structure of economic division depends on an organizational structure of the hospitals, its type and size. Generally, it involves accounting department (responsible for the whole bookkeeping (linked to the main and additional activities of hospitals, and creation and control of budget resources utilization with respect to hospital departments), invoicing department, business department, operational recording department, department of relations with health insurance companies and cash desk.

The most frequent type of database is the one used by outpatient departments. Among the outpatient care of analyzed hospitals, classical secondary outpatient care, subsequent care after termination of hospitalization and care before hospitalization can be distinguished, including emergency and acute care. In comparison with the client's

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patient report (CPR) of an inpatient care, the CPR of an outpatient care is much simpler. Medical team is usually limited to physician and nurses what decreases the need for communication. Database of inpatient departments includes CPRs systematized into blocks according to the patients' visits and outpatient episodes. The CPRs of each patient present demographic and identification data and information about his visits. Their form and content depend on type of the outpatient department and follows the legislative, directives and rules of hospitals. Another group of data connected to the outpatient care involves administrative issues and bookkeeping which are easier to process with help of an IS. Within a process of outpatient care management, the scheduling of patients' visits is very important. This process must fulfill many technical requirements, include medical criteria connected to the state of the patient, urgency of health care and be in accordance with the consequent outpatient activities. Planning calendars as a scheduling application are mainly utilized as web applications enabling external users to connect to the system. The advantages of scheduling system are rapid shortening of patients' waiting times, a possibility of operative management of outpatient department, redirecting a patient to another expert etc. Broad database allows for various statistical analyses focused on capacity utilization, time schedules compliance or average waiting times. These outputs may lead to an improvement of health care in hospitals.

Operational and technical department belongs to the largest departments of hospitals. It is mainly responsible for catering, cleaning services, laundry, medical technique, transport, material-technical supplies, internal security and building administration. Within the Figure 24, these activities are included in Administration (55 % of hospitals using databases), Additional support (55 % of hospitals) and Inventories (40 % of hospitals).

Within the analysis of hospital departments using databases, it is necessary to mention the ICT department. In some hospitals, it may be a part of operational-technical department. The ICT department manages, coordinates and participates in implementations of subsystems and modules of the Complex Hospital Information System (KNIS). Moreover, it sets the general strategy of the IT application in hospitals,

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provides classical data record of the ISs, data security, consistent support of all applications' users and solves the associated problems. Furthermore, the ICT experts adjust application equipment according to the requirements of users and transfer the requirements on suppliers of solutions.

2.5.4 Outsourcing

Based on the outputs of research (Figure 25), 20 % hospitals have used the outsourcing for e-Learning, 15 % in telecommunication services and 10 % for Help Desk services.

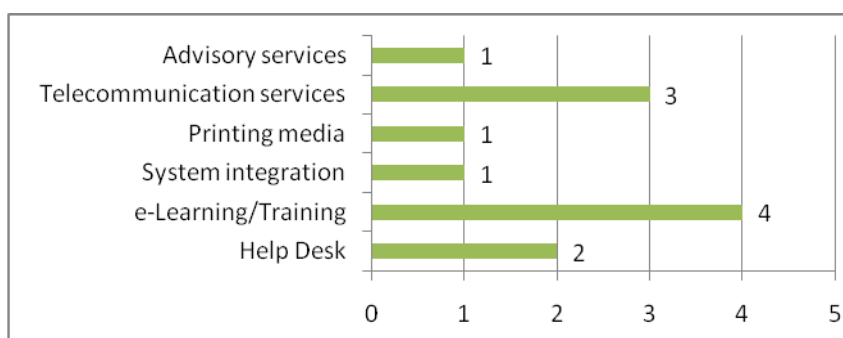


Figure 25 Outsourcing in hospitals

Insignificant role of outsourcing in Slovak hospitals is confirmed by the fact that only 15 % of hospitals intend to invest in the outsourcing services within upcoming 3-6 months and another 20 % of hospitals plan to invest in more than 12 months. Remaining 65 % of hospitals do not know. Considering the storage devices, the most prevalent technology is disc arrays (Figure 26). They contain multiple disc drives enabling to create one large logical disc space used by several servers. It assures high level of data security and easy use. Moreover, it provides increased availability and maintainability by using additional, redundant components (controllers, power supplies, fans, etc.) (Münz, 2011). Analyzed Slovak hospitals only use three types of storage devices.

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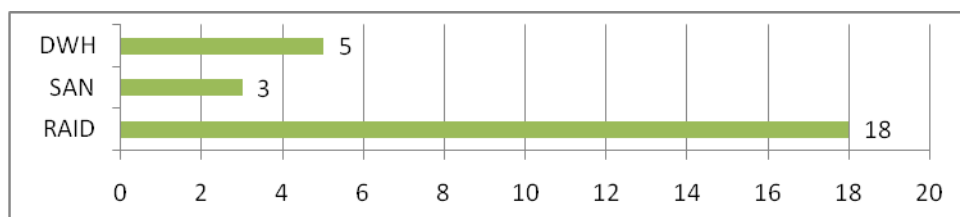


Figure 26 Storage devices in analyzed hospitals

Data Warehouse (DWH) represents tools to store the data enabling their complex review and their analysis (Sodomka and Klčová, 2010). It is a complex, never-ending process involving data transformation from operative sources, their elaboration, storage and finally transport to final users in an appropriate structure, form and time. Owing to these facts, the DWHs present important data storage tool what is also declared by 25 % of analyzed hospitals (15 % of them use DWH together with RAID).

IBM (2006) defines the Storage Area Network (SAN) as a high-speed network attaching servers and storage devices whose primary purpose is to transfer data between computer systems and storage elements. The advantages of the SAN are flexibility of administrator who is able to expand or add a storage space, optimization and consolidation enabling centralization of administration leading to the cost reduction. (T-Systems, 2012) However, several shortcomings may also occur. Adding new storage elements increases the complexity of the whole system and may cause new risks and problems. The administrator must be qualified. Among the analyzed hospitals, only 15 % of them have used the SAN, always in combination with the RAID.

The most often used storage device in analyzed hospitals (90 % of hospitals) is RAID (Redundant Array of Independent Disks). This system enables to create one disc space from several physical discs and according to the level of RAID to assure larger capacity, data availability and reliability of storage. 15 % of hospitals use a combination of RAID and SAN and RAID and DWH, respectively.

Considering investments in the storage devices, although 50 % hospitals announced their intention to invest in data storage systems, only one hospital plans to do

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so within the upcoming three months. Another two hospitals want to invest in 6-12 months. The rest of the hospitals do not know.

2.5.5 Network, security and telecommunications

The analysis of network and telecommunication technologies has brought the following outputs (See Figure 27):

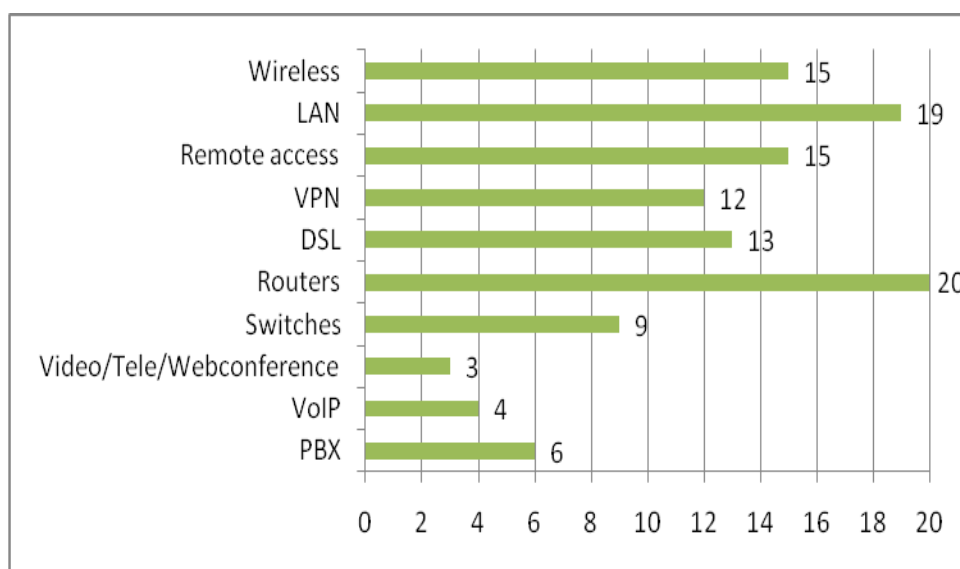


Figure 27 Network and telecommunication technologies

95 % of hospitals use LAN, 60 % use VPN, 75 % hospitals use remote access and the same number use wireless network. DSL is utilized by 65 % of hospitals. Each analyzed hospital uses routers, 45% of them switches. These numbers show that hospitals are equipped by common technologies which are nowadays necessary in any organization.

Considering various telecommunication techniques, only 15 % of hospitals use Video/Tele/Web conference, 20 % apply VoIP and 30 % of hospitals PBX.

20 % of hospitals intent to invest in network technologies within upcoming three months, 5 % of hospitals in 3-6 months, 15 % of hospitals not earlier than in one year and the rest of hospitals do not know.

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If we focus on results of analyzed hospitals, 100 % of hospitals use antivirus programs and almost all use Firewall. As all analyzed hospitals have been using intranet, the secured communication between intranet and Internet is essential. Other security technologies are utilized to a smaller extent (See Figure 28).

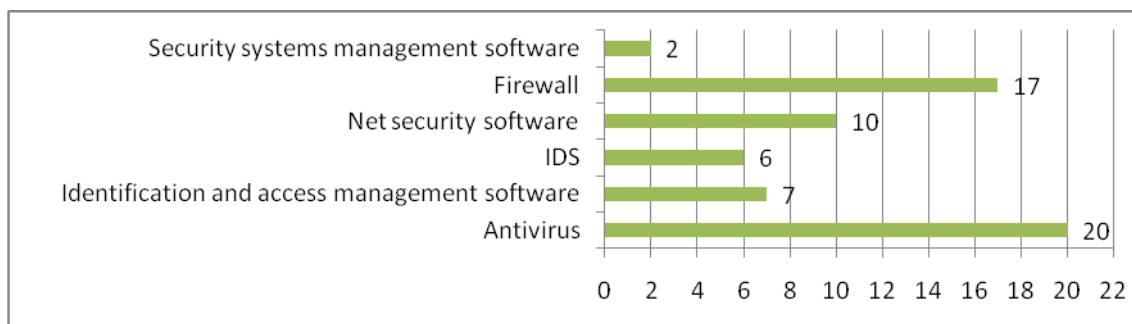


Figure 28 Security technologies in analyzed hospitals

10 % of hospitals intent to invest in security technologies during upcoming three months, 25 % of hospitals in 6-12 months and the remaining 65 % do not know. Moreover, 35 % of hospitals regularly create an action plan of information security, 20% hospitals do it sometimes and the rest 45 % of hospitals do not have such plan at all.

With respect to high sensitivity of data in hospitals, it is possible to conclude there is still space to improve. Firewall and Antivirus system are essentials when working with computer networks. However, regarding high number of hospitals without any information security plan, security measures do not seem to be sufficient in all analyzed hospitals.

2.5.6 IT management

Considering management systems in analyzed hospitals (Figure 29), 80 % of the hospitals prefer asset management software, 70 % financial software and 70 % applications for PC. Low number of hospitals using HR software, ERP systems, logistic applications, BPM and CRM systems can be considered as negative. Costs of health

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care in Slovakia have been rising (Szalay et al., 2009) and patient should stay in the centre of attention. It can be assumed that the CRM system would significantly support a policy of relationships between hospital and its patients through tools like: availability control, contract administration, overview of deliveries and orders in a real time, invoicing, marketing planning, campaign administration, telemarketing, administration of complaints, business opportunities creation and administration and patients' segmentation.

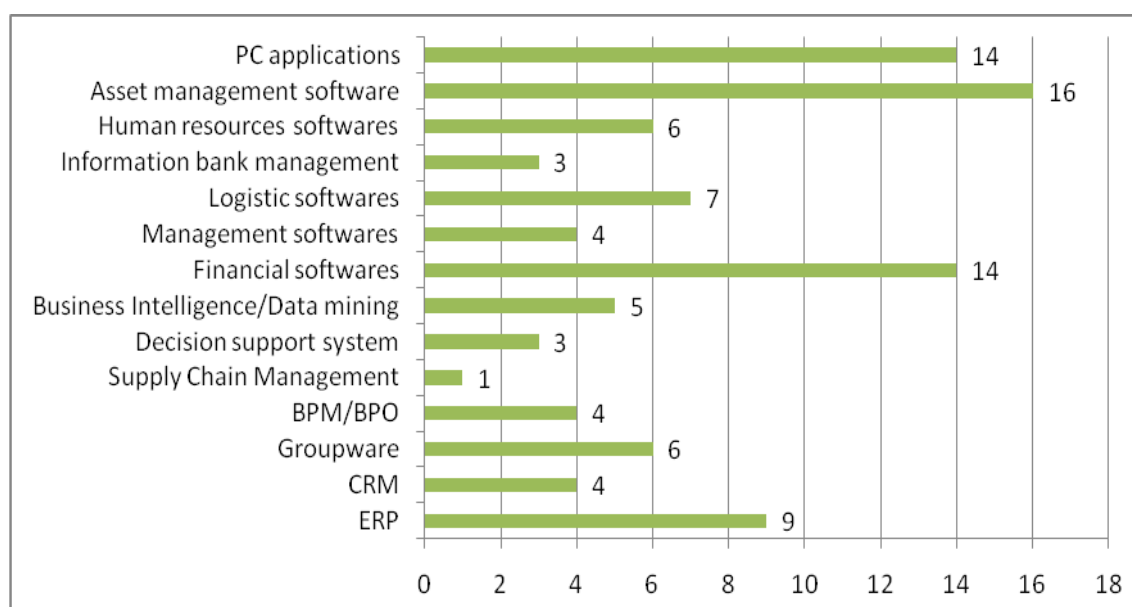


Figure 29 IT management solutions used in analyzed hospitals

The situation in investment plans of hospitals with respect to management solutions is more positive than those in network, security and telecommunication technologies. 15 % of hospitals intend to invest within three upcoming months; 30 % of hospitals will do so in 6-12 months and 30 % hospitals after one year. 25 % of hospitals have no investment plans.

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2.6 E-commerce

Electronic business (e-business) involves all business activities executed through computer networks. Electronic commerce (e-commerce) represents a transaction carried out through computer network which results in change of ownership or rights connected to use of products or services.

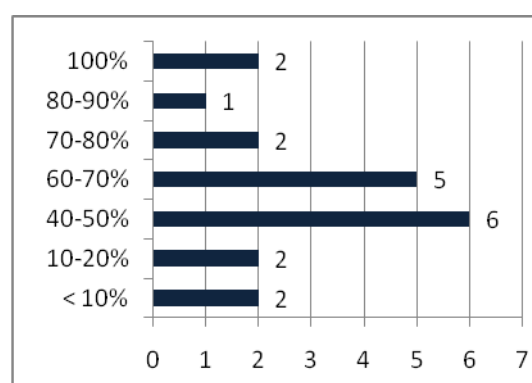
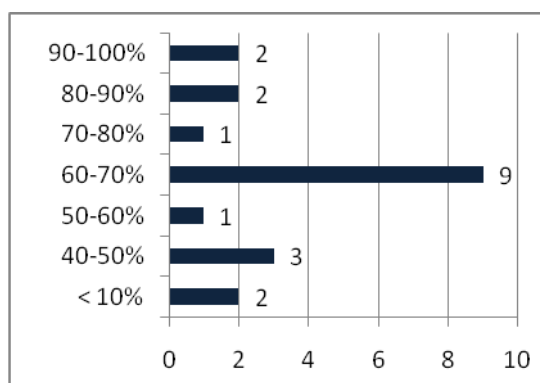
2.6.1 Module A: General information about communication and information technologies

Traditional ICT such as Internet and email are used by all the hospitals. 100 % of them also use intranet, 55 % have extranet and 70 % WAP. (See Table 21)

Table 21 Selected ICT in hospitals

	Since 2001 or earlier	Since 2008	Since 2012	In upcoming 5 years	Does not plan to use
Intranet	17	3	-	-	-
Extranet	2	6	1	2	9
WAP	6	5	2	1	6

Almost a half of analyzed hospitals have declared 60-70 % use of computers within their work routine (See Figure 30-left). In 30 % of hospitals, 40 - 50 % of employees are continuously connected to the Internet; in 25 % of hospitals 60-70 % of employees are connected. (See Figure 30-right)



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Figure 30 Use of computers in daily working routine (left), connection of PCs to the Internet (right) in % of number of employees

2.6.2 Module B: Use of the Internet

Among the analyzed hospitals, each one uses Internet and has its own website. Concerning the Internet connection, the following graph presents the results (Figure 31). The hospitals often use modem, radio communication or ISDN.

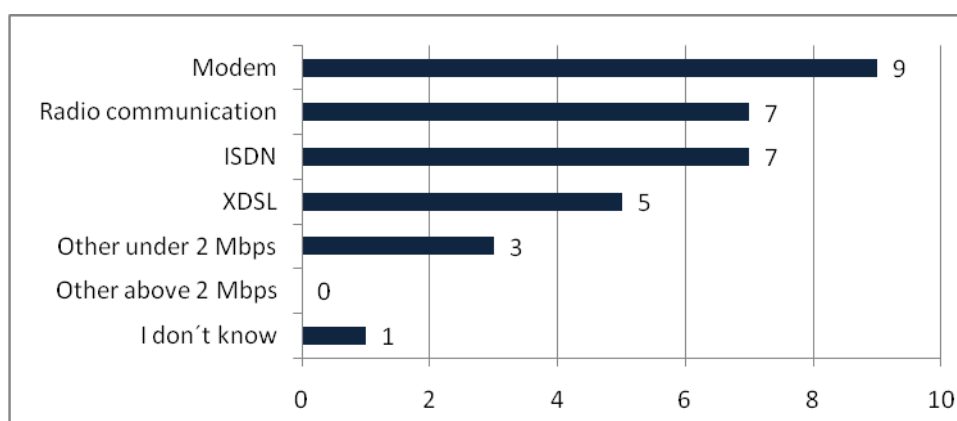


Figure 31 Internet connection

Table 22 gives an overview about the intention of respondents to use the Internet.

Table 22 Use of Internet

		Use	Plan to use	No plan to use
General activities	Information search	20	-	-
	Market monitoring	13	5	2
	Communication with public institutions	17	3	-
	Bank and financial services	19	-	1
	Recruitment information	20	-	-
Purchase of	Information search	20	-	-

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products and services	Receipt of digital products	20	-	-
	Free receipt of digital products	5	12	3
	Warranty service	11	6	3
	Website	20	-	-
Use of a website to purchase of products and services	Product marketing	16	2	2
	Simplifying of contact	15	5	-
	Website adjusted to clients	15	3	1
	Easy access to a product catalog, price list etc.	15	4	1
	Receipt of digital products	6	5	9
	Safe transactions	7	6	7
	Back End Systems	1	8	11
	Warranty service	3	4	13

The analysis of general activities has shown that hospitals use the Internet mainly to search for information of different nature (100 % of hospitals), to gather information on potential employees, especially when searching for top employees - experts in the field (also 100 % of hospitals). Other prevailing purposes are communication with banks and public institutions or gaining recruitment information. Focusing on a dimension of e-purchases, 100 % of the respondents use the Internet to find information, to receive digital products and to establish their websites. 60 % of hospitals plan to receive digital products² in the future and 30 % of them intent to use a warranty service (15 % of hospitals do not plan to use the Internet for the last two purposes). Structured answers focused on the use of website for e-purchase purposes, product marketing dominates in 80 % of hospitals. Other objectives were simplification and efficiency of the contacts in 75 % of hospitals or easier access to product catalog and price list in 75 % of hospitals. 75 % of hospitals adjust website for their client needs (with the

² Digital product – for example e-learning.

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presentation of products and services). 30 % of hospitals indicate that they use websites for receiving of digital products and 35 % for safe transactions.

2.6.3 Module C: E-commerce via the Internet (E-business)

As far as the results of the questionnaire in Slovak hospitals are concerned, all hospitals involved in e-commerce use Intel hardware platform, one also uses RISC/SUN and AMD, respectively. (See Figure 32)

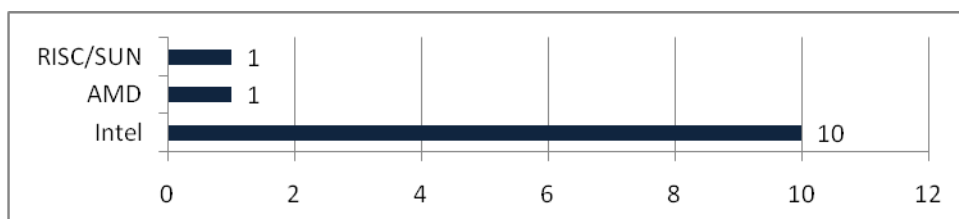


Figure 32 Hardware platform of e-commerce

Considering software, analyzed hospitals only use two operation systems, Windows and Linux, (Figure 33) and do not use any specialized e-commerce software.

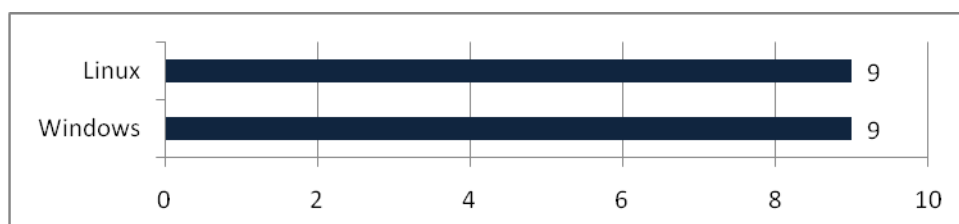


Figure 33 Operation system used within e-commerce

e-Purchases and e-Sales

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Internet purchases are conducted by 50 % of hospitals, while the volume of e-purchases is lower than 10 % of total purchases in each of the hospitals. Some of them have a catalog of their products and services online and 50 % use e-markets. (See Figure 34)

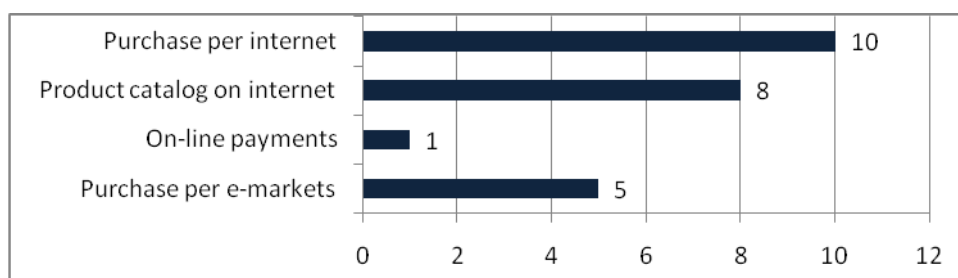


Figure 34 e-Purchases

Relationship between type of hospital and e-purchase activities was studied in detail. (See Table 23).

Table 23 Do hospitals purchase via Internet?

		Yes	No	Total
Legal form	Joint stock	1	6	7
	Non-profit	7	1	8
	Private limited	0	3	3
	Contributory	2	0	2
	Contingency coefficient = 0.6287			
Owner-ship	Private	3	6	9
	Public	6	3	9
	University	1	1	2
	Contingency coefficient = 0.3015			

According to contingency coefficients, a legal form influences intention to e-Purchases strongly, an ownership mid-strongly. It is visible that non-profit organizations and public hospitals represent majority of Internet purchasers.

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Considering e-Sales, 40 % of analyzed hospitals realize them. The volumes of Internet sales are under 10 % of total sales in each hospital. Unlike in case of e-Purchases, hospitals do not use e-markets when realizing e-Sales. Hospitals have not recorded increased sale volume after e-commerce implementation. (See Figure 35 and Table 24)

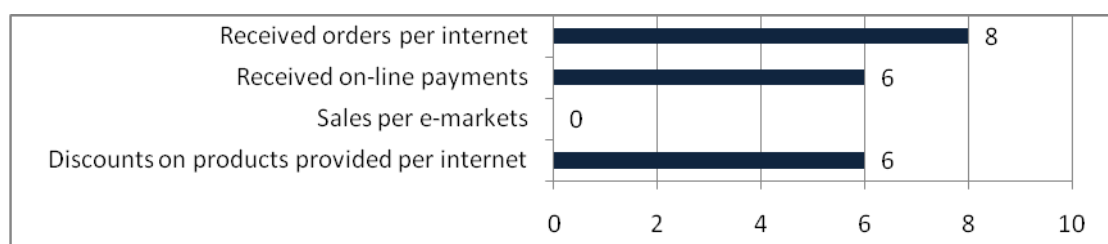


Figure 35 e-Sales

Table 24 Received orders via Internet

		Yes	No	Total
Legal form	Joint stock	1	6	7
	Non-profit	3	5	8
	Private limited	0	3	3
	Contributory	2	0	2
	Contingency coefficient = 0.5912			
Owner-ship	Private	1	8	9
	Public	4	5	9
	University	1	1	2
	Contingency coefficient = 0.3507			

According to contingency coefficients, relationship between reception of orders via Internet and the legal form and ownership of analyzed hospitals is medium-strong. e-Sales are carried out mostly by contributory organizations (to a slightly lower extent by non-profit organizations) and public hospitals.

Moreover, opinions of hospital managers about advantages of e-Purchases and e-Sales and the impact caused by their realization were analyzed. Within the following

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section, only hospitals involved in e-commerce (50 % of hospitals for e-Purchases, 40 % of hospitals for e-Sales) answered.

Table 25 provides an overview of importance of three potential advantages of the Internet purchases according to the hospitals and quality of results brought by realizing purchases per Internet in each particular hospital.

Table 25 Advantages and results of Internet purchases

Hospitals	Cost minimizing		Better access to information of suppliers		Business processes velocity increase	
	Importance	Results	Importance	Results	Importance	Results
1	Very important	Good results	Very important	Good results	Important	Weak results
2	The most important	Weak results	Very important	Good results	Very important	-
3	The most important	-	Important	Weak results	Important	Weak results
4	Important	Good results	Very important	Good results	Very important	Good results
5	The most important	Weak results	Very important	Good results	Very important	Weak results
6	The most important	Weak results	Very important	Good results	Important	-
7	The most important	Weak results	Very important	Good results	Very important	Weak results
8	The most important	Weak results	Very important	Good results	Very important	Weak results
9	The most important	Weak results	Very important	Good results	Important	-
10	The most important	Weak results	Very important	Good results	Important	-

The following table (Table 26) depicts advantages of e-Sales and effects of selling per Internet for analyzed hospitals.

Table 26 Advantages and results of e-sales

Hospital	1	2	3	4	5	6	7	8
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Image	Importance	I	VI	I	VI	VI	VI	VI	VI
	Results	WR	GR	WR	GR	GR	WR	WR	WR
Cost minimizing	Importance	I	MI	I	MI	MI	VI	MI	MI
	Results	WR	GR	WR	GR	GR	WR	GR	WR
Business processes velocity increase	Importance	LI	VI	I	VI	VI	VI	VI	VI
	Results	WR	WR	WR	WR	WR	WR	WR	WR
Service improvement	Importance	VI	MI	I	VI	VI	VI	VI	VI
	Results	GR	GR	WR	GR	GR	WR	WR	WR
Acquisition of new customers	Importance	I	VI	VI	VI	VI	VI	VI	VI
	Results	WR	GR	WR	GR	GR	WR	GR	WR
Expansion on a market	Importance	LI	I	VI	VI	VI	VI	VI	VI
	Results	WR	GR	WR	WR	WR	WR	GR	WR
Introduction of new products	Importance	LI	VI	VI	VI	VI	VI	VI	VI
	Results	WR	GR	WR	WR	WR	WR	WR	WR
Keeping up with competitors	Importance	VI	VI	VI	VI	VI	VI	VI	VI
	Results	GR	GR	WR	GR	GR	WR	WR	WR

LI - Little important, I – Important, VI - Very important, MI - The most important

NR – No results, WR – Weak results, GR – Good results, FE – Fulfilled expectations

Interesting result is also high importance of a factor “Access to suppliers’ information” (45 % of hospitals) and “Business processes acceleration” (25 % of hospitals).

2.6.4 Module D: Costs/Expenditures of implemented system

Despite significant time and administration savings of the e-commerce, its utilization is connected with some costs. These differ with respect to the size of a hospital. Out of 10 hospitals using e-commerce, the implementation costs of three of them were 20 000 – 30 000 EUR and less than 10 000 EUR for the remaining hospitals. The maintenance costs exceed 50 000 EUR in case of hospitals with higher implementation costs and remain under than 10 000 EUR in other hospitals.

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Costs are structured according to the phase of e-commerce in which they arise (implementation maintenance). 50 % of analyzed hospitals which have used e-commerce have brought the answers in Table 27.

Table 27 Expenditures connected with the e-commerce (in % out of 100%)

		0	10	20	30	40	50	60	70	80	90	100
Implementation	Website creation	6	1	3	-	-	-	-	-	-	-	-
	Domain purchase	8	1	1	-	-	-	-	-	-	-	-
	Telephone	5	4	1	-	-	-	-	-	-	-	-
	Hardware	5	4	1	-	-	-	-	-	-	-	-
	Software	5	-	5	-	-	-	-	-	-	-	-
	Database	5	-	5	-	-	-	-	-	-	-	-
	Other costs	6	-	3	-	-	1	-	-	-	-	-
Maintenance	Maintenance of website	3	1	-	-	6	-	-	-	-	-	-
	Telephone	2	8	-	-	-	-	-	-	-	-	-
	Provider and Hosting	4	6	-	-	-	-	-	-	-	-	-
	Direct costs	3	5	2	-	-	-	-	-	-	-	-
	Email	4	6	-	-	-	-	-	-	-	-	-
	Marketing	5	5	-	-	-	-	-	-	-	-	-
	Database	2	8	-	-	-	-	-	-	-	-	-
	Other costs	1	8	-	-	-	-	1	-	-	-	-

According to Table 27 the highest expenditure items (20 %) are spent mostly for creating web pages (three hospitals), software (five hospitals) and databases (five hospitals). With regard to the maintenance of e-commerce system, most hospitals (8 of 10) indicate 10 % of their total e-commerce expenditures to be used for telephone, database maintenance and other costs. Six hospitals use 10 % of costs for hosting provider's site and e-mail services (paid e-mail addresses). Six out of the 10 hospitals

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spend 40 % of costs for web pages maintenance. In small hospitals, these activities are not performed by own IT department; the service is provided by outsourced company.

2.6.5 Module E: Barriers in use of the Internet and IT in general

Barriers of e-Commerce can be divided into two main areas: barriers of technical character and barriers of non-technical character. Within the analyzed hospitals, non-technical obstacles prevail (See Table 28, 29, 30).

Table 28 Barriers of sales via Internet

	Not important	Little important	Important	Very important	The most important
Hospital products are not suitable for Internet sale	2	1	1	1	10
Clients are not ready to use e-commerce	5	3	5	2	0
Security problems with payments	5	1	4	3	0
Uncertainty in contracts	5	2	5	3	0
Costs of e-commerce system creation and maintenance	5	3	1	5	0
Issues connected to existing sales channels	7	0	4	4	0

Table 29 Barriers of Internet utilization

	Not important	Little important	Important	Very important	The most important
Security	0	2	6	8	1
Complexity of technology	1	4	6	5	0
High costs of creation and maintenance of website	3	2	5	7	0
Loss of working time	0	4	3	10	0
High costs of data communication	3	1	4	9	0
Slow or instable data communication	2	1	6	8	0
No visible advantages	3	1	6	5	0

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Table 30 Barriers of ICT utilization

	Not important	Little important	Important	Very important	The most important
Very high costs	0	1	8	5	1
Frequent new software versions	3	2	5	5	0
ICT solutions are insufficient for hospital purposes	3	3	6	2	1
Low level of employees' qualification	0	6	5	3	1
Difficulties of employing qualified ICT personnel	0	1	11	3	0
Unwillingness of current employees	0	3	8	2	2
Nonexistence of actualized ICT strategy	2	2	8	3	0
No visible advantages	3	8	2	2	0

Another problem is high costs of e-commerce application implementation, development and maintenance. One of expensive items is training and education of employees in this area. Moreover, this endeavor may meet an unwillingness to learn new things and limited acceptance. Customer access is also expensive. Deregulation of telecommunication services is slow and still causes high prices for Internet access in certain regions. Significant advantages of the e-commerce can only be achieved in case of high demand.

Another obstacle announced by four hospitals is insufficient development of Internet sales channels. Insufficiently developed e-sales infrastructure such as slow data transfer mistrust of potential clients. Moreover, lack of users' trust may also occur. Many customers do not believe in non-paper transactions and electronic money.

2.7 Telemedicine

Telemedicine represents use of telecommunication and information technologies in order to provide medical services at a distance. A location of providers, patients, medical records or facilities is not important. Examples of telemedicine are transfer of medical images between hospitals to establish diagnosis at a distance or a provision of a health care to elderly people, diabetics or to chronically ill. Basic telemedicine services are: tele-consulting, tele-diagnostics, tele-monitoring, tele-care, medical videoconferences and tele-education, remote accesses to databases, tele-radiography, emergency services, information services. Telemedicine represents the part of e-Health involving active clinical treatments.

Within e-Health, applied questionnaire focused mainly on telemedicine. Among the analyzed hospitals, only two have reported use of telemedicine. One hospital introduced it into cardiology in 2006 and, unfortunately, did not provide any further information. The other one applies telemedicine for diagnostics in cardiology (including research activities) and radiology (including research activities) using PASC software. Telemedicine enables to save and transfer images and text. Moreover, this hospital also provides videoconferences using IP, despite not having an own device. The connection speed is 100 Mbps.

Despite limited use of telemedicine in analyzed hospitals, Slovak health care sector has been in the process of e-Health implementation at present. Overview of the current situation is added, as the development and whole conception of the e-Health in Slovakia influence hospitals in the country and thus also the analyzed hospitals.

2.8 Approach to clients eHealth

Broader picture of this issue can be provided by answers of hospitals on questions concerning directly applied structures of customer's care and practical approach to clients. According to these results, several conclusions about analyzed hospitals may be drawn:

- 10 hospitals of 20 do not use any structures of customer's care. (See Figure 36)

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- When having a system, most of hospitals apply the CRM (50 % of hospitals), four hospitals use regular clients' visits and satisfaction questionnaires.
- Despite no organized structure, 60 % of hospitals pay attention to and evaluate clients' satisfaction regularly (for more details see Table 34 in Appendix).
- 80 % of the hospitals are interested in safety deficiencies pointed out by customers.
- 15 hospitals (75 % of the sample) believe, their customers' care is sufficient.

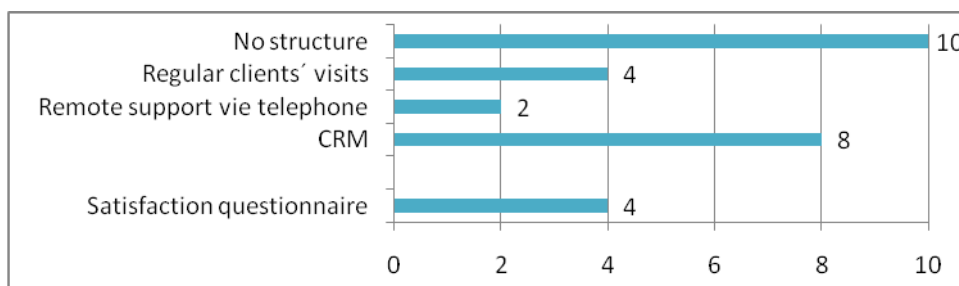


Figure 36 Structure of customer's care

The CRM conception (Customer Relationship Management) as the most often used clients' satisfaction system is based on three main principles: human resources, technological tools and process dynamic structure. Managers have to assure optimal use of the CRM technology in order to fulfill their defined business goals. They must specify which feature and functions of the CRM hospital should be focused on to improve its position on the market. Moreover, implementation of the CRM systems also means a rising pressure on the labor productivity, flexibility in adjusting to the external changes, early revision of hospital strategy etc.

2.9 Quick prototyping of health

At present, specialized devices to gain measured data have been used more and more often in a health care sphere. These data can be represented by individual number, one-dimensional signals or images, static 2D, 3D or 4D outputs. The use of three-

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dimensional technologies in a form of physical and virtual models in analyzed medical institutions is depicted in Figure 37.

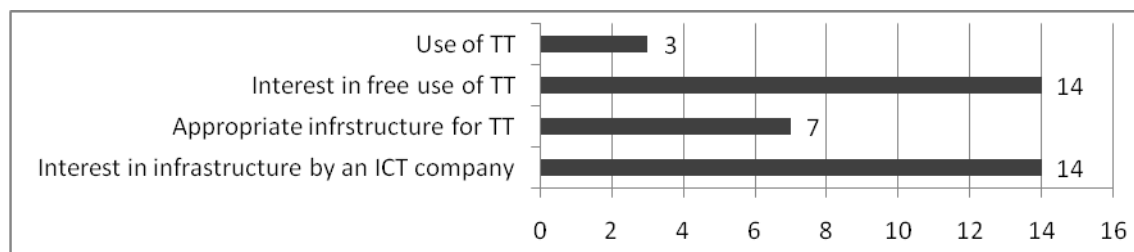


Figure 37 Use of three-dimensional Technologies

One of the successful implemented 3D Technologies in specialized Slovak hospitals is also Mammonat Inspiration providing imaging, diagnostics, stereotactical biopsy and tomosynthesis on one integrated digital platform.

Table 31 Use of 3D technologies

		Yes	No	Total
Legal form	Joint stock	1	6	7
	Non-profit	1	4	5
	Private limited	0	3	3
	Contributory	1	1	2
	Contingency coefficient = 0.3329			
Owner -ship	Private	1	8	9
	Public	0	9	9
	University	2	0	2
	Contingency coefficient = 0.6281			

Looking at the Table 31, the relationship between the use of 3D technologies and legal form of analyzed hospitals and ownership of hospitals is medium-strong and

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strong, respectively. Considering the latter one, both university hospitals, while no public and only one private hospitals use them.

2.10 Waste management in a health-care

Considering research results, hospitals were asked to comment if they have developed a management plan of waste in healthcare. The Figure 38 and Table 32 represent the responses.

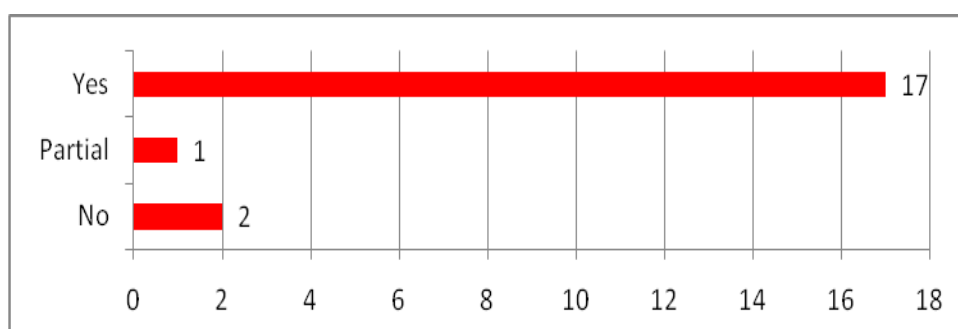


Figure 38 Waste management plan

Looking closer at relationship between the presence of waste management plan and type of hospital, it is strong with respect to the legal form and medium-strong considering the ownership. 100 % or almost 100 % of joint stock, non-profit and private limited companies prepared the plan, while situation is slightly different in case of contributory organizations. Furthermore, all private and university hospitals have the plan, while within public hospitals there are two (10 %) with partial or no plan.

Table 32 Plan of waste management in hospitals

		Yes	Partial	No	Total
Legal form	Joint stock	7	0	0	7
	Non-profit	6	0	1	7
	Private limited	3	0	0	3

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	Contributory	1	1	0	2
	Contingency coefficient = 0.6002				
Owner -ship	Private	8	0	0	8
	Public	7	1	1	9
	University	2	0	0	2
	Contingency coefficient = 0.3400				

*19 hospitals have answered this question

Each hospital with implemented waste management plan conducts also staff trainings. Their frequency varies. 25 % hospitals implement trainings every six months, 25 % hospitals every year, and 10 % hospitals as needed (e.g. in case of hiring new employees).

A closer look at the stages of waste management in analyzed hospitals has shown a dominance of stages - sorting, packing, temporary storage and internal transport. (Figure 39)

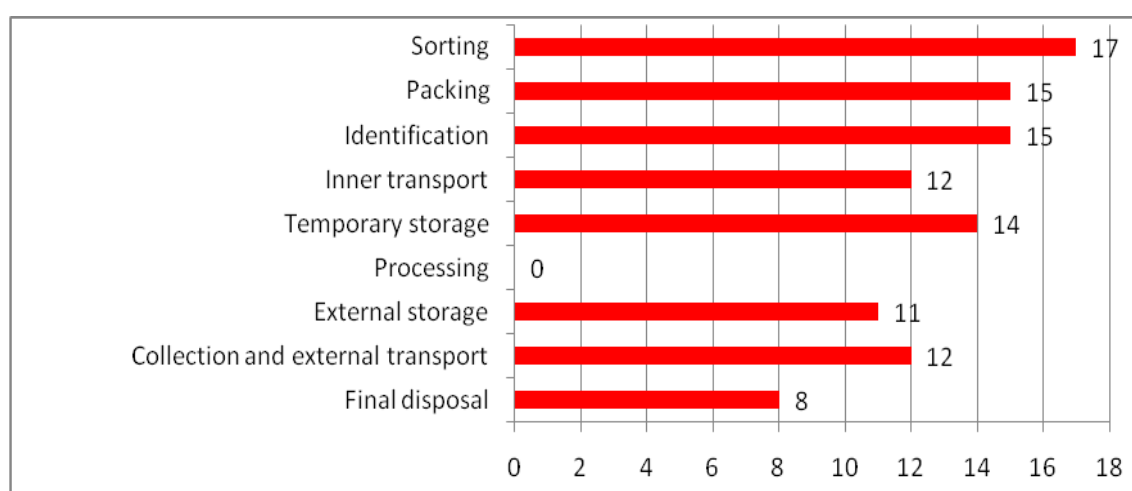


Figure 39 Waste management stages

A major problem of our hospitals is correct classification of medical waste (the issue is not involved in any act except for the Act on Waste). It is therefore up to the assessment of individual health care worker if the waste represents a risk with respect to infection and if it must be removed as hazardous waste. Hospital must treat this problem

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responsibly and try to reduce the amount of infectious waste. It must establish a proper system of uniform principles for waste management. The choice of appropriate methods of waste management should take into account specifications of each hospital, range of provided services, architectural terms, the amount and types of waste produced. Development of the program as well as waste disposal instructions, defining sites for waste containers and waste accumulation must be adapted to the size and nature of the institution. Trend in the world is moving to a search for suitable alternatives, particularly in environmental and cost-effective waste management. Most waste generated in health care is communal in nature. Only a part of it is a real threat to health and environment. If the program is performed regularly, it can reduce the amount of infectious waste from 5 to 25 %, depending on equipment type and scope of health services.

Following graph provides information on usual division of communal waste (Figure 40).

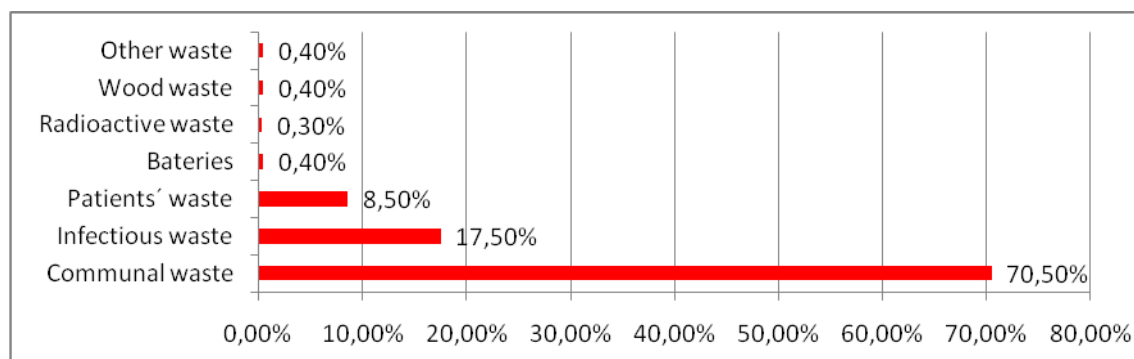


Figure 40 Communal waste

The group characterized as waste produces by patients may also include an infectious disease hospital waste and non-hazardous waste - depending on whether the patient suffers from an infection or not.

- The result of the waste analysis is also a precise mapping of the current state of waste management in health facilities. It is necessary to put emphasis on a

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reduction of the amount and harmfulness of waste produced, reusing and recycling.

2.11 Summary

To conclude - research had been carried out in 20 hospitals in the Eastern Slovakia. The main findings are summarized as follows:

Human resources

- European directives emphasize the necessity of life-long education of medical personnel which is according to Act No 578/2004 Coll. a responsibility of each medical worker. Furthermore, the employers must create conditions for continuing education of their personnel.
- 60% of analyzed hospitals provide qualification courses to their employees and dispose of formal educational plan.
- In the past two years, hospitals have been focused mostly on education of key employees - of main processes executors (85% of hospitals), top managers and controllers (55%).
- 95% of analyzed hospitals evaluate employees' performance although only in 25 % of them on a regular basis.

Strategic management

- The strategic plan is essential for a successful existence of an institution as it involves its vision, strategic goals and strategic operations.
- 95% of analyzed hospitals have their own strategic plan.

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- Strategic plan is known by management of analyzed hospitals, employees at operational level are familiar with strategic plan only in 10 % of hospitals.
- Strategic plan needs to be reevaluated regularly in order to be adjusted to changing environment. 35% of analyzed hospitals review their strategic plan every three months or more often, 45% of them every 6-12 months.
- 75% (85%) of hospitals consider clients (resources) very important in the process of strategy creation.
- Several methods may be used to conduct strategic analysis. Majority of hospitals - 75% use SWOT analysis, 45% use Scenario Analysis and 35% apply Benchmarking,

Research and development

- Research and development activities in hospitals, especially those linked to the ICT, in hospitals are related to many changes in hospitals processes.
- R&D activities of analyzed hospitals have been identified as "occasional" (irregular) in 90 % of hospitals with respect to the frequency. 5% of analyzed hospitals analyze R&D continuously and 5% of them do not carry out R&D activities.
- 65% of hospitals consider research & development activities as medium important, only 10% of them declare high importance, the rest find them little important or unimportant.

Technological Innovation

- Dynamic development of external environment of hospitals leads to a higher saturation of ICT applications and often to a generation exchange. At present, the attention is focused on more efficient resource utilization and hospitals' growth and expansion than on ICT capacity expansion.
- Managers of each analyzed hospital are aware of positive influence (improved productivity – 70% of hospitals, improved quality of services – 65%, cost

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minimization – 25%) and added value of information technologies. Moreover, 75% of hospitals monitor current situation in the IT sphere.

- The most significant factors restricting investments into IT are perceived economic risk (65% of hospitals) and lack of financial resources (45% of hospitals).
- Hence, within past three years, only 5% of hospitals have invested more than 4% of revenues, 35% of hospitals have invested between 3-4% of revenues and 5% of them between 2-3% and 1-2%, respectively. The rest of hospitals have invested less than 1%.
- Considering plans for upcoming year, intention is to invest unchanged sums relatively to revenues in 75% of hospitals. 20 % of subjects want to invest less (by 1-3 %), and 5% of hospital consider sharp increase in technological investments (from less than 1% of revenues to more than 4%). Moreover, the hospitals plan to focus on ERP systems (65% of hospitals), administration (60%), data storage systems (50%) and telemedicine (40%).
- Main objectives of IT investments are improvement of clients' databases (70% of hospitals), informatization in general (75%) and management automation (65%).
- Significant majority of analyzed hospitals (85%) use small and middle-sized domestic companies as suppliers of technological innovations.
- Considering the quality management of analyzed hospitals, 85% of analyzed hospitals use quality management system and 60% are certified by an independent certification authority although it is not obligatory.
- Nevertheless, the quality certificate does not guarantee a quality of hospitals. In Slovakia, there are approximately 30 certificate authorities of different quality which may be or may not be accredited.
- As far as cooperation for innovation is concerned, 45% of analyzed hospitals have cooperated with some other subject (subjects of high importance: clients, suppliers, universities, institutes of professional capacities, and of medium or

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lower importance: other hospitals, advisory companies) in the past three years and 20% of non-cooperating ones would be interested in it.

- Main goal of hospital's cooperation with some other subjects are R&D and technical assistance (95% of hospitals are involved at least in one of mentioned types of cooperation).

Competitiveness and Cooperation for strategic advantage

- Strategic management of a hospital is the most important and the most complex management element. It is a means to improve competitiveness of a hospital. In order to implement it efficiently, a decision made by top management about a strategy of a hospital and its active implementation is necessary. A successful strategy implementation depends on strategic management and its principles.
- According to managers of analyzed hospitals, among the most significant challenges of hospitals in the 21st century, efficient strategic management (75% of hospitals), innovations (40%) and hospital processes efficiency (35%) are included.
- The most significant factors of efficient management are cost minimization (according to 85% of hospitals), ICT use (60%) and profit creation (40%).
- 45% of hospitals declare continuous accordance of their project activities with their strategy; in 50% of them the accordance is not always ensured.
- The most important factors improving the hospital's competitiveness of financial resources (70%), increase of flexibility (65%), decrease of costs of applications (55%) and IT management in a decentralized way (50%) are considered.

Information technology

- Current competitive environment requires high quality management systems and, consequently, from the point of view of data reception, elaborating and storage, high quality information systems.

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- Computers with Internet connection represent the majority (approximately 75% on average) of all computers in hospitals.
- The most commonly used type of printer in the analyzed hospitals is laser printer.
- Analyzed hospitals use Microsoft Office; moreover, 50% of them also use free software Open Office.
- As far as software in general is concerned, 100% of hospitals use software for accounting, 60% of them for both hospital management and human resources management, 55% of hospitals use software applications for purchasing and sales management and inventories management.
- For IS of hospitals and web application, a necessity to work with large data files is typical. In order to save and use them efficiently, it is useful to create databases.
- 70% of analyzed hospitals use a central database; moreover, analyzed hospitals use databases mainly within outpatient department (85% of hospitals), financial department (75%), patients' reception (70%), clinical laboratories (also 70%) and preparation of medical reports (60%).
- In medical institutions, the outsourcing is often used to carry out services, such as catering, laundry, cleaning, disinfection services etc. However, it is not commonly used by analyzed hospitals; only 20% of them use it for e-learning, 15% of them for telecommunication services and 10% of them for help-desk.
- Considering the storage devices, the most prevalent technology is RAID (90% of hospitals) assuring larger capacity, data availability and reliability of storage.
- As far as network and telecommunication technologies are concerned, 75% of hospitals use wireless connection and remote access, 65% of them apply DSL, 60% of them use VPN,
- Among security technologies, widely used antivirus (in 100% of hospitals), firewall (85%) and net security software (50%) dominate. However, regarding high number of hospitals (45%) without any information security plan, security measures do not seem to be sufficient in all analyzed hospitals.

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- Considering management systems in analyzed hospitals, 80 % of the hospitals prefer asset management software, 70 % financial software and 70 % applications for PC. Low number of hospitals using HR software, ERP systems, logistic applications, BPM and CRM systems can be considered as negative.

e-Commerce

- At present, in time of informatization of many various activities in life, traditional ICT such as Internet and email are used by all the hospitals. 100 % of them also use intranet, 55 % have extranet and 70 % WAP.
- In almost a half of analyzed hospitals (45%), 60-70% of employees use computers within their work routine, in 25% of hospitals more employees use computers and in 30% of them the share of employees using computers in their daily routine is lower.
- In 30% of hospitals 40-50% of employees use computers within their work routine, in 25% of hospitals 60-70% employees use computers and in 25% (20%) of them the share of employees using computers in their daily routine is higher (lower).
- For the Internet connection, 45% of hospitals use modem, 35% of them radio communication or ISDN, respectively, and 25% use XDSL.
- Analyzed hospitals mainly use Internet to search for information and to recruit staff (100% of them), to buy and use financial services (95%), to communicate with public institutions (85%) and to monitor the prices on the market (65%).
- Each of analyzed hospitals has its own website; 70% of hospitals use their website to present their products and services and 75% adjust their websites to clients.
- Internet purchases are conducted by 50% of hospitals, Internet sales are realized by 40% of them.
- e-Commerce in general offers many potential advantages for organizations, individuals and society as a whole. 90% of hospitals consider cost minimizing

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an advantage of the highest importance of e-purchases; however, only 20% of hospitals reported their results of applying e-commerce as good.

- 88% of hospitals conducting e-sales consider acquisition of new customers an advantage of the highest importance; however, only 50% of them reported their achieved results to be good.
- 75% of hospitals conducting e-sales consider improved image of a hospital and service improvement advantages of the highest importance, however, only 38% of them reported their achieved results to be good.
- Within e-commerce, the highest expenditure items are stated to be in creating web pages (30% of hospitals), software (50% of hospitals) and databases (50% of hospitals). With regard to the maintenance of e-commerce system, most hospitals (80%) indicate 10% of their total e-commerce expenditures to be used for telephone, database maintenance and other elements. 60% of hospitals spend 40% of costs for maintenance of their web pages.
- Considering the barriers of e-commerce, 100% of involved hospitals consider unsuitability of hospital products for Internet sale the most important reason. Another very important barriers are high costs of creation and maintenance of e-commerce system (50% of hospitals involved in e-commerce), issues connected to existing sales channels (40%), uncertainty in contracts, security problems (both 30%) and non-readiness of clients (20%).
- Analyzing the barriers of Internet use, 50% of hospitals consider it wasting of time and 45% stated high costs as a significant barrier of using the Internet. 80% of hospitals see problems in insufficient security and slow communication per Internet.
- Regarding the use of ICT in general, 25% of hospitals consider very high costs and frequent software upgrades very important barriers of ICT utilization. Moreover, 55% of hospitals consider insufficient employees' qualification and 40% consider unwillingness of employees and nonexistence of ICT strategy important barriers.

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Telemedicine

- Telemedicine represents use of telecommunication and information technologies in order to provide medical services at a distance. Telemedicine represents a part of e-Health involving active clinical treatments.
- 10% of analyzed hospitals use telemedicine.
- 40% of hospitals intend to invest in telemedicine within an upcoming year.
- In general, despite limited use of telemedicine in analyzed hospitals, Slovak health care sector has been in the process of e-Health implementation at present.

Approach to clients

- An important element of a process of strategy creation is the client. A client must stay in a center of attention if hospital intends to improve its competitiveness.
- However, 50% of hospitals do not use any structure (CRM, questionnaires etc.) of customers' care,
- When in possession of a system of customers' care, 50% of hospitals apply the CRM, 20% of hospitals use regular clients' visits and satisfaction questionnaires,
- Applied organized structure of customers' care or not, 60% of hospitals pay attention to and evaluate clients' satisfaction regularly.
- 80% of the hospitals are interested in safety deficiencies pointed out by customers.
- Despite all the above mentioned facts 75% of hospitals believe that their customers' care is sufficient.

Quick Prototyping of Health

- At present, specialized devices to gain measured data have been used more and more often in a health care sphere.

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- 15% of analyzed hospitals use 3D technologies (all university hospitals and none public hospital involved in the research), 70% of them are interested in the use of them.

Waste management

- Waste management is an important element of hospitals' management. It is necessary to put emphasis on a reduction of the amount and harmfulness of waste produced, reusing and recycling.
- 90% of hospitals have waste management plan, 5% of them dispose of a partial one.
- 25% of hospitals implement trainings on waste management every six months, 25% of hospitals every year, and 10% of hospitals as needed.
- Specifications of each hospital, range of provided services, architectural terms, the amount and types of waste produced should be considered by a choice of appropriate methods of waste management. Trend in the world is moving to a search for suitable alternatives, particularly in environmental and cost-effective waste management. This fact is in accordance with "sorting" as a dominant stage of waste management in 85% of analyzed hospitals.

3 Conclusion

At the present time management of health care facilities is increasingly demanding and complicated process. Improving the process of strategy making in health care organizations in Slovakia requires early identification of positive and negative effects of existing development and exploitation of new opportunities to create to create higher customer value.

Form and content of the strategy greatly depends on the type and ownership of hospital. Projects funded by EU structural funds also have a significant impact on the process of hospital's strategy creation. Through targeted projects EU structural funds enable to support healthy growth of the elderly, e-Health, cross-border cooperation, various innovative activities in health and also implementation of information technologies.

Effective strategic management expects process managed medical institution. Results from the survey indicate that analyzed hospitals declare availability of quality management certification (through ISO 9001:2008 and Environmental Management System ISO 14001:2004) to a significant extent. Benefits of established quality management system are particularly evident in improved strategic planning, improved clinical outcomes, improvement of the managerial and operational efficiency etc. Whereas this process is relatively complicated because of time and sources (human resources, financial costs of the certification process, etc.), it appears that the support of certain phases of the certification process (e.g. processing of quality documentation, internal audit and the pre-certification audit, etc.) through BPM solutions could be very rewarding.

Analyzed hospitals use e-commerce only to a limited extent. ICT and e-business skills have been identified and confirmed by the European Commission to be critical barriers for its development. However, from respondent's point of view, inappropriateness of hospital products for online sale is seen as the most important barrier resulting in the small use of e-business. Higher awareness of concerned workers about the potential use of electronic commerce would be helpful. It can be suggested

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that the effective use of e-commerce is not affected by the price or size of organization, but rather by the ability of organization and the responsible managers to decide about investment into the project of implementation and use of e-commerce. An effective instrument leading towards more intensive use could be the support and increase in attractiveness of the relevant disciplines, specializing in ICT and e-business.

Innovations are the key features of development of ICT in health care organizations and represent a platform for its competitive advantage. Within the innovation of processes which were originally oriented on technological innovation systems, the so called organizational innovations have been separated. The reason is the fact that hospitals can execute innovations of their processes not only through new technologies, but also via administrative changes.

As shown by the results of the research the most relevant barrier (95 % of hospitals) for the introduction of technological innovations in hospitals identified by hospitals themselves is the lack of financial and staff resources. Any introduction of new technologies, whether it is implementation of new IT solutions or modernization of existing processes and reconstruction, requires interventions in individual organizational units and completion of knowledge of participating personnel, which implies further expenses. Installing of IT solution to IT system also requires constant tuning and maintenance of the systems.

Priorities of hospitals in the area of technological innovation are devoted to use of databases of clients, to area of informatization and automation of hospital units. The reason is a basic requirement of effective hospital information system. It is assurance that clinical, managerial and administrative activities at all levels of the hospital dispose of actual and complex information. The concept, designing, implementation and operation of the HIS must be linked to hospital activities and its functions, to the current flow of information and links connected to the external environment. The aim of hospitals is to have such a management system that would facilitate, improve and increase the reliability of operations and contribute to the possibilities of optimizing ratio of performance and costs.

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Reported aspects are closely related to every hospital's effort to be flexible depending on the rapid development of ICT technologies. Analyzed hospitals have focused on two categories of technological innovations into which they are planning to invest the largest sums - categories of economic and management processes and hospital and health information systems.

Trends in the IS/IT area direct to higher use of telemedicine, which more and more institution plan to utilize. Moreover, architecture of open information systems is used more and more frequently. In order to solve the problem of lack of resources, hospitals must apply innovations in organization and structure, in use of available resources, system financing etc. They have the potential to reduce health care costs and improve quality of care. Furthermore, hospitals must exchange rigid, long-existing organizational structures and norms of behavior for flexible and easily changeable forms and interconnected networks. The importance of interconnection of selected structural forms is rising constantly. In the process of customer's care, analyzed hospitals use mostly CRM system (Customer Relationship Management). This concept is based on three attributes: human resources, technology tools and process dynamic structure. Implementation and using of CRM also means rising the pressure on increase in labor efficiency, flexibility in adapting to changes in the external environment, early revision of hospitals strategies etc.

Each health care organization must dispose of certain level of adaptability enabling to adapt also to negative impacts of external environment. This adaptability is possible if the hospital performs regular diagnostic of quality and efficiency of its operations, where the evaluation of the use of ICT is an important part.

Research report as presented managed to analyze health care organizations, to describe use of ICT in different areas of their activities and to determine the optimal strategic objectives and their values. In practice, it is often the case that although a hospital achieves its strategic objective, it is insufficiently ambitious to increase its performance. Moreover, certain hospitals never reach their strategic goals because of over-ambitiousness and imperfect analysis of actual situation. It can be suggested that presented analysis of current state of using ICT in hospitals should encourage

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researchers to design more ambitious follow-up projects aimed at constant improvement of efficiency and effectiveness of ICT and performance of the whole organization.

Bibliography

- [1] BALLONI, A.J. , GESITI Project, “AN EVALUATION OF THE MANAGEMENT INFORMATION SYSTEM AND TECHNOLOGY IN HOSPITALS” (GESITI/HOSPITALS).[online] Updated November 2011 03/06/2012]. On the Internet:
http://www.cti.gov.br/images/stories/cti/atuacao/dtsd/gesiti/gesiti_project_hospital_s.pdf
- [2] BASL, J. et al. 2011. Inovace podnikových informačních systémů. Praha: Professional Publishing, 2011, 150 p. ISBN 978-80-7431-045-4
- [3] BRYNDOVÁ, L. et al. 2009. Czech Republic: Health System Review. In: Health Systems in Transition. 2009, Vol. 11, No. 1.122 p. ISSN 1817–6127.
- [4] CHLEBOVSKÝ, V. 2005. CRM Řízení vztahů se zákazníky. 1. vyd. Brno: Computer Press, 2005, p. 190. ISBN 80-251-0798-1
- [5] DELINA, R. – VAJDA, V. – BOLHA, J. 2008. Teória a prax elektronického obchodovania. [Theory and Practice of e-Commerce] Košice: TU EkF, 2008. 170 p. ISBN 978-80-969953-3-2
- [6] DRUCKER, P. F. 2001. To nejdůležitější z Druckera v jednom svazku. 1. vyd. Praha: Management Press, 2001, p. 293. ISBN 80-7261-066-X
- [7] EMARK. 2010. Problematika analýz a spracovania veľkého objemu dát. [online] [11/08/2010]. On the Internet:
<http://www.prorecks.sk/tl_files/tiny_templates/emark_analyzy_a_spracovanie_u_dajov.pdf>
- [8] e-Health: Vlastný materiál [online] [11/15/2011]. On the Internet:
<http://www.ezdravotnictvo.sk/swift_data/source/profesional/dokumenty/strategicke_dokumenty/vlastny_material.pdf>
- [9] e-Health: e-Health brožúra [online] [15/11/2011]. On the Internet:
<http://www.ezdravotnictvo.sk/swift_data/source/profesional/dokumenty/publikacie/e-Health_brozura.pdf>

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- [10] e-Health: e-Health elektronizácia zdravotníctva [online] [20/01/2012]. On the Internet:
<http://www.ezdravotnictvo.sk/swift_data/source/prezentacie/e-Health_elektronizacia_zdravotnictva.pdf>
- [11] e-Health: Infraštruktúra a dátové centrum [online] [25/03/2012]. On the Internet:
<http://www.ezdravotnictvo.sk/Program-e-Health/PieH/Podporne-projekty-e-Health/Stranky/Infrastruktura--a-datove-centrum.aspx>
- [12] eTrend: Penta skupuje regionálne nemocnice. 2011. [online].[26/11/2012]. On the Internet: <http://firmy.etrend.sk/firmy-nefinancny-sektor/penta-skupuje-regionalne-nemocnice.html>
- [13] DRAGULA, M. 2010. Prečo systém manažérstva kvality aj v zdravotníctve? [online] [11/08/2010]. On the Internet:
www.lekom.sk/files/media/80_Precu_QMS_v_zdravotnictve.ppt
- [14] EUROSTAT: Data on GDP, inflation, foreign trade, unemployment, public deficit. [online].[18/05/2012]. On the Internet:
<http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/>
- [15] FISHER, R. A. 1922. On the interpretation of χ^2 from contingency tables, and the calculation of P. In Journal of the Royal Statistical Society 85 (1). 1922, 87–94.
- [16] FOCUS. 2002. Public Opinion Survey. FOCUS. 2002
- [17] GAVUROVÁ, B. 2010. Meranie výkonnosti v organizáciách s dôrazom na aplikáciu systému Balanced Scorecard. 1. vyd. Košice : Technická univerzita, 2010, 188 p. ISBN 978-80-553-0437-3
- [18] GAVUROVÁ, B. 2012. Aplikácia vybraných podporných nástrojov v problematických fázach systému Balanced Scorecard. 1. vyd. Technická univerzita v Košiciach, 2012, 113 s. ISBN 978-80-553-0847-0.
- [19] GAVUROVÁ, B. – SZABO, S. 2011. Meranie výkonnosti v zdravotníckych zariadeniach na Slovensku. In: Výkonnosť organizácie: Prístupy k zvyšovaniu výkonnosti organizácie : zborník príspevkov z medzinárodnej vedeckej konferencie: 22. - 23.9.2011, Nový Smokovec. - Poprad : Výskumný ústav ekonomiky a manažmentu, 2011, s. 139-149. ISBN 978-80-970458-3-8

RELATÓRIO TÉCNICO DE PESQUISAS DO PROJETO GESITI HOSPITALAR.

PROJETO GESITI/HOSPITALAR.

An Evaluation of the Management of the Information Systems (IS) and Technologies (IT) in Hospitals: The Region of

the Technical University of Košice, Slovakia

- [20] GLADKIJ, I. a kol. 2003. Management ve zdravotnictví. [Management in Health Care] Brno: Computer Press, 2003, 379 p. ISBN 80-7226-996-8
- [21] HEALTH AT A GLANCE: Europe 2010 OECD.[online] [01/06/2012]. On the Internet:
<http://www.oecdilibrary.org/docserver/download/fulltext/8110161e.pdf?expires=1305730479&id=id&accname=guest&checksum=8E5013067EC2D633834D8D3B09C84520>
- [22] HLAVATÝ, T. et al. 2011. Správa o stave zdravotníctva na Slovensku [Report on a state of a health care sector in the Slovak Republic]. Bratislava: Ministerstvo zdravotníctva SR. 2011. 240 p. ISBN 978-80-969507-9-9
- [23] HOGGAN, D. 2002. Challenges, Strategies, and Tools for Research Scientists. In Electronic Journal of Academic and Special Librarianship [online]. 2002, Vol. 3, No. 3 [cit. 2003-01-10]. On the Internet:
<http://southernlibrarianship.icaap.org/content/v03n03/Hoggan_d01.htm> ISSN 1525-321X
- [24] Hospital Information System. [online] [25/03/2012]. On the Internet:
<http://fmph.uniba.sk>
- [25] IBM: Introduction to Storage Area Network. [online] [06/06/2012]. On the Internet: <http://www.redbooks.ibm.com/redbooks/pdfs/sg245470.pdf>
- [26] INFOSTAT: Slovak Republic population information. Bratislava: Infostat. [online].[18/05/2012]. On the Internet:
http://www.infostat.sk/vdc/sk/index.php?option=com_wrapper&Itemid=38
- [27] ISO 690-2: 1997, Information and documentation – Bibliographic references - Part 2: Electronic documents or parts thereof.
- [28] JAKUŠOVÁ, V. 2010. Základy zdravotníckeho manažmentu. Martin: Osveta, 2010. 142 p. ISBN 978-80-8063-347-9
- [29] JAŠŠO, R. 2011. Stav riešenia podporných projektov PieH [online]. Aktualizácia 14-11-2011 [25/03/2012]. 4 p. On the Internet: http://data.nczisk.sk/e-Health/nis_2011/jasso.pdf

RELATÓRIO TÉCNICO DE PESQUISAS DO PROJETO GESITI HOSPITALAR.

PROJETO GESITI/HOSPITALAR.

An Evaluation of the Management of the Information Systems (IS) and Technologies (IT) in Hospitals: The Region of

the Technical University of Košice, Slovakia

- [30] KAŽÍK, P. 2011. Program implementácie e-Health. Ministerstvo zdravotníctva SR. [online] [25/03/2012]. 12 - 13 p. On the Internet: http://data.nczisk.sk/e-Health/nis_2011/kazik_lomnica.pdf
- [31] KAŽÍK, P. 2012. Zmeny v Programe implementácie e-Health. Ministerstvo zdravotníctva SR [online] [cit. 2012-03-25]. 5 - 8 p. On the Internet: http://www.ezdravotnictvo.sk/Documents/Prezentacie/zmeny_implementacie.pdf
- [32] KLUCHO, J. 2009. Skutočná kríza v slovenskom zdravotníctve ešte len príde II. [online] [11/08/2010]. On the Internet: <http://klucho.blog.sme.sk/c/183721/Skutocna-kriza-v-slovenskom-zdravotnictve-este-len-pride-II.html>
- [33] LAGOZE, C. et al. 2004. The Open Archives Initiative Protocol for Metadata Harvesting. Protocol Version 2.0 of 2002-06-14. Document Version 2004/10/12T15:31:00Z 2004 [online] [10/11/2004]. On the Internet : <http://www.openarchives.org/OAI/openarchivesprotocol.html>
- [34] LINN, L. – GREENFIELD, S. 1982. Patient suffering and patient satisfaction among the chronically ill. In: Medical Care, No. 20, p. 425 – 431. ISSN 0025-7079.
- [35] MAP OF EUROPE: Europelink - Slovaquie. [online].[18/05/2012]. On the Internet: <http://www.europelink.eu/orient/slovaquie.htm>
- [36] MARMOT, M. – BOBAK, M. 2000. International Comparators and Poverty and Health in Europe. In: BMJ, 2000, Vol 321, p. 1124-1128.
- [37] MALLYA, T. 2007. Základy strategického řízení a rozhodování. 1. vyd. 2007. ISBN 978-80-247-1911-5
- [38] MANIS – NOVEKON. 2011. Riešenia pre zdravotníctvo. 2011. [online] [18/05/2012]. On the Internet: <http://www.novekon.sk/riesenia-pre-zdravotnictvo.html>
- [39] Ministry of Health of the Slovak Republic: Správa o vývoji dlhov v zdravotníctve. 2010. [Report on Development of Debts in Health Care Sector]. December 2010. [online] [20/05/2012] On the Internet: <http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=19624>

RELATÓRIO TÉCNICO DE PESQUISAS DO PROJETO GESITI HOSPITALAR.

PROJETO GESITI/HOSPITALAR: VOLUME I, ANO 2012.

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RELATÓRIO TÉCNICO DE PESQUISAS DO PROJETO GESITI HOSPITALAR.

PROJETO GESITI/HOSPITALAR.

An Evaluation of the Management of the Information Systems (IS) and Technologies (IT) in Hospitals: The Region of

the Technical University of Košice, Slovakia

- [40] MÜNZ, J. 2011. Informační technologie ve zdravotnictví. [Information Technologies in Health Care] Prague: České vysoké učení technické v Praze, 2011, 304 p. ISBN 978-80-01-04720-0
- [41] NATIONAL BANK OF SLOVAKIA (NBS): Data on FDI. 2012. [online] [18/05/2012]. On the Internet: <http://www.nbs.sk/sk/titulna-stranka>
- [42] NCHI: Health yearbook for the year 2007. Bratislava: National Centre for Health Information. 2008 [online] [01/04/2012]. On the Internet: http://data.nczisk.sk/rocnky/rocnka_2008.pdf
- [43] NCHI: Information on medical institutions. [online] [02/05/2012]. On the Internet: <http://www.nczisk.sk/en/Pages/default.aspx>
- [44] NEČAS, J. 1938: 20 let sociální péče v Československé republice [20 years of social care in the Czechoslovak Republic]. Prague: Ministry of Social Care. 1938
- [45] NIKLÍČEK, L. 1994. Systém veřejného zdravotnictví a nemocenského pojištění za první Československé republiky [The system of public health care and health insurance during the first Czechoslovak Republic]. Prague: Lidová Univerzita Akademie J. A. Komenského. 1994.
- [46] OECD: Health data 2010. Paris: OECD. [online] [11/05/2012]. On the Internet: <http://www.oecd.org>
- [47] OTTINGER, P. 2012: Čo prinesie transformácia nemocníc? [online].[11/06/2012]. On the Internet: <http://www.sksapa.sk/201109121652/Monitoring-m%C3%A9di%C3%AD/o-prinesie-transformacia-nemocnic.html>
- [48] PATRICK, D.L., SCRIVENS, E., CHARLTON, J.R.H. 1983 Disability and patient satisfaction with medical care. Med. Care, 21 1062-1075.
- [49] PENNY, W. – HENSON, R. 2006. Analysis of Variance. In K. Friston, J. Ashburner, S. Kiebel, T. Nichols, and W. Penny, editors, Statistical Parametric Mapping: The analysis of functional brain images. London: Elsevier, 2006.
- [50] PETRULAK, M. 2011. Integrácia manažérskych informačných systémov. [online] [11/08/2011]. URL: <www.emark.sk>

RELATÓRIO TÉCNICO DE PESQUISAS DO PROJETO GESITI HOSPITALAR.

PROJETO GESITI/HOSPITALAR.

An Evaluation of the Management of the Information Systems (IS) and Technologies (IT) in Hospitals: The Region of

the Technical University of Košice, Slovakia

- [51] PEŠEK, J. 2003. Tvorba systému jakosti ve zdravotnictví a lékárenství s využitím norem ISO. [Quality System Creation in Health Care Sector Using the ISO Norms] Prague: Grada Publishing, 2003, 107 p. ISBN 80-247-0551-6
- [52] PETRÍKOVÁ, A. – SABADKA, D. 2011. Knowledge Economy Impact on Innovation Management techniques. In: The 14th International Scientific Conference – Trends and Innovative Approaches in Business Processes “2011”. Košice: TUKE. 2011. p. 1-5.
- [53] PORUBSKÝ, J. 2011. e-Health v podmienkach slovenského zdravotníctva. Ministerstvo zdravotníctva SR, Actualization 25-10-2011[online]. [25/03/2012]. Dostupné na Internet: http://data.nczisk.sk/e-Health/itapa_2011/porubsky.pdf
- [54] QPR Software. 2008. GUIDELINES FOR IMPLEMENTING BALANCED SCORECARD. [online] [8/8/2008]. On the Internet: <http://www.impactline.net/%EC%9E%90%EB%A3%8C%EC%B2%A8%EB%B6%80%EB%AC%BC/BSC/QPRGuidelinesImplementingBSC.pdf>
- [55] QPR Software. Moderné softvérové nástroje pre podporu riadenia. [online] [8/8/2011]. On the Internet: http://www.emark.sk/images/stories/qpr/emark_qpr_podniky_v2.pdf
- [56] REGIONAL DATABASE OF THE STATISTICAL OFFICE OF THE SLOVAK REPUBLIC: Regional Database of the Statistical Office of the Slovak Republic: Data of the Košice and the Prešov region. [online] [01/05/2012]. On the Internet: <http://px-web.statistics.sk/PXWebSlovak/>
- [57] ŠOLTÉS, V. – GAVUROVÁ, B. – BALLONI, A. J. – PAVLIČKOVÁ, V. 2012. ICT in Medical Institutions in Selected Regions of the Slovak Republic. Research report of the GESITI Project: An Evaluation of the Management of the Information Systems (IS) and Technologies (IT) in Hospitals. Center for Information Technology Renato Archer – Ministry of Science, Technology and Innovation, Brasil. 2012.
- [58] SLÁVIK, Š. 2005. Strategický manažment. 1. vyd. Bratislava: Sprint vfra, 2005, p. 403. ISBN 80- 89085- 49-0

RELATÓRIO TÉCNICO DE PESQUISAS DO PROJETO GESITI HOSPITALAR.

PROJETO GESITI/HOSPITALAR.

An Evaluation of the Management of the Information Systems (IS) and Technologies (IT) in Hospitals: The Region of

the Technical University of Košice, Slovakia

- [59] SANIGEST INTERNATIONAL EVALUATION OF HOSPITALS, Slovakia, 2004. Bratislava: Ministry of Health. 2004
- [60] SODOMKA, P. - KLČOVÁ, H. 2010. Informační systémy v podnikové praxi. [Information System in Company Practice] Brno: Computer Press, 2010, 501 p. ISBN 978-80-251-2878-7
- [61] SOUČEK, Z. - BURIAN, J. 2006. Strategické řízení zdravotnických zařízení. [Strategic Management of Medical Institutions] Prague: Professional Publishing, 2006. 196 p. ISBN 80-86946-18-5
- [62] STATISTICAL OFFICE OF THE SLOVAK REPUBLIC: Census 2001. Bratislava: Statistical Office of the Slovak Republic, 2002.
- [63] STATISTICAL OFFICE OF THE SLOVAK REPUBLIC: Data on number of hospitals in the Slovak Republic 2009. Regional database [online] [06/06/2012]. On the Internet: <http://portal.statistics.sk/showdoc.do?docid=96>
- [64] STATISTICAL OFFICE OF THE SLOVAK REPUBLIC: Data on population and area of the Slovak Republic, GDP, nominal wage. [online] [18/05/2012]. On the Internet: <http://www.statistics.sk/>
- [65] SZALAY, T. et al. 2011, Slovak Country Study.
- [66] SZALAY, T. 2008. Zmena prerozdelenia: náklady prevyšujú prínos. Changes in risk adjustment. The costs outweigh the benefits]. In: Into Balance. Oct. 2008
- [67] SZALAY, T. et al. 2011. Slovakia: Health System Review. In: Health Systems in Transition. 2011, Vol. 13, No. 2. 174 p. ISSN 1817–6127
- [68] SZALAY, T. et al. 2009. Slovenské zdravotníctvo 2009 – Dopady krízy. [Slovak Health Care Sector 2009 – Impacts of crisis]. Bratislava: Health Policy Institute. 2009. 94 p. ISBN 978-80-969907-4-0
- [69] STN ISO 690: 1998: Dokumentácia - Bibliografické odkazy - Obsah, forma a štruktúra.
- [70] ZÁKON č. 183/2000 Z.z. o knižniciach, o doplnení zákona Slovenskej národnej rady č. 27/1987 Zb. o štátnej pamiatkovej starostlivosti a o zmene a doplnení zákona č. 68/1997 Z.z. o Matici slovenskej.

RELATÓRIO TÉCNICO DE PESQUISAS DO PROJETO GESITI HOSPITALAR.

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**RELATÓRIO TÉCNICO DE PESQUISAS DO PROJETO GESITI
HOSPITALAR.
PROJETO GESITI/HOSPITALAR.**

An Evaluation of the Management of the Information Systems (IS) and Technologies (IT) in Hospitals: The Region of

the Technical University of Košice, Slovakia

- [71] TKÁČ, M. 2001. Štatistické riadenie kvality. Bratislava : Ekonóm, 2001. 313 s. ISBN 80-225-0145-X
- [72] T-SYSTEMS. 2012. Administrácia heterogénneho prostredia diskových polí SAN. [Administration of Heterogenic Environment of Disc Arrays SAN] [online] [25/05/2012]. On the Internet: <http://www.itnews.sk/tituly/infoware/2011-05-20/c139784-administracia-heterogenneho-prostredia-diskovych-poli-san>
- [73] TVRDÍKOVÁ, M. 2008. Aplikace moderních informačních technologií v řízení firmy. Nástroje ke zvyšování kvality informačních systémů. Praha: Grada Publishing, 2008. 173 p. ISBN 978-80-247-2728-8
- [74] VRÁBLOVÁ, K. 2012. Klasifikácia a separácia odpadov vznikajúcich v zdravotníckych zariadeniach. 2012. [online] [18/05/2012]. On the Internet: http://www.priateliazeme.sk/spz/files/Klasifikacia-odpadov_prirucka.pdf
- [75] VYHLÁŠKA č. 131/1997 Zb. Ministerstva školstva Slovenskej republiky zo 7. mája 1997 o doktorandskom štúdiu.
- [76] WOLLEY, F. R. - KANE, R. L. – HUGHES, C.C. - VRIGHT, D. D. 1978. The effects of doctor-patient communication on satisfaction and outcome of care. Soc. Sci. Med., 12, 123-128 p.
- [77] ZVÁROVÁ, J. et al. 2010. Data a znalosti v biomedicíne a zdravotníctví. 2010. [Data and Knowledge in Biomedicine and Health Care] Prague: Univerzita Karlova v Prahe. 427 p. ISBN 978-80-246-1805-0

RELATÓRIO TÉCNICO DE PESQUISAS DO PROJETO GESITI HOSPITALAR.

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Appendix

e-Commerce

Table 33 Purchases on e-Markets

		e-Purchases		
		Yes	No	Total
Legal form	Joint stock	1	0	1
	Non-profit	3	4	7
	Private limited	0	0	0
	Contributory	1	1	2
Owner-ship	Private	1	2	3
	Public	4	2	6
	University	0	1	1

Approach to clients

Table 34 A hospital is interested in clients' satisfaction

		Systematically	Irregularly	Total
Legal form	Joint stock	3	3	6
	Non-profit	5	2	7
	Private limited	2	1	3
	Contributory	2	0	2
Owner-ship	Private	2	6	8
	Public	3	5	8
	University	1	1	2

*18 hospitals have answered this question

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