Aspect of the Designing and Developed Integrated Information Systems in Large Organizations

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Abstract: this article shares the experience of designing, developing and operating big integrated information systems in public institutions and large business organizations. It demonstrates the major advantages and disadvantages of the different means of creating an integrated information system. The main development stages of an IS are reviewed while paying attention to the most common problems associated with this process.

Key words: Integrated information systems, corporate databases, IS development, IS operation.

1. Introduction

Currently all big organizations and public institutions need integrated information systems. It is necessary to coordinate the links between the different departments which is a very difficult process. Therefore, the exchange of experience in ordering, designing, developing and introducing such systems would decrease the percent of unsuccessful IS implementations [1].

System implementation efforts offer extraordinary challenges to information technology professionals and the organizations impacted by the implementations. A successful implementation can reap vast rewards in organizational strengths and efficiencies. A failure can drain an organization of people, funds and vitality.

Consequently, many people have puzzled over the reasons for the successes and failures experienced with these implementations. This paper examines the reasons for success and failure as offered through scholarly research and first-hand reports of system implementations within institutions of higher education. It discovers that many answers lie outside the bounds of technology.

Every high-growth business grapples with decisions around the best business system to manage its expanding operations. Proper planning of an integrated business management software system often takes a back seat to short-term revenue acceleration goals. As a consequence, various disparate applications are installed at different points in time in various functional areas, resulting in business process inefficiencies and software integration challenges.

2. Problem Analysis

In general, each organization needs constant support and update of its IT resources, regardless of whether we are speaking about hardware or software. Expected question is which system is better,

cheaper and with the best characteristics. Vital also is which system will give a more thorough answer to the given problems. The most common answer is – the one currently in operation given that it is working properly. Although it does not sound so well very often it happens that this is true. To evaluate a prospective introduction of such system in a given organization it is necessary that all pros and cons are assessed. When introducing an IT system it is fundamental that it should add value to the organization by improving the work of the different departments and facilitating management. This is usually perceived in the context of the improvements it will make to a particular department [1,2,3].

- The positive aspects of the system currently being in operation are the following [4]:
- These systems are already accepted and there is no need of any guidelines.
- The necessary equipment is installed
- The personnel is trained to work with the systems
- The company has practical experience in operating with its systems in place
- The company has experience with the development of its current systems
- There are established maintenance teams
- The management is well aware of the capabilities of its operating IT system

A paradox is that the above mentioned positive sides are also drawbacks of the existing IT systems. For example:

The current systems use an equipment with expiring exploitation life cycle.

The existing software is often very old.

It is common that systems designed to work for 3 to 5 years are left in operation far longer. Once they are morally old they should be replaced.

The second disadvantage is associated with the old software. During the standard exploitation of an IT system, the office packs, antivirus programs, data protection software are all subject of considerable development. However, this is very important for all programs except for the office packs. First, it is expected that in a typical operation system as Windows for example, there will be frequent introductions of numerous patch updates which are most often security-based. The antivirus programs are a typical example as well as the cleaning machines. Security is also constantly updated. As a result, the operating system takes 2 to 3 times more disk space and works with more files in the RAM memory. Once 1-2 Mb today the antivirus programs are often 50-100 Mb and utilize far more time and resources. The same applies to the defensive mechanisms. As a result, a computer that has been contemporary until 2-3 years ago (1-1.5 GHz, 256 Mb RAM, etc.) is currently working on the limit of its capabilities, using the majority of its hard disk resources. There is a constant lack of memory because the processor is constantly looking for viruses. In addition, if a user receives a file in a new office version there is a big chance that the file would not open in the older version. This negatively affects the work in all departments.

It's perceived that the implementation of an IT system would solve the problems of a given organization. But this should not be considered as a panacea. An IT system should add value to the organization by improving the efficiency and the communication between the different departments. In general, Bulgaria has a good record of creating IS systems based on constructive technical requirements. These guidelines are made as a result of mutual compromises from both the client (the organization that need a new IS) and the company providing this system. Thus, the only thing that is left is the right system to be chosen.

3. System Implementation Success Factors

In general, each organization needs constant support and update of its IT resources, regardless of whether we are speaking about hardware or software. Expected question is which system is better, cheaper and with the best characteristics. It is also vital which system will give a more thorough answer to the given problems.

There a number of ways for a big organization (variants for modernization is souwed on Fig. 1) - client to modernize its IT resources [5,6]:

- Updating the existing system
- Buying a ready-made system from the market
- Introducing a system developed for a particular firm with similar requirements
- Developing a completely new system

Fig. 1. Variants for modernisation.

3.1. Modernizing an Existing System

The first possibility is to update the current IT system.[5,6] Usually most managers are inclined to try this option first. Two possibilities can be applied in this occasion as shown in Fig 2:

Requirements :	The system has started to work	
	Variant 1 From 2-4 years	Variant 2 Before 5 years
Modifying existing modules	🟠	🟠
Creating new modules	🟠	🟠
Integration with external systems		🟠
Buying new equipment	🟠	

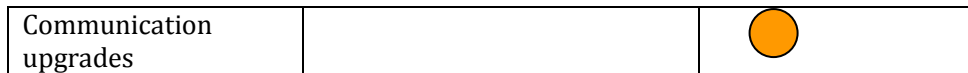| Communication upgrades		

Fig. 2. Possibilities to update.

Option I – updating recently installed modules [6] – implemented 2-4 years ago. This is a relatively lucrative alternative; the only problem is to find the right executor. Common obstacle is the fact that often the company that has implemented this system is setting very high prices for updating the system. The reason behind this is the fact that the creators are in a lucrative position given that they know the system very well. However, also common is that the team of programmers that have designed the system are no longer working for the same company or have progressed in the organizational ladder. This implies that in order for the executor to update an existing system it should either employ the old team of programmers that currently have bigger salaries or to hire a new team of young programmers at more acceptable cost. The latter is often preferred which in turn increases the time needed to execute the order because the new team needs to read and understand the old code and means of designing the system.

If the client decides to hire a new IT company, it often finds that the contract with the previous developer does not include any clause for disclosing the programming code of the IT system that has been developed. This implies that the new firm will have to start everything from scratch.

Option II - Updating relatively old systems – of more than 5 years ago. This alternative is plausible only if the initial database is from the middle or higher class – Oracle, MS SQL server, IBM DB2, Interbase/Firefird, etc.[7] This allows the clients to chose a new executor that is not familiar with the current IT system. The update is achieved by developing new modules that give the necessary functionality. This approach makes the IT system more updatable and prone to new technologies.

3.2. Buying a New System from the Market

This approach does not need any detailed observation. It just needs to be acknowledged that there is no universal software that can meet the needs of many clients. This is the reason for the existence of so many software development firms that aim to offer personalized solutions to their clients.

3.3. Implementing Systems, Developed By the Order of a Given Company

Even the new developments do not come without some significant initial preparation. They are result of the accumulated experience of the developers from their work on various previous projects. No one has the resources to develop a system just for the system itself without concern of the prospective market capitalization. These are the rules of the market economy. Also a lot money has been given even for projects that for one reason or another haven't been implemented yet. The design of an IT syste demands considerable resources. It is normal that the programmers need a few days only to understand the weirdest ideas for a new system or update. Usually there are different grounds for starting a new IT initiative. It often starts with rumors, conversation among colleagues, information (mainly from internet) etc. In big organizations, the contacts play an important role for determining the system requirements. Every company that has the resources to start a similar initiative wants to achieve the maximum results from it. There are salaries, bonuses, and the company image that are at stake, especially if it is a public order or the initiative is financed from international projects. Many negotiations need to be done for clarifying different parameters from the necessary documentations to training personnel. Therefore, the projects from scratch are close to professional orders, only they do not come with detailed technical requirements. [8]-[10].

This approach is viable for large organizations as well as startups. Middle-sized firms from one side never have the financial resources to implement a big IT system for which there is no guarantee that it would be successful. However, a successful implementation would add to the company's prestige.

3.4. Building a System from Scratch

This is an option that is chosen either when there is no IT system in place or the existing one is obsolete.

This is the slowest option and the final result can hardly be predicted. A typical system is designed, developed and introduced from one year (given that there is excellent organization and the client is not public institution) to 3-5 years. These terms are necessary given the nature of the whole process as illustrated in Fig. 3 showing the main development stages:

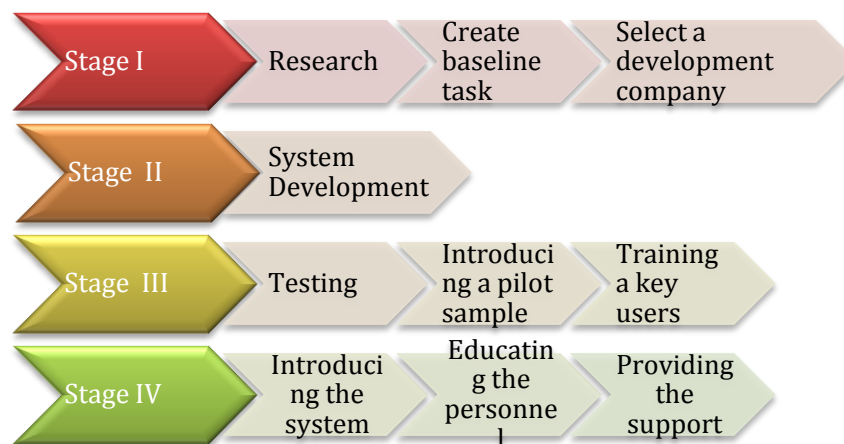| Stage I | Research | Create baseline task | Select a development company |
Stage II	System Development		
Stage III	Testing	Introducing a pilot sample	Training a key users
Stage IV	Introducing the system	Educating the personnel	Providing the support

Fig. 3. Main development stages.

Stage I – research, selecting a company that needs to form the system requirements in the necessary form so that the client will then be able to organize an auction for executing company. This stage defines the needs of the organization. Better results are achieved if the ordering company hires a specialized firm to construct a proper review of the necessary requirements of the needed IT system. Main questions are clarified such as construction plan, selecting interface type, selecting a database, the necessary technical requirements and last but no least determining the relative cost of the project. It is crucial that no hardware paramaters are set, bacause their price will change by the time of developing the system or some may be stopped from production. This stage finishes by accepting an initial project, taking guidelines from the company management, and if the project is approved – planning expenses and starting a contest for choosing an executor of the project and selecting one.

Stage II – system development. Here it is important that the client assigns people responsible for assisting the team of programmers. By the end of this stage it is important that a method for testing the system is developed.

Stage III – testing the system and introducing a pilot sample. The main sytems users need to be trained. This is the hardest stage for both the client and the IT firm given that there is no perfect system. It is common that during the initial tests the client understands that the system that is developed is not as good as it needs to be. Not in terms of fuctionality but in terms of "appearance". Thus, it is necessary that a lot of the existing algoritms need to be replaced. This is a major challenge

for the organization and it is the time when management should impose its opinion. In 75% of the public organizations (from statistical data), this prevents the projects from successful implementation [11]. It often appears that managent cannot force the elder personnel (often those over 40) to adopt the IS. In private organizations, this process if far easier and the system of successful implementations rises up to 80%. The reason is as simple as that – the management cannot afford to fail with something that has consumed significant organization resources such as money, time, etc.

Stage IV – introducing the system, educating the personnel and providing support. This is the easiest stage. It is important that the training should be provided on time, the provision of adequate support as well as the timely problem recognition and correction.

3.5. Example Point Assessment System

One exemplary system is shouwed on Table 1:

Table 1. Weight on Criteria

Criteria	Point weight
Functionality	30
Ease of use	25
Corporate environment	20
Flexibility	20
Integrity	20
Reliability	20
Security	15
Scalability	15
Implementation	15
Support	15
Technology	10
Additional developments	10
Easy access	5

The total number of points per system is obtained as a sum of the point weight of each criterion.
The following evaluation criteria are met:

- A summary overview of the results of all parameters;
- Graphically - with histogram;
- Unlimited, customer-specific evaluations and analyzes - reports, charts, Pareto, PPM, and more. [11], [12].

4. Conclusion

As concluding remarks, it needs to be emphasized that the process of securing contemporary informational resources in a given organization is crucial for the work of all departments and any underestimation of its importance nowadays could cause a significant losses of time, money and last but no least, prestige.

Today, companies in virtually every industry are using sophisticated business software to fuel their growth but many are still struggling to keep up with their growth and manage costs effectively because of a hodge-podge of disconnected functional systems causing process bottlenecks and employee productivity issues. Integrated business software suites are transforming how companies run, and enable them to transcend growing pains that previously were holding them back from taking their businesses to the next level of profitable growth.

Acknowledgment

References

[1] American psychological association. (2001). Publication manual of the american psychological association. Washington, D.C.: Publisher.

[2] Panayotova G., & G. P. Dimitrov. (2016). Modeling and data processing of information systems. Published in: *Artificial Intelligence and Pattern Recognition (AIPR). Proceedings of the International Conference on, Date of Conference.*

[3] Jim, C. (2001). Special edition using oracle 11i.

[4] Georgi, P., & Dimitrov, G. P. (2015). Analysis of the quering of databases in systems for quality management of education, Macedonia. *Proceedings of the 12th International Conference on Informatics and Information Technologies.*

[5] Galina, P., & Georgi, D. (2015). Balancing automated and manual testing with opportunity cost. *Proceedings of the 4th International Virtual Conference 2015.*

[6] Georgi, P. (2015). Dimitrov, galina panayotova. *Aspects of Website Optimization.*

[7] Galina, P., & Georgi, P. D. (2015). Deign of web-based information system for optimization of portfolio. *Proceeding of the 13th International Symposium on Operational research SOR'15.*

[8] Erpwire. (2009). Understanding integrated information systems. Retrieved from the website: http://www.erpwire.com/erp-articles/integrated-information-systems.htm

[9] Wikipedia. (2009). Architecture of integrated information systems. Retrieved from the website: http://en.wikipedia.org/wiki/Architecture_of_Integrated_Information_Systems

[10] Airforce. (2009). Что можно ответить на вопрос «Какой самолет лучше?». Retrieved from the website: http://www.airforce.ru/uncle_bu/page1.htm

[11] Axapta. (2009). Стратегии внедрения ERP–системы. Retrieved from the website: http://axapta.mazzy.ru/lib/strategy_erp/

[12] Открытые Технологии. Управление рисками при внедрении корпоративных информационных систем. Retrieved from the website: http://www.ot.ru/press20070712.html

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