Analysis of Information Literacy of Health Management in the Republic of Croatia

Biljana Marković, PhD. Student[1*], Prof. PhD. Marin Milković[2]

University North, Croatia
bimarkovic@unin.hr

Abstract:

Today, it can be heard that information and communication technology (ICT) acts as a support to management in business and it represents the primary level of information. ICT as a tool produces relevant information for decision makers.

The aim at this paper is to investigate whether the management in general hospitals is information-literate, i.e. whether it uses the information produced by ICT to make quality decisions.

Namely, management often sees ICT as a cost without appreciating the contribution of ICT through the awareness of trained employees, optimized business processes, satisfied patients all of which affects the increase in financial results.

Hypothesis: "Hospital management is not information-literate enough to appreciate ICT properly."

In the process of researching and finding answers in order to test the hypothesis, a questionnaire (the questionnaire was completed by board members, heads of services, department heads), focus group questionnaire analysis, available literature research and information literacy analysis with the case study method were used.

By analyzing the answers obtained in the survey and comparing them with the expected management behavior described in the literature, it was found that the hospital management is not sufficiently information-literate, i.e. it does not recognize the contribution of ICT to more efficient business.

The paper provides recommendations on how health management can recognize relevant information as well as how to collect, process, structure and distribute it to stakeholders with the help of ICT. If management does all this, then it governs with ICT and ICT really serves as a decision support.

Keywords: information and communication technology (ICT); health management; information literacy; governance of information and communication technology

1. Introduction

Over the last twenty years, computers and the availability of information have become an integral part of the healthcare system in Croatia. Information literacy in health care is a specialty that integrates health care, computer knowledge and the field of information system in the recognition, collection, processing and use of data and information in health practice, administration, management, education, research and dissemination of knowledge.

The aim of this paper is to point out the role and importance of information literacy for health system management. It is necessary for management to make effective and efficient decisions. These decisions can be such if the management governs information technology, ie creates the conditions for the information and communication technology to support decision-making.

2. Governing with information technology (how management could become information literate)

In order for information and communication technology [1] to support business management should answer the following research questions:

• Is information technology / are information systems (IT-IS) important to us in business? Why and to what extent do we need IT-IS?
• What is the business value of IT-/IS? What are the risks of using IT-/IS?
• What is the quality of service that IT-/IS offers?
• How to use IT-IS in the organization efficiently and optimally?
• What will can we do without IT-IS? How much to invest in IT/IS?
• What is the return on IT/IS investment?
• Is the current information infrastructure aligned with the business needs and objectives?
• Do we know how to identify priority IT-IS projects and can we assess their contribution to business?
• Can our information infrastructure meet future business needs?
• What IT-IS mission, goals, strategies and architecture are necessary for IT-IS to support business?

In other words, management should manage ICT at the level of the institution, i.e. it should *govern information and communication technology.* The aim of this paper is to show how this can be implemented.

Governing information technology is a set of techniques and methods whereby the top management fully understands and controls the application of ICT in business, but also takes responsibility for the implementation of information processes and all activities.

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Governing ICT means:
- adoption and implementation of ICTstrategy
- firm connection between the business strategy and ICT strategy, i.e. determination of the optimal role of ICT in business
- adoption of metrics that measure the impact of ICT on business and measuring the business value of ICT
- organizational and comprehensive management of information risks
- effective management of IT projects and investments and
- responsibility for the effectiveness of the IT control system.

Governing information technology includes:
- a connectivity business strategy and IT strategy (**Strategic Alignment**)
- ICT as a function that creates new value (**Value Delivery**)
- optimal investment and good management of critical IT resources: people, network, data, applications, projects, infrastructure (**Resource Management**)
- understanding and managing organizational risk, (*corporate appetite for risk);* should create a system of continuous monitoring level of risk, determine counter measures to avoid or minimize risks (**Risk Management**)
- performance of operations and performance measurement - implementation of strategies, projects, performance monitoring of business processes and / or services, etc. (**Performance Measurement**)

3. How to govern with information technology

There are different frameworks or "good practices" [2] for mastering information technology by health management. This paper will present one of the frameworks with which information technology can be mastered COBIT (Control Objective for Information Technology), version 4.0. The method for mastering information technology presented here is therefore COBIT 4.0.

COBIT is an information technology management framework with the following aims:
- information technology should be a strategic partner in business
- information technology should enable gradual integration of business, new business opportunities, quick adaptations to changes and reactions to new business challenges
- information technology must provide management with information that will enable it to operate more efficiently and effectively.

COBIT [3], [4], [5]is the acronym for **C**ontrol **Obj**ective for **I**nformation and related **T**echnology. It was created in 1992 under the auspices of two organizations: the Information Systems Audit and Control Association (ISACA) and the IT Goverment Institute (IGI). COBIT provides managers, supervisor and information technology users with a set of measures, indicators, processes and examples (best practice) that help them make the most of

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information technology as well as to develop appropriate management and control of business processes in their organizations.

COBIT offers a chance for the ICT department to be not only a provider of information services but also a strategic business partner. The key role of COBIT is to provide control of all processes related to information technology, to be directed towards the constant checking and safety performance. The goal of COBIT is the management of business services. This should solve the so-called surplus of information technology i.e. underutilized ICT, on the other hand should ensure that information technology can support the demands of the business system (it should mitigate any information technology deficit).

3. 1. Basic features of COBIT 4.0

COBIT 4.0 supports of information and communication technology (ICT) governance, ie business process management (ICT governance) by providing a framework within which to present domains, processes and activities in a usable and logical manner. It consists of four basic domains and 34 processes within the domain. The domains are as follows:

Planning and organizing. This domain refers to the strategy and tactics, it defines the best manner in which IT can contribute to the achievement of business goals.

Acquisitions and implementation. The subject of interest here is the realization of the strategy. ICT solutions are defined, developed and enriched, implemented and integrated into the business process.

Delivery and support. This domain refers to the delivery of required services, which includes the delivery itself, security and continuity management, customer service support, data management, and operational services.

Monitoring and evaluation. Over time, each ICT process needs to be controlled to establish whether it works according to the user requirements. Within this domain, performance is managed, internal control is monitored, and processes are regulated.

Through these four domains and 34 processes within these domains, COBIT achieves its purpose, which is to support the realization of business services. However, in addition to being process-oriented, COBIT is business-focused, control-oriented, and measurement-driven. The focus of COBIT on business means that it is not just a tool for ICT service providers, users and controllers, but also a clear guide for *managers and business process owners*. This is because quality information is crucial for decision making, and information management and control are at the core of COBIT. COBIT ensures that information is effective, efficient, confidential if necessary, accessible, legal, secure and verified. COBIT is focused on control through *control goals* that ensure the quality of each of the 34 processes. In addition to goals that apply only to a specific process, there are also global goals that apply simultaneously to all processes in all domains. COBIT is driven by measurements. This means that performance measurements of goals and processes are applied within COBIT. Specifically, the CMM (Capability Maturity Model) model is used to determine the level of maturity of a particular ICT process in order to determine the state in which the process is currently as well as the need for improvement. There is the initial level and five further stages of maturity. These are: initial /

ad hoc phase, repetitive but intuitive, defined process, manageable and measured and optimized phase.

The basic COBIT [2] principle is as follows: investments in ICT resources are initiated on the basis of the business requirements. ICT resources are used in ICT processes. ICT processes deliver business information. This business information responds to customer requirements. Through this principle, it supports the basic areas of business management: *strategic alignment* (the link between the business and ICT plan; defining, maintaining and evaluating ICT values, harmonizing ICT and business operations), *value delivery* (ensuring that ICT delivers information valuable for business, and in accordance with the strategy), *resource management* (optimal investment in resources), *risk management* (requires awareness of the existence of risk by management, there must be understanding of the need for risk because without it there is no progress, agreement on significant risks, defining responsibility for risks in the organization), *performance measurement* (monitors the implementation of strategies, project execution, resource use, process execution and delivery of ICT services; the Balanced Scorecard (BSC) method is used for monitoring).

The concept of goal in COBIT is crucial. There is a hierarchy of goals here. At the highest level is the business goal. It is achieved through ICT goals. Every ICT goal is realized through the achievement of process goals. Each process goal consists of a series of activity goals. The indicator of the achievement of each goal in COBIT is called the measure of results (in earlier versions it was called the key indicator of the goal). The scale of results shows whether a goal has been achieved or not. It is always used after an event. Performance indicators (formerly key process indicators) are also linked to the goal and its achievement. Performance indicators show whether there is a chance that a goal will be achieved. It actually shows the ability of a process to achieve a goal, so it is sometimes called the driver of performance (in BSC, for example).

Due to the hierarchy of goals, the same thing that was a measure of results at a higher level becomes an indicator (driver) of performance at a lower level.

In COBIT, each ICT process has a specific display structure. There are four parts to the display:

- First part **:**
  - information criteria are shown (what information must be)
  - which business requirement the ICT process satisfies
  - the gaals whereby the ICT process satisfies the business requirement
  - what activities are carried out by the ICT process to achieve the goal
  - how goal achievement is measured
  - the business area within the business management which ICT process primarily processes, and the secondary supports
  - what ICT resources the process uses to achieve the goal
- Second part:
  - contains control objectives for achieving the purpose of the IT process
- Third part:
  - contains inputs to and outputs from the processes (these are activities from different domains)

○ a so-called RACI matrix that shows which activities make up the IT process and who is responsible for a particular activity, who is counted on, who is consulted and who is informed (**R**esponsible, **A**ccountable, **C**onsulted, **I**nformed)
○ the RACI matrix also shows the functions needed to fulfill the purpose of the IT process (management, head of ICT, executive director, manager, employee, project manager…)
○ the objectives in a hierarchical relationship and metrics for measuring achievement

Example of a RACI matrix:

RACI Chart — Activities	CEO	CFO	Business Executive	CIO	Business Senior Management	Head Operations	Chief Architect	Head Development	Head IT Administration	PMO	Compliance, Audit, Risk and Security
Determine risk management alignment (e.g., assess risk).	A	R/A	C	C	R/A	I					I
Understand relevant strategic business objectives.		C	C	R/A	C	C					I
Understand relevant business process objectives.				C	C	R/A					I
Identify internal IT objectives, and establish risk context.					R/A		C	C	C		I
Identify events associated with objectives (some events are business-oriented [business is A]; some are IT-oriented [IT is A, business is C]).	I			A/C	A	R	R	R	R		C
Assess risk associated with events.				A/C	A	R	R	R	R		C
Evaluate and select risk responses.	I	I	A	A/C	A	R	R	R	R		C
Prioritise and plan control activities.	C	C	A	A	R	R	C	C	C		C
Approve and ensure funding for risk action plans.		A	A		R	I	I	I	I		I
Maintain and monitor a risk action plan.	A	C	I	R	R	C	C	C	C	C	R

A **RACI** chart identifies who is Responsible, Accountable, Consulted and/or Informed.

- Part four:
  ○ the ICT process maturity model according to CMM [2], [12], [13] model (5 levels)

The process does not exist. The management is not information-literate. The organization does not take into account the consequences of information literacy to business (a consequence of vulnerability and uncertainty of projecting and this). Information literacy has not been identified and as risk i.e. something essential for the realization and delivery of ICT services.

The process is in the initial phase (ad hoc). The need for information literacy is observed on a case-by-case basis. There is an informal assessment of the level of information literacy depending on the project and the project manager. Assessment sometimes exists, but

is not a formal task for managers. Specific risks of information illiteracy such as security, availability, integrity are sometimes examined. Information literacy is rarely mentioned at a board meeting. There is awareness that the risks associated with insufficient information literacy of management are dangerous and that they should be seriously considered.

The process is in a repetitive but intuitive phase. There is a developed approach to assessing information literacy at the project level and is dealt with by project managers. Risk management of insufficient information literacy of management is applied only in large projects and reactively, i.e. in response to a problem. There are procedures for information literacy through the process of lifelong learning.

The process is defined. The organization defines the management of the information literacy process, method of assessment and time of performance. Information literacy management follows a certain procedure that is documented. There is training available to the staff. The process of reducing the risk of information illiteracy is defined. Responsibility for information literacy of management is built into the job description.

The process is manageable and measurable. Information literacy assessment is a standard procedure. Exceptions to the information literacy management procedure are reported to the quality management assistant. Managing the information literacy process is the responsibility of management. Management considers risk reduction strategies.

The process is optimized. The process of information literacy is structured, expanded in all segments of the organization, the processes are well defined and managed. Good practices are applied throughout the organization. The coverage, analysis and reporting of information literacy is highly automated. There are guides to information literacy. Management continuously evaluates information literacy strategies.

3. Information literacy and health system management

Information literacy [6], [7], [8], [9], [10], in the narrow sense, is the ability to recognize the need for certain information, to find information, to structure it (place it in relation to each other) as well as to create new knowledge and forward information to those who need it. The tool with which health management achieves its information literacy is an integrated information system that supports business processes within medical institutions (eg. hospitals) and business processes between different information systems.

Information literacy, in the broader sense, as described by Anemaree Lloyd [11] is information landscape consisting of social space, physical space and space dealing with the level of knowledge (intersection of truths and beliefs).

The space that deals with the level of knowledge is based on information that is true, provable and objective. These are the rules, the laws that apply in everyday life.

The social space is filled with intangible information that is not written down. These are social norms, conventions, practices that are observed in certain environments.

Physical space is filled with information that we give to the environment with our own body (appearance and gestures, for example).

All of the three described spaces are intertwined and must be viewed as a whole for a person to be declared information-literate.

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From this perspective, how can we know if a healthcare manager is information-literate? Formal education alone is not enough. It covers only the space that deals with the level of knowledge (so-called *epistemiology*). The manager should:

- have a formal education in management (*space dealing with the level of knowledge this can be obtained throughout formal education*)
- have "intangible" knowledge about the employee's habits and reactions to criticism/praise, the way employees think, about organizational culture (*social space this is the knowledge that the manager acquires through time, ie experience*)
- be able to recognize the physical reactions of employees; based on reactions, be able to recognize whether everything is fine or not (*physical space knowledge can be gained partly throughout formal education, but practice is also necessary*)

According to Lloyd's approach, an information-literate manager must be able to access information, assess its value, make correct conclusions based on the information obtained and share the information obtained (information literacy in the narrow sense) *but all this must be achieved knowledge but also the social and physical space of employees. Information-literate managers have to know the social habits and physical reactions of employees.*

Information literacy in the narrow and broader sense is the basis for governance with information and communication technology and this is again necessary for the establishment of the conditions for information and communication technology to be support decision-making. Health management should aim for efficient and effective management with the aid of information and communication technology. For that, it is necessary to be information-literate.

Managing a health system [15], [16] as one large, complex system is very challenging and requires many managerial skills, the most important of which are: human resource management, quality communication skills, information management, motivation, financial management and strategic planning. All of these skills require management of information literacy.

The question that arises is what the state-of-play is today? Do health care managers possess these skills? This should definitely be investigated.

4. Research and results

The area that studies the importance of information literacy of management in health system management is insufficiently researched. It is necessary to determine the readiness of health management to be information literate and master information technology. This is necessary in order to define the current situation and to suggest improvements based on it. The current situation will be described by the so-called CMM (Capability Maturity Model), ie the Maturity Model for the determination of the level of information literacy of *management and their governance of information technology.*

The aim of the research is to determine the degree of the maturity of health management so that is can become information literate and govern information technology. Research was conducted in four general hospitals.

The research method used was a survey conducted by means of a questionnaire. The same questions were asked to all respondents. Three groups of management were interviewed: the boardsof the general hospitals, the middle management (heads of services, department heads) and the CIO (chief information officer). The survey was based on four domains of COBIT 4.0. The first two domains (*Planning and organizing; Acquisitions and implementation*) reffered to the members of the management of the hospital (the Board and middle management), while the other two (*Delivery and Support, Monitoring and Evaluation*) focused on the heads of IT (CIO). The average number of affirmative answers was calculated for each question. Based on this, a level of maturity was assigned for each percentage obtained. Finally, the level of maturity was determined on the basis of the average maturity for each question.

With the survey we examined the process of computerization. Computerization is the process of planning, analysis, design of ICT support, implementation and maintenance activities within the same organization.

In this sense, the readiness of management to recognize the importance of computerization was examined. The willingness of management to recognize the importance of computerization also shows the degree of their computer and information literacy.

The questions from the survey which was conducted in the hospital are the shown in Table 1. The same questions were posed to the top and middle management, as well as to the CIO.

The answers show that top and middle management have not governed with ICT. Their answers are also shown in Table1.

			% of affirmative answers Board	Level of Maturity – Board (N=16)	% of affirmative answers Middle management	Level of Maturity – Middle management (N=78)	% of affirmative answers CIO	Level of Maturity – CIO (N=4)
Planning and organization	1.	Does ICT play a role in decision-making?	31	2	37	2	27	2
	2.	Is the information you receive from the system of sufficient quality (reliable, complete and accessible)?	40	2	39	2	57	3
	3.	Is the information system you are using standardized (comparable to others) and as such better support to decision-making?	41	3	40	2	66	4
	4.	Do you think that ICT should play an important role in the organization?	23	2	31	2	21	2
	5.	Is there collaboration between IT and other parts	50	3	57	3	50	3

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		of the organization?					
	6.	Is financial viability taken into account when investing in ICT?	67	4	66	3	21	2
	7.	Is the financial plan of computerization an integral part of the financial plan of the entire organization?	78	4	64	3	23	2
	8.	Does management discuss ICT?	20	1	37	2	10	1
	9.	Is your organization learning?	23	2	36	2	17	1
	10.	Are your employees computer literate? Do they know how to use applications, ICT system in a satisfactory way?	27	2	33	2	32	2
	11.	Do ICT products meet customer needs?	32	2	43	3	57	3
	12.	Have your risks in relation to computerization been assessed?	36	2	44	3	68	4
	13.	Are risks in computerization managed?	20	1	31	2	19	1
	14.	Do you manage ICT projects?	41	3	50	3	60	3
Monitoring and evaluation	15.	Is the quality of your ICT service (application) monitored?	30	2	45	3	84	5
	16.	Do you have defined parameters that are monitored when evaluating the quality of ICT performance?	17	1	20	1	77	4
	17.	Do you have control mechanisms in place to protect IT assets from destruction?	23	2	25	2	56	3
	18.	Do you make sure that ICT services comply with laws, regulations and business policies?	40	2	41	3	71	4

			% of affirmative answers Board	Level of Maturity – Board (N=16)	% of affirmative answers Middle management	Level of Maturity – Middle management (N=78)	% of affirmative answers CIO	Level of Maturity – CIO (N=4)
Aquisition and implementation	19.	Do you develop solutions yourself?	3	1	5	1	10	1
	20.	Do you have a maintenance contract (SLA, etc.) with your partners with precise definitions of the partners' obligations?	73	4	50	3	80	4

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	21.	Does the outsourcing partner respond to your requirements to your satisfaction?	50	3	51	3	40	2
	22.	Is the support response time satisfactory?	49	2	57	3	59	3
	23.	Do you have enough resources for a quality IT service (to make it continuous)?	45	3	55	3	34	2
	24.	Has the service always been available in the last year?	20	1	26	2	1	1
	25.	Has the service been unavailable for a long time?	10	1	12	1	1	1
	26.	Are your applications used in the right way?	49	3	57	3	50	3
	27.	Do you conduct application user training?	51	3	47	3	60	3
	28..	Do you manage ICT costs? Are they viewed as part of an organization's costs?	30	2	32	2	30	2
	29.	Do you have physical controls and logical protection (passwords) in place for ICT services?	55	3	59	3	60	3
Delivery and support	30.	Is there a procedure for accessing the server and the database?	40	2	49	3	67	5
	31.	Do you have customer support?	49	3	50	3	44	3
	32..	Do you deal with incidents right away?	46	3	51	3	57	3
	33.	Do you always know what you have at your disposal (number of PCs, servers, routers, switches)?	8	1	10	1	60	3
	34.	Is there an up-to-date list of equipment?	19	1	21	2	50	3
	35.	Are there records of problems in the use of the ICT service?	34	2	20	1	56	3
	36.	Are corrective and preventive actions being taken regarding the problem?	32	2	37	2	58	3
	37.	Do you handle user requests quickly?	58	3	44	3	59	3
	38.	Is there a data management procedure?	20	1	18	1	55	3
	39.	Is there physical	52	3	39	2	57	3

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		protection in place for ICT resources?					
	40.	Is there preventive maintenance and is it planned?	39	2	40	2	58	3
	41.	Is the performance of the ICT service monitored?	34	2	30	2	60	3
	42.	Are you backing up data?	40	2	38	2	80	4

Table1. Questions, % of affirmative answers and level of maturity

Level of maturity – Management Board:2,21
Level of maturity – Middle management: 2,48
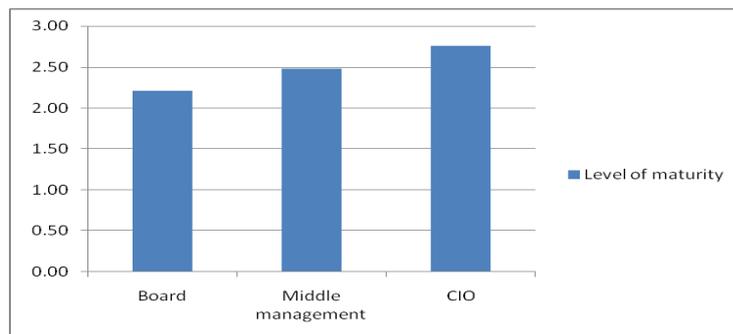Level of Maturity – CIO: 2,76

Figure1. Results of survey

Results show that members of the Management Board use information and communication technology (ICT) to the least extent. Middle management using ICT in larger scale. CIO use ICT the most often, which wasexpected.

Criterion for determining the level of maturity:
- the percentage of all answers from the maturity survey scale

Percentage from answers	Level of maturity
0%	Does not exist / 0
1-20%	Initial / 1
21-40%	Repetitive / 2
41-60%	Defined / 3
51-80%	Managed / 4
81-100%	Optimized / 5

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Level of maturity of management's information literacy is: $2,48 = 2^{nd}$ level.

This is the CMM (Capability Maturity Model) method. The average percentage of answers was examined, leading to the following conclusion:

The governing with information technology in 4 general hospitals is on the second level.

It is repetitive, but intuitive. This means that there are certain defined and documented processes used in day-to-day business, but they are not defined at the level of the whole organization (they do not take place in the same way everywhere, in all parts of the organization). There are requirements to management and projects. Care is being taken to procure everything necessary for the delivery of the ICT service. It strives to work in accordance with business policies.

5. Conclusion

Information literacy in the narrow and broader sense is necessary for health system management because it enables management to govern with information and communication technology, i.e. it enables them to establish conditions that enable information and communication technology to support decision making (efficient and effective health system management). This is especially important today when any savings on the one hand and an increase in income on the other are extremely important. Information literacy can help with both of those challenges. It enables recognition of information in timely manner, access to information as well as processing and transmission of information to make optimal decisions at a given time.

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