

# **The Role of Information System in Hospital Management and its Developing Process**

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## **Abstract**

Information system of a good quality is a basic requirement for effective management of the hospital. There are more possibilities to build it internally or to order the developing of the new information system by the external company. This article describes how the quality of the implemented information system influences the management of a hospital with the focus on the risk resulted from working with bad information. Another area discussed in this article, is the possible ways to implement new information system in a hospital and the advantages and disadvantages of them.

Managing of the hospital is more complex as it seems when comparing it to managing of the company. The companies are usually focused to supply service or product. The main areas to manage such company can be characterized as:

- delivery management
- finance management
- product selling
- service providing
- public relation
- human resources

All these areas, in more details said, the processes in these areas, produce and also consume information. And the management of these processes needs this information. The time of obtaining the needed information and the quality of the obtained information influences the quality and effectiveness of the management. Therefore the information, the managers work with, and the information system in the company is very important for the effectiveness of the management and the whole company as well. While in medium sized company the business is usually focused on selling some product or on service providing and therefore the majority of important information is dealt with in one - the main of the previously listed areas (abstracting from the finance, which is, of course, important for the company and hospital as well), in hospital, there are some differences when looking on the information requirements of these areas. There can be said that no one area is the main. In the hospital, the delivery (usually important in product selling companies) is very important, but not only this one. Also the service providing is one of the most important areas in the hospital, while this area is not so main in product selling company (is important in service providing company). If continued, we would describe that the all areas are very important in the hospital and the management cannot risk and not pay attention to one of them.

Another difference can be described when considering the dealt information in hospital management and company management. The hospital works with the personal data much more than the majority of the existing companies. The companies usually work with some personal data such as addresses, place and date of birth, salaries and so on, but the hospital works with all these data plus another personal data such as: diagnosis of the patient, diagnosis of his relatives, prognosis and so on.

These all differences described previously give big reason to pay attention to the information system for the hospital. It is very important to use the information system of a good quality because only in this situation the management of the hospital can be done in high effective way. The following steps can be defined to ensure obtaining and using such information system:

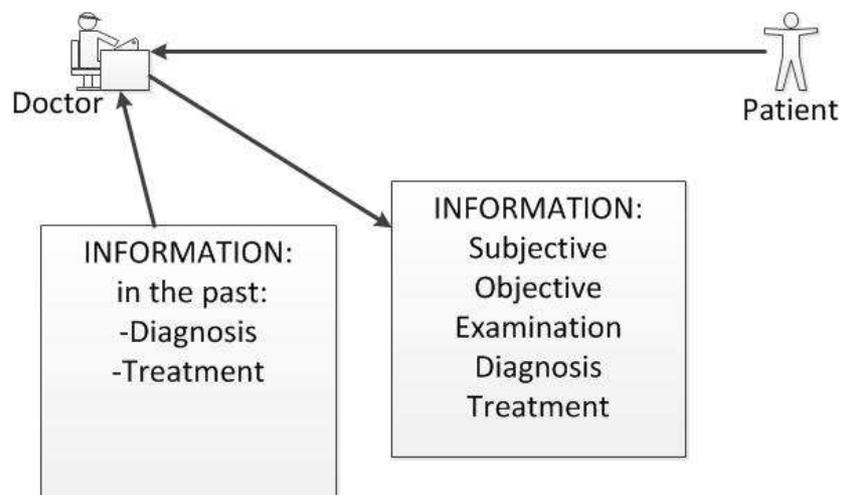
1. considering, analysing the existing information system,
2. buying / developing the information system,
3. using the system in correct way, having the organised and trained staff.

As it is hard to find a hospital with no automated information system at present, the first step to ensuring a good information system is considering the present status of information management in the hospital and collecting the requirements for improving.

### Information system and the quality of the information provided by it

Considering the existing information system is the first precondition to reach higher quality, more effectiveness, simply said, to improve. To consider the existing information systems from the manager's point of view, it is needed to evaluate the information provided by the system and the information required in the processes in focused areas.

The particular employees are the source of the data which are processed then and given in needed form at the (another) place of need. So the employees when they do their job, they are the source first but also are the consumer on the other side. On the picture 1, there the information is shown, which the doctor is working with when examining the patient. In this process the doctor needs the information about the patient first, which was created in the past, when the patient was examined or treated previously. But at the end of the process, the doctor puts new information into the system and this information is going to be needed in the future for the next examination of this patient.



Picture 1 The information needed and produced in process realised by employee

On the picture 2, there the business process diagram is shown. This diagram contains more details of the business process and the places of information exchange are pointed. During the process realisation the doctor needs the information about the patient at the beginning. Then he produces other information in next steps of the process when obtaining the information from the patient, defining the diagnosis and treatment and arranging the next appointment.

To analyse the possible risks from working with bad, incorrect information, it is good to look at these steps in the process in more details. For example the doctor can get incorrect information from the patient and put them into the system. In this step it is the responsibility of the doctor to consider the information. It is not possible to delegate it to the system. Also the other steps when the doctor puts the information about the diagnosis and treatment to the system are influenced by the expertness of the doctor. On the other side this factor would be the same if no automated system was used in this process, so it can be said that the quality of the input information is influenced by the system user. Training and good organising of the staff is very important for input information then.

At the beginning of this process the doctor gets the information from the system. And according to this information he chooses next steps in the process. If this information is not complete or is not correct, the doctor could be the best expert from the world; neither would he decide right when having bad suggestion (based on bad information). So for the output information it can be said, that the information system and its quality is very important. Not last important thing is that the output information could not be of good quality if the information processing in the information system is not correct.

As the conclusion of this analysis, according to previously defined steps, it can be said:



1. Considering, analysing the existing information system – the management should analyse the information of the existing information system and its quality on the output (together with the output as the result of its processing).
2. Buying / developing the information system – when developing the new system, it is very important to pay attention for the correct output information and its processing. The possible ways of developing the new information system are discussed later in this paper.
3. Using the system in correct way, having the organised and trained staff – mainly the quality of the input information is influenced (abstracted from the quality of the process itself) by the staff expertness and/or training. The management should pay attention on this fact when organizing the staff.

The information used by the employees during the process is not only its using purpose. The information processing by the information system during the processes in the organization is very important for the management. Because only well informed manager can do the right decisions the information system becomes the tool to be competitive for the organization. Information system collects all the needed information and provides it in the required form at the place where it is needed. There can be characterized the following strategic roles of the information system in the organisation [OBR99]:

1. Improving business processes – the places of possible improving of the processes can be found after analysing them. The business diagrams (described in [KNI13]) as in previously described case can be created. After looking at the places of using the information, the processes can be redesigned so as to shorten their time, lower costs or some other type of improving can be done.
2. Promoting business innovation – investments in information system technology can help to improve products or services. In case of the management of the hospital, the investments in new technologies can bring the advantage of being able to realize more detailed patient examination. Or new information system can collect information about new ways of treatment of some diseases and also new statistics about this treatment, which can be very valuable for the hospital's services and their quality.
3. Locking in customers and suppliers – the good information system can help to manage good relations to customers and keeping them for the future business. In case of the information system of the hospital, the customers are the patients. According to [CAN07] the management of the hospital, of course, shouldn't want to keep the patients in the hospitals, but on the other side, the management should try to build the trust of the patients to the hospital so as they would come in case of having some problems.
4. Creating switching costs – once the company has information system proved, in some cases it can be used also for other areas, than it was at the beginning built, for example the reservation system. This can be also the case of the hospital, because the reservation system could be used for ordering of the patients to examination - using for internal ordering first and then providing ordering patients using web browser for the first consultation directly.
5. Raising barriers to entry – building effective information system can bring such advantage, that other companies get a barrier to entry the same market segment. In case of the hospital it can be when the hospital management invests in new technology for patient examination (for example modernized magnetic resonance imaging).
6. Leveraging a strategic IT platform – investing in high level automatic (computer based) information systems. Information interchange becomes very quickly then and the processes can be done more quickly in their flow. When the company (and this is also the case of the hospital) invests in developing department and employees and builds effective intranet, web applications, internet services and so on.
7. Developing a strategic information base – investing in information systems, which work with the knowledge, can replace the work of experts. The hospital can invest in information system with best practices, which can help the young employees to improve their work. In the finance area the hospital can use expert systems which can help the managers with the important decisions.

### **The risks of working with bad information system**

As the hospital personnel works with the personal data, the risk of bad information processing is much higher then. When incorrect information is used in process, it may result in bad product of this process. Bad result in a company means higher costs, longer times, in worse cases more complains and repairs, lower the number of customers. But in the hospital, it is more serious, because the worst risks are mortality increasing, invalidity increasing. The risks, which come from bad information processing, can be defined:

- Bad input information – this influences all the next processing of this information and also the product of all the processes using this information. This place of information management is very important and depends on the employee, who this information inputs. The management can only focus on the quality of the employees (recruitment process) and their trainings.

- Bad information processing – this is the part of the processes where the information system becomes the main actor and the quality of the information system influences the information processing. The management has to choose the optimal strategy of obtaining the new information system. This area is discussed in next part of this paper.
- Bad information interpretation on the information system output. This part again is influenced by the users of the information system. The users are mainly the hospital employees and in this case this is the same dealing area for the hospital management that in the first case. But the information system users on the side of information consumers (output information), are not only the employees, or should not be only the employees. Suitable information system is built so as to provide the needed information to all the users and the places of business processes realisation for who and where it is needed. So in case of the hospital the information system should provide the needed information (according to the information rights) also to the patients. Then the doctor can focus on the treatment itself and doesn't have to inform so much. Informing the patient is more explanation of the some special information provided by the system to the patient then.

Based on the previously described places of the possible risks of bad information processing the hospital management has to focus on the quality of the information system (investing in new information system is described later in this article) but also on the quality of hospital employees and their daily done work. When looking on the way of working with information and information system, there can be defined more points of possible faults:

- Not complete information – the users of information system but also all the employees who are the supplier for the process with the need of this information can provide this information not completely. The reason may differ but most possible can be: time shortness, not understanding situation or simply not well done job. The management can minimize the faults based on this reason by motivating the employees, realisation their exercising and precisely choosing the people to hire.
- Incorrect information – in some cases the employee can make a mistake in his work, which results in mistakes in information provided to the system. This should not happen very often. If it is so, the business processes are not mapped, defined and managed well and the management should reengineer them. If only some employees do this (more often than the others), the management should train them or hire new people instead of these.
- Not clear information – it is very important to input the information in such form to the information system so as the other user could interpret it in the same way. This is the most difficult area to manage when comparing the previous reasons. Because it can happen quite easily that one employee inputs some information to the system, but its form allows another interpretation than the origin. The management can only prevent or minimize this by defining exact form of the inputted information which is important for the other users and their processes. Defining the exact form is done when the information system is being built and then the information system allows inputting the information only in this form. Not clear defined information can have more ways to interpret or an expectation to not correctly interpret. These two possible and not wanted situations can happen then.

According to the previously described situation the hospital management should pay attention on the quality of the information system and also the quality of the employees working with it. There can be pointed exact places in the business processes where the management can focus on the specific details and control the realised processes where the employees work with the information.

### **Investing in new information system**

Building of new information system is complex process consisting of more steps which have to be done before the final product is prepared for the customer [KNI13]. The quality of the information system determines the quality of the information the employees work with. Using good information systems creates the conditions to effectively manage the business processes and effectively realize these processes as well. Because only the well informed management can do its job and the same is valid for the particular employees doing the processes.

The quality of the information system can be reached mainly by controlling the quality during the development process of the information system. This process is very important. There are several possibilities to develop the new information system for the hospital and the management has to choose the right of them.

One of the possibilities how to get the new information system is to place an order to some software developing company. As the software developing is quite fair from people treatment the hospital management usually decides for this way of getting the new system. There are some advantages then, the first most interesting is, that the management doesn't have to solve the issues about the development process and possible problems appeared during the development. The all matters are dealt in the software company and the hospital management gives only the terms and acceptations. The hospital doesn't have to organize the developing works.

These advantages are taken out by the finance needs as this way of getting the new system means quite big investments at the beginning and also through the development. The all amount has to be paid till the system is created.

There can be pointed also other disadvantages of the buying the new system. The processes are analyzed by the external people (the software company employees) and the information support of these processes done by the new information system is limited to the level of getting known the processes by these people. Internal employees know the processes better and can better define the information needs.

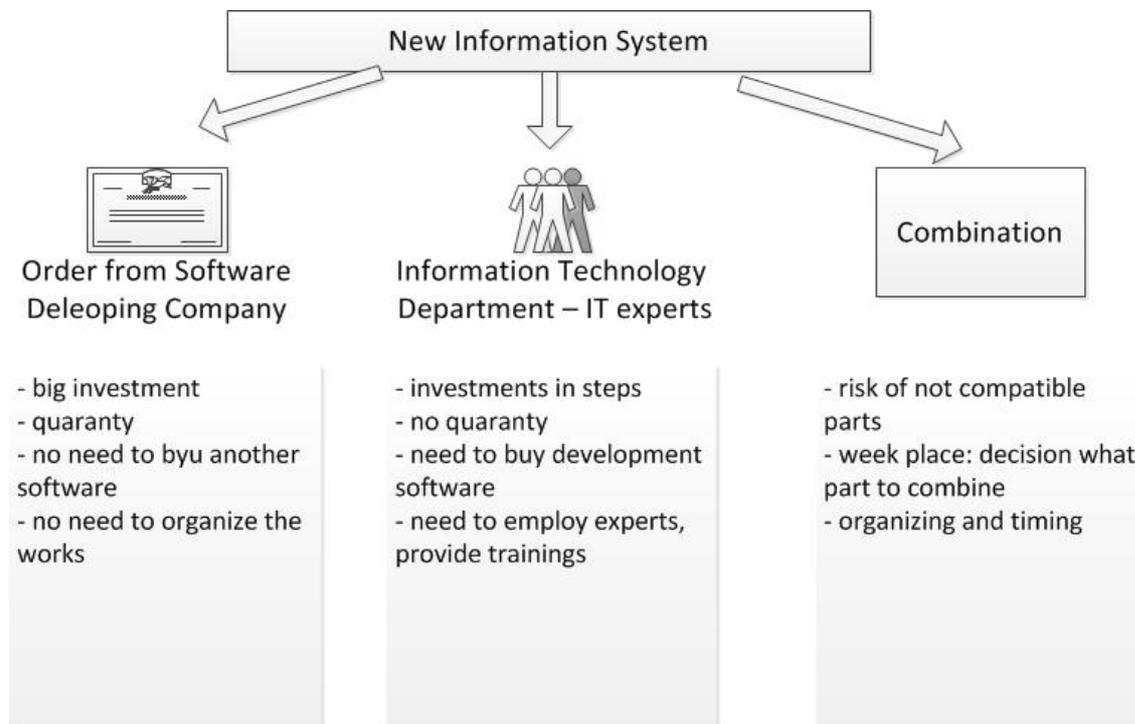
The hospital management should also consider the fact that after delivering the new system and starting of using it the process is not ended. It is very often and usual, that during using the system new requirements appear or some parts of processes are changed and this invokes the changes in the system. This is solved by the support of the supplier company but this is also paid. The price of the support has to be added to the price of the information system developing.

Other possibility for the hospital management is to build the IT (information technologies) department and to hire the employees, who will develop and take care of the information system. This way of getting the new system enables the management to divide the investments in more steps if it is needed. Also the people developing the software are internal and can better get to the realised processes and understand them.

As the disadvantages the additional investments for employing IT experts and training them can be considered. So the management has to decide whether to invest into the external company or internal employees. Internal employees can do also the later system support and there is no need to pay for this then.

One of the interesting ways of getting the new system can be combining the previous two ways. Some parts of the system can be develop internally and some by the external company. When choosing this way some aspects should be considered as the quality of the decision of what to do externally and what internally. Good decision takes the advantages the previous ways and leaves the disadvantages of them.

The disadvantage of combining can appear as increased risk of incompatibility of the internally done part and externally done part and as the high organizing and timing the works so as to get the whole system to the defined deadline. The possible ways of getting the new system and the advantages and disadvantages of them are on the picture 3.



Picture 3 Possible ways of getting the new information system

## Conclusion

The hospital management has to control the processes in many areas. The quality and effectiveness is influenced by the information on which the decisions are done. This is the reason why the information system of

the hospital and its daily using is very important and should be controlled and improved. While the quality of the information system itself depends mainly of the developing process, using of the information system is influenced by the employees doing this.

The hospital management has to focus on the processes done in the hospital, the employees who do these processes and the way they work with the information when doing their job. There can be pointed exact parts of the processes where the information is worked out and the risk of using incorrect information appears. The quality of the employees work should be monitored and considered and the decision made if there are some shortages defined. This is the way of improving but mainly preventing the risks of working with bad information.

The second main area to control when assuring the correct information processing, is the information system itself. Only the information system of a good quality can provide the correct information and on the place of information need. There are more ways to get new information system (or its part) for the hospital, all of them bring some advantages and disadvantages and the hospital management has to choose the right way so as to achieve the defined goals.

## References

- [OBR99] O'Brien, J., A.: *Management Information Systems*, Irwin McGraw-Hill Companies, 1999, ISBN: 0-07-115811-1
- [REP12] Řepa, V.: *Procesně řízená organizace*, Grada, 2012, ISBN: 9788024741284
- [CAN07] Čandík, M.: Komparácia faktorov zákaznickej orientácie organizačnej kultúry v príspevkových a neziskových zdravotníckych zariadeniach, In: *Manažment v teórii a praxi, on-line odborný časopis o nových trendoch v manažmente*, No.3, 2007
- [KNI09] Kniežová, J.: *Metódy v softvérovom inžinierstve*, EKONÓM Bratislava, 2009, ISBN:978-80-225-2696-8
- [AGI11] Composite authors: *Manifesto for Agile Software Development*, available at: <http://agilemanifesto.org/>
- [RUS05] Russev, S., Kniežová, J., Russev, R.: *Effective Way to Develop Effective Software Applications*, In: *Strategijski menadžment, časopis za strategijski menadžment i sisteme podrške strategijskom menadžmentu*, Nr. 1-2 2005, p. 17-28
- [KNI04] Kniežová, J.: *Kvalita koncepcie informačného systému v štruktúrovanom a objektovo orientovanom prístupe*, In: *Ekonomika a informatika*, Nr. 2, 2004
- [KOV07] Kovář, F., *Moderní přístupy v soudobém managementu*, In: *Acta Oeconomica Pragensia*, Vol. 15, No. 3, 2007
- [KNI05] Kniežová, J.: *Modelovanie riadenia obrazoviek v projektovaní informačných systémov*, In: *Ekonomika a informatika*, Nr. 2, 2005
- [KOT00] Kotter, J.: *Vedení procesu změny*, Management Press, 2000
- [KNI13] Kniežová, J.: *Modelling of Information System Requirements*, In: *E-Leader*, Vol 8, No. 1, 2013, Ljubljana
- [KNI13a] Kniežová, J.: *Vybrané aspekty výuky informatických predmetov vzhľadom na reflektovanie ich náplne potrebám praxe* In: *Dnešné trendy v inovácii – Dubnica nad Váhom, Dubnický technologický inštitút*, 2013, p. 136-143, ISBN 978-80-89400-60-7
- [KNI09a] Kniežová, J.: *Riešené príklady softvérového inžinierstva*, Vydavateľstvo Ekonóm, Bratislava, 2009
- [RUS06] Russev, S., Kniežová, J., Russev, R.: *Softvérové inžinierstvo*, Vydavateľstvo Ekonóm, Bratislava, 2006
- [VAL01] Valenta, F.: *Inovace v manažerské praxi*, Velryba, Praha, 2001