

Information Systems Management — Modular Approach

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Abstract—Information systems management can be a challenging task, especially in a smaller organization. In smaller organizations the resources tend to be limited, and often there are no IT staff or expertise in the organization. Despite this, information systems need to be running without interruptions, and act as a robust infrastructure for business activities and processes.

Management of information systems is needed, it should support business objectives and operations in the best possible way. Here we suggest modular approach to information systems management – mapping key domains and activities in the system, and working together with external service providers in order to provide a flexible information systems and infrastructures in the organization.

Index Terms—Information systems, infrastructure, technology, flexibility, modular.

I. INTRODUCTION

Information systems are an important part of organizations today. Whether we are looking at a major global enterprise or a starting entrepreneur the role of information technology is vital. In case of a technological problem, system shutdown or similar the results tend to be significant and bring down operations of the company. For example, sales cannot be done if the sales system is not functioning. Therefore, it is important to develop information systems to run as a robust backbone for processes and activities within the organization. Here we see the management of information systems as a critical success factor for operations and activities of the organization.

In this article we look at challenges of information systems management. In many organizations the resources are limited, yet there is a need for flexibility and robustness in information systems. In different words, in any case the management of information systems needs to be organized so that the systems bring value to operations. Here we discuss the idea of modularity, and apply it to information systems management. Working together with external partners, operators and service providers can a solution that provides needed flexibility and robustness in information systems.

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II. INFRASTRUCTURE

Information systems infrastructure is the organization's basic shared platform for all applications and systems [1]-[7]. It is the technological platform which is the basis for various

business activities and processes within different types of organizations, enterprises and companies [8]. Here the term infrastructure refers to platforms and underlying systems that are shared amongst users. In most organizations technology, especially information systems and information systems infrastructure is the enabling foundation upon which business depends.

What is information systems infrastructure really? There are several key dimensions to information systems infrastructure [4], [6]:

Embeddedness: Infrastructure is part of other technologies and systems, organizational and social structures.

Modularity: Infrastructure allows modularity in design of the information system. Infrastructure does not have to be modified for each application; instead it should make it possible to add new applications without significant trouble.

Reach and scope: Infrastructure is widely across the organization, extending beyond a single place, process or event

Sustainability: it is expected to serve and be useful over a long period of time, in many locations and for variety of purposes.

Built on an installed base, development of infrastructure takes time; it is built and based on existing infrastructure. As a result, infrastructure is dependent on strengths and limitations of existing technologies and infrastructures.

Based on standards, Standards make it possible to expand the system and connect it to other infrastructures, also to infrastructures of other organizations. Therefore, standards are a vital part of infrastructure.

Based on conventions of practice, Information systems infrastructure is shaped by organizational practices and vice versa.

Learned as a part of membership of the organization, Infrastructure is specific to each organization. New staff members learn about the infrastructure and gradually get familiar with it.

Transparency: information systems infrastructure is transparent to the user - when running normally and delivering as intended.

Becomes visible upon breakdown, transparency of the infrastructure disappears immediately if the infrastructure fails to deliver as expected.

Development of information systems infrastructure is takes a long time, and it is a process of interaction between people and technology. This makes infrastructure organization specific; it cannot directly be copied or imitated from one company to another, for example (Broadbent *et al.* 1996). Generally, information systems infrastructures are shared throughout the organization and its units, among different levels of users and processes [9].

Information systems are far more than technology alone. As Byrd and Turner [10] notice information systems

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infrastructure is a domain that can further be divided into two related components: technical IT infrastructure and human IT infrastructure.

In general, information technology is often seen only as a combination of various

- Technical devices and
- Software components.

Technical component is understood as devices and technologies that connect computers and systems together. It contains networking devices like switches and routers. Furthermore, servers, systems and devices that are commonly shared among users are considered to be part of technical information systems infrastructure.

The other, vital part of information systems infrastructure is the human component [3], [11], [12]. This consists of individual and organizational skills, expertise, competencies, motivation and commitment to use, maintain and develop the technologies [3], [13], [10]. Lee *et al.* [11] write that human information systems infrastructure is a combination of expertise in four areas:

- Technology management.
- Business understanding.
- Technical issues and
- Interpersonal skills and management.

Technology management is understood as organizational ability to deploy information technology in a way that it enables and supports business targets [11], [14], [15].

Business understanding is close to the concept of technology management; it refers to understanding business processes which make it possible to select technologies, systems and applications that make it possible to meet business needs and operational targets [11]. In other words, business knowledge is an ingredient that is needed in developing technical capabilities so that business targets, operative and strategic goals can be met [16].

Technical understanding is needed in information systems management. Even though there are cases where IT manager has a non-technical background it is typical that there even in these cases are people in the IT department with technical expertise. IT department needs to have both broad and deep technical knowledge in various technologies, systems and networking [11]. This can be quite challenging in smaller organizations where the IT departments are small, having expertise in different technologies may not always be possible. Having knowledge in wide range of different technologies and systems and knowing each particular system in detail is seldom possible. Here using expertise from external partners can be the solution.

Furthermore, interpersonal skills are increasingly important in information systems management. Development is about cooperation with people in the organization and with external partners. There is a need to understand requirements from operative actions and processes combine them with technical innovations and see the potential for successful business. It is clear that communication skills are in a critical role in information systems management and development activities.

III. IMPORTANCE OF FLEXIBILITY

Today environments where organizations operate are increasingly competitive and turbulent. Therefore, flexibility is an increasingly important issue as it allows rapid changes to when environment, demands or goals change. Flexibility is here defined as the degree to which an organization possesses procedures that it can implement in response to changes happening in the environment [17]. It is important that connections and interfaces are standardized in order to enable flexibility, changes in the system and modularity possible [18], [19].

Let us take a closer look at flexibility, and study it from the information systems perspective. Whereas technology is concerned flexibility is characterized by issues like connectivity, compatibility and modularity [20]. Here connectivity refers to the ability to interface technologies with other technologies, devices and systems whereas compatibility refers to the ability of sharing information across different technologies, platforms and information systems. Ideally, integration should be transparent meaning that data could be accessed, processed and shared regardless of the systems and technologies used in underlying information systems.

Modularity refers to a system that consists of parts - or modules - which have clear functions, interfaces and can be combined to different purposes [21]-[23]. In real life there are continuous changes in environment, technologies and requirements, which create a constant need for changes and modifications. Therefore, technologies should be modular so to make it possible to add, remove or modify different components in the system. It is important here that modifications are possible with little or minimal impact on other systems. Notice that if changes are possible without significant technical or operational difficulties the costs involved in changes can be kept at reasonable level. Clearly, flexibility is very important in information systems. Technically it is about the possibility to make changes, but there are also other concerns. From business perspective flexibility and modularity are connected with costs, profitability and possibility to create added value to operations and customers.

Flexibility is important in information systems for several reasons [24]: Firstly, there is a need for connecting different technologies, applications and systems together. Otherwise it would not be possible to access, integrate or simply use information from various systems for organizational purposes. For example, checking whether a customer has received and payed a shipment requires integration or access to data from different information systems in the company.

Connectivity across different systems requires flexibility, interfaces have to be defined and standardized in order to make integration possible. In fact, this is critical because there are constantly changes in systems, updates and new features. Furthermore, the need for flexibility goes beyond organizational boundaries. There are also increasing pressures to develop connections to information systems of other organizations, for example connecting with suppliers or significant customer organizations information systems to streamline processing of order management.

It is typical that information systems are serving their purpose for several years. During this time business

environment, operations and processes may change, and this calls for changes in information systems as well [3], [25]. There is a need for stability and robustness, but also flexibility for changes in information systems infrastructure. Secondly, information systems are having a critical role as backbone of business activities. This means that there needs to be a tight connection between company's vision, strategies and business targets and the developers of information systems. Changing business and needs in the organization such as expansion through mergers impacts information systems. It is inevitable that during the long time span of many systems and infrastructures there will become a need to modify systems, add new applications and technologies directly into existing infrastructure in order to meet the changes within organization and its environment.

Thirdly, the technological development as such generates a need for change. For example, upgrading a system may affect also other connecting information systems thus leading to problems. Changes are needed often widely when technologies mature, new applications, systems are being implemented. As a result, flexibility is needed in order to keep systems functioning as smoothly as possible. Also business growth and expansion in general requires flexibility. It is typical that new users, workstations, systems and services are created into existing information systems and infrastructures.

It is important to build flexibility into the infrastructures so that it enables rather than limits, whatever the future might bring to the organization. Here flexibility can be maximized by establishing development on modularization [17], [18]. Generally, the principle is to develop systems as modules which are logically and functionally autonomous, and defining standards and interfaces between the modules. This strategy emphasizes simplicity of each individual system, module and component in the infrastructure. The benefit is that modularization and encapsulation can be a significantly faster and more effective strategy than trying to deal with one large organization-wide standard in information system development. This approach is also referred to as "leanness" [24]. The principle in leanness is that it is easier to change something small and simple rather than trying to make changes in complex and large systems.

IV. CONCLUSIONS

Information systems, computers and applications are the basis of operations in practically all companies and organizations. The technical infrastructure – information technology infrastructure - should be robust and flexible to allow daily activities and changes in future actions of the organizations. As a result, it is important that underlying technology, systems and networks are reliable [26]. Information technology infrastructure can be seen as a combination of technology, procedures and knowledge which form the backbone that supports business processes [8].

Here we have studied the management of information systems in organization. Technology is seen as a resource, which in most organizations is a vital part of all operations and processes. An information system is more than choosing right technologies; it also has a human component.

Knowledge, experience and understanding how to use technology are vital for successful information systems management. Human component is therefore vital part of information systems infrastructure [10]-[12]. The other part of information systems is the technical component which consists of hardware, networking technologies and operating systems, as well as applications that are shared throughout the organization and users [20], [26].

In an organization it is important to use technology innovatively, in a way that it adds value to operations, processes and bring value to the customer. IT industry brings new innovations and advancements in existing technologies to the marketplace. The key is to understand how to best take advantage of the opportunities of these technologies and to develop services for business purposes in the organization [27]. The challenge is not about having the best technology, it is more connected to what to do with it, in order to create value and generate productive outputs [10].

Information systems management, developing and providing reliable information systems can be challenging. Here we suggest that developers of IT should use a modular approach in information systems management. This refers to identifying technically, logically or functionally integrated domains in information systems, and then developing and managing them as modules. It is also possible that modules can be provided by external partners, or their role in delivery of these modules is significant. In fact, modularity can be a good strategy in cases where flexibility and innovations are considered critical [28](Baldwin & Clark 2000). Partnerships require clearly defined modules and interfaces between them in order to provide information systems for the users, for operative and strategic purposes. This can be a solution in smaller organizations where the IT resources are limited. Looking for expertise and cooperation with external partners can be fruitful also in larger organizations.

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