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Table of Contents

Research Articles

Book Review

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Information Architecture For IS Function: A Case Study

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ABSTRACT

Today's complex, unstable and competitive society raises several difficulties to organisations. In this context, Information and Communications Technologies (ICT) and information itself have become resources of vital importance. The pressing need for Information Systems (IS) to meet several business requirements, in addition to the complexity involved in technology and business management, turns the IS Function one of the main areas of influence for success of modern organisations. Through its capacity of representing activities, management objects and corresponding relations, the Information Architecture of the Information Systems Function (IAISF), a technique derived from the well-known Information Architecture but exclusively focused on the Information Systems Function (ISF), allows not only the conceptualization and understanding of the ISF itself, but also of its interactions with other areas within organizations. This paper presents the main results of a case study related to the application of the IAISF technique in a computer service centre of a University.

Keywords: *Case Study, Information and Communications Technologies (ICT), Information Architecture (IA), Information Architecture of the Information Systems Function (IAISF), Information Systems Function (ISF)*

1. INTRODUCTION

The Information Systems Management (ISM) focuses on information resource management and on the management of all related resources involved in Information Systems (IS) planning, development and exploration. By other words, it is responsible for the management of the Information System Function (ISF) (Amaral, 1994). At the CI-UTAD (Computer Service Center of the University of Trás-os-Montes e Alto Douro), the need to supply computer services with guaranteed service levels, requires the effective management of all resources and activities, as

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well as the monitoring of performance, in order to deliver efficient and effective services to the organization's units which depend on IS and Information and Communication Technologies' (ICT) infrastructure.

Therefore, an architectural view of the ISF turns to be very useful and necessary, to allow the characterisation of this function and the systematization of its reality.

This work presents the process of construction of the Information Architecture of the Information Systems Function (IAISF) (Varajão, 1997; Varajão, 2002; Varajão, 2005) of CI-UTAD. The performed activities and corresponding management objects are identified, reflecting the overall integration of the Information Systems Planning (ISP), the Information Systems Development (ISD), the Information Systems Exploration (ISE), and the Information Systems Management (ISM) processes.

Next, in Section 2, it is presented the background; section 3 is dedicated to a generic presentation of CI-UTAD construction process and to the results obtained in the CI-UTAD IAISF case study; finally, some considerations on the conceptualisation process and about the case study are reported.

2. THE INFORMATION SYSTEMS FUNCTION AND THE CHIEF INFORMATION OFFICER

There is no doubt that information systems (IS) are the backbone of today's organizations (Muhic & Johansson, 2014). ISF is seen as the functional area in an organization, responsible for the information resources and for the planning, development, exploration and management of the IS. It is considered a key area due to the increasing importance of information technology (TI) and to the strategic opportunities promoted by IS and ICT.

ISF includes a set of features and activities that must be tuned to organization's size, culture, structure and to several business issues like, for instance, environmental aspects. ISM must address all these aspects.

ISF can be conceptually described by four main groups of activities (Varajão, 1998; Varajão, 2005): Information Systems Planning (ISP); Information Systems Development (ISD); Information Systems Exploration (ISE) and Information Systems Management (ISM).

The ISP is responsible for the identification of systems that the organization need, preceding the ISD which is responsible for their development. The ISE follows, being responsible for ensuring the correct use of the IS. ISM coordinates all the ISF activities.

The ISP allows the creation of a long term vision, identifying the potential systems to be created and defining management policies.

It is assumed that ISP is aligned with business planning, taking into account that ISP itself is a way of planning organisational changes, reachable through ISD (Varajão, 2002).

ISF activities must be "tuned" to each organisation (and its IS), according to its own idiosyncratic, most suitable models, methods and techniques (Reis, 1987).

Due to its nature, ISF can be seen both as cyclic and as continuous (Varajão, 2005): its activities feed each other mutually in every system generation cycle, in a tightly coupled way.

The Chief Information Officer (CIO) is the main responsible for the ISF.

The CIO's profile requires technical skills in the areas of ICT and IS, as well as an in depth knowledge of the organization itself (Trigo, Varajão et al., 2007).

The CIO's importance is today well recognised. It is demonstrated by the position CIOs occupy in most organizations: CIOs report their decisions and activities, to a large extent, to the organisational top manager (CIOMAG, 2007).

Gottschalk and Taylor (Gottschalk & Taylor, 2000; Gottschalk, 2002) identify six types of responsibilities assigned to CIOs: Chief Architect; Project Creator; Technology Manager; Tutor; Operations Strategy Manager.

Trigo, Barroso and Varajão (Trigo, Varajão et al., 2007) discuss a set of eight essential roles for the ISM: Leader, Linker, Monitor, Spokesperson, Entrepreneur, Resources Allocator; Architect of Changes; Technology Planner. In order to succeed, CIOs must develop the adequate skills and capacities to perform their role.

It is possible to find a set of activities which CIOs usually perform (Carvalho et al., 2009): interact with top management (Preston, 2003); take strategic decisions (Bilhim, 1999); plan information systems (Feeny & Willcocks, 1998); manage the process of viability assessment of new systems and technologies (Benamati & Lederer, 2001); analyse, assess and select systems (software/hardware; Tam & Hui, 2001); systems acquisition (Sutter, 2004; Marshall et al., 2005); manage projects (Gorgone & Gray, 2000; Bhatt et al., 2006); manage the development and the implementation of information systems (Varajão, 2002); manage the maintenance of information systems (Reddy & Reddy, 2002); optimize business processes (Davenport & Short, 1990; Carvalho & Costa, 2007); manage the information systems team (Nelson, 1991); manage the contract services (Rockart et al., 1996; Feeny & Willcocks, 1998); manage crises in the information systems (Varajão, 2002); mediate individual and collective conflicts (Varajão, 2002); define rules and processes for the information systems (Ross et al., 1996); manage the infrastructure of the information system (Bakos, 1992; Singh, 1993); assess the performance of information systems and plan their optimization (Heo & Han, 2003); evaluate the business problems, identifiy opportunities and define solutions for the information systems (Trauth et al., 1993); optimize processes of the information systems function (Gottschalk, 2000); manage the information and guarantee its access and security (Montazemi et al., 1996); follow and explore new technologies and knowledge (Karimi et al., 1996; Ross et al., 1996); manage the system's integration (Ross et al., 1996); manage the purchase of equipment (Varajão, 2002); develop the competences of final users (Rondeau et al., 2002).

In order to develop the activities he/she is in charge, the information systems manager needs to get several competences (Portela et al., 2010; Colomo-Palacios et al., 2010; Trigo et al., 2010): capacity of thinking and act strategically (Hawkins, 2004); capacity to mediate conflicts (Varajão, 2002); capacity to lead and motivate teams (Chiavenato, 1994; Lane & Koronios, 2007); capacity to manage projects (Gorgone & Gray, 2000); capacity of communicating (Feeny & Ross, 2000; Smaltz et al., 2006); capacity to follow up technological innovations (Lee et al., 2002; Lutchen, 2003); capacity of personal inter-relating (Katz, 1995; Reis, 1987); capacity of creating teams and structure them (Ward, 1995; Nelson, 1991; Polansky et al., 2004); capacity of negotiation (Reich & Nelson, 2003; Ertel & Gordon, 2007); capacity of adaptation to changes (Amaral, 1994; Rhinesmith, 1996); business knowledge (Keen, 1991; Reis, 1987; Rhinesmith, 1996); technical knowledge (Polansky et al., 2004); capacity of making decisions (Bilhim, 1999).

In this context, IAISF is a management tool for CIOs, which allows them to have a deep understanding of ISF activities and their integration.

3. INFORMATION ARCHITECTURE OF THE INFORMATION SYSTEMS FUNCTION

IAISF is a technique based on the well known Information Architecture (IBM, 1974). It allows the complete and global representation of the planning, development, management and exploration of the ISF activities.

The relevance of an architectural view of the ISF is based on the need for the existence of tools that must be simultaneously powerful, comprehensive, able to describe the ISF in a wide and integrated manner, and compatible with organisational models and representations.

In the IAISF conceptualization and construction process, it is possible to identify two moments of outmost importance (Varajão, 2005): current characterization of the situation; construction of a global vision for the desired future.

IAISF is both a diagnosis and a management tool that allows the creation of an overview of the ISF in the organization. Therefore the

ISP must be the leading activity boosting the emergence of the main orientations for the construction and use of the IAISF (Varajão, 2005).

As a diagnosis and a management tool, IAISF constitutes a reference for ISP, ISD, ISE and ISM contextualization within the organisation. IAISF must therefore address each of these domains of the ISF (Varajão, 2005).

There is not a unique model of management objects or activities that can be applied to all organisations. The process of IAISF construction must be studied and detailed according to each organisation's specificities.

The aim of IAISF is to show how the components of a specific reality fit together and interact. Instead of avoiding other techniques, the architectural approach captures their differences and sets suitable interfaces among them, constructing customised solutions according to the specific problem requirements (Poel, 1989).

Any type of architecture needs a well defined context and a set of known and accepted components (or objects) that allow the architecture construction. After their identification, it is necessary to understand the relations between them. It usually involves modelling and evaluation of the scope of the interacting components options (Tapscott & Caston, 1993).

The early development stage of IAISF enables the comprehension of the *status quo* of the ISF and leads, for instance, to the checking of interface problems between activities, or to the identification of problems that would not be visible otherwise. In practice, the IAISF design brings benefits to the ISF and contributes significantly to its efficiency and effectiveness (Varajão, 1997).

4. CASE STUDY

In this section we present the case study of CI-UTAD. As a university, UTAD goals are education, research, promotion of local and social development, as well as creation and communication of culture, science and technology.

The organisational structure of UTAD includes administrative and technical units and services, both for teaching and research support.

Of all those services, this study focuses exclusively on the Computer Services Unit (CSU). CSU provides technical services and support related to ICT for academic activities to all departments, degrees and users (professors, staff and students).

CSU infra-structure is complex concerning technology. Its heterogeneity is quite high considering the type of users and provided services.

CSU services include: maintenance and upgrade of network technologies and services; data centre management; helpdesk; education support information systems; students services; intranet; administrative support systems; training; special projects and academic partnerships; intellectual property's support office.

CSU human resources are separated hierarchically in two groups: coordination and technical staff. The coordination group is headed by a coordinator, a vice-coordinator and two technical directors.

The coordination group is assigned with the overall management of the activities, as well as with the human resources management. Although there is one person responsible for each technical sub-unit, goals and milestones are set by the directors together with the coordination team. Each sub-unit and respective services have to report their activities to the coordination team on a regular basis. CSU has an annual plan and budget which is elaborated by the coordination team. This document is included in the overall Engineering School plan and budget.

CSU technical sub-units are composed by four teams defined according to their specialization and the activities they perform: Helpdesk, Systems administration, Network administration, and Systems development.

The Helpdesk unit is composed by five people performing face-to-face support, phone support and support by electronic/Internet means and resources. This unit establishes a more direct contact with users.

The system administration team manages the entire university physical network and sup-

Table 1. Example of Management objects analysis

Activity			Creation of user profile		
Management Objects (U - used by the activity)			Management Objects (C - created by the activity)		
Records of users' needs	E	S	Users' Records	E	S
Requirements records of users	E	S		E	S
Users' manuals for systems	E	S		E	S
Records of systems utilization	E	S		E	S

Legend: E–Input / S–Output

port services, email, web, etc. Services based on Window and Linux operating systems are managed by different groups/sub-teams.

The network management team, composed by two employees, is responsible for the maintenance, configuration, monitoring, tuning and upgrading of the technological network's infra-structure.

The system development team, with 13 people, is organised in three groups: one for small size projects, another for medium and big size projects, and another one exclusively devoted to the SIDE (e-learning) platform, which is the main support system for teaching activities.

The system development team is responsible for developing internally (inside the university) requested projects, as well as external ones.

CSU staff is composed by permanent staff, as well as temporary hired employees, whose remuneration is insured by specific projects.

CSU human resources internal policies enforce staff training, staff mobility and education, including their participation in MSc and PhD programmes.

5. CI-UTAD INFORMATION ARCHITECTURE

The first stage of the IAISF construction process of CI-UTAD consisted in the identification and the description of the activities needed to manage IS resources. That allowed the understanding of current skills and of IS assets. The outcome from this first stage was: a list of activities of the ISF, a description of each activity, the knowledge about how each activity is performed inside the organisation, and the identification of opportunities for the positioning and development of the ISF.

In a second stage, management objects related to the activities previously identified were defined, as well as the relationships between them.

Like for the activities, the identification of management objects is basic for the definition of IAISF. The relationships between the activities and the corresponding needed data, lead directly to the identification of the management objects and their relationships.

In the same way it happens with the activities, it is useful to group or split the management objects in order to ensure that only one activity is responsible for a specific management object creation. In this context, "creating" means that the activity is responsible for the initial creation or for the maintenance of a specific management object (Varajão, 2005).

All management objects in this case study were analysed taking the following into account: what it represents; which activity creates it; and which activities make use of it.

Table 1 shows an example of identified management objects for the "Creation of user profile" activity. In the column "Management Objects Used", it is possible to check the data needed for that activity. In the column "Created Management Objects" it is possible to see which data is created by this activity.

Figure 1 shows the relation between each management object and its related activity. It is possible to see, in the intersection of both, a "C", a "U", an "E" or a "S" letter. These letters refer if a management object is created ("C"), is used ("U"), is an input ("E") or an output ("S") of the activity. Whenever any of those situations applies to an activity, it is represented by the respective shadowed letter.

So, the following situations may occur:

- A management object is created ("C" relationship) but it is not an input or an output of the activity (neither "E" nor "S" are shadowed). It is thus an internal object for the activity with no interest for other activities (it is only obtained or developed internally in the context of this activity). It is likely to be relevant and used for the development of other outputs of the activity that creates it;
- A management object is created ("C" relationship) and it is an input ("E" shadowed) and an output ("S" shadowed) of the activity. It means that the activity is not only responsible for its creation, but it also makes the object available for other activities. In addition, the activity uses it after its creation for revision or supervision;
- A management object is created ("C" relationship), it is not an input ("E" is not shadowed), but is an output ("S" is shadowed) of the activity. It means that the object is created by a specific activity which will not use it later in following revisions/redefinitions. But other activities make use of it;
- The management object is used ("U" relationship) but is not an output ("S" not shadowed) of the activity. It means the activity needs the object as a reference, but does not change it;
- The management object is used ("U" relationship) and is an output ("S" shadowed) of the activity. It means the activity not only needs the object but also changes it.

6. DISCUSSION

The construction of the IAISF for CI-UTAD made the management of the IS of the organization more comprehensive, through the identification and description of the ISF activities, their respective management objects, and the relations and interactions between the activities.

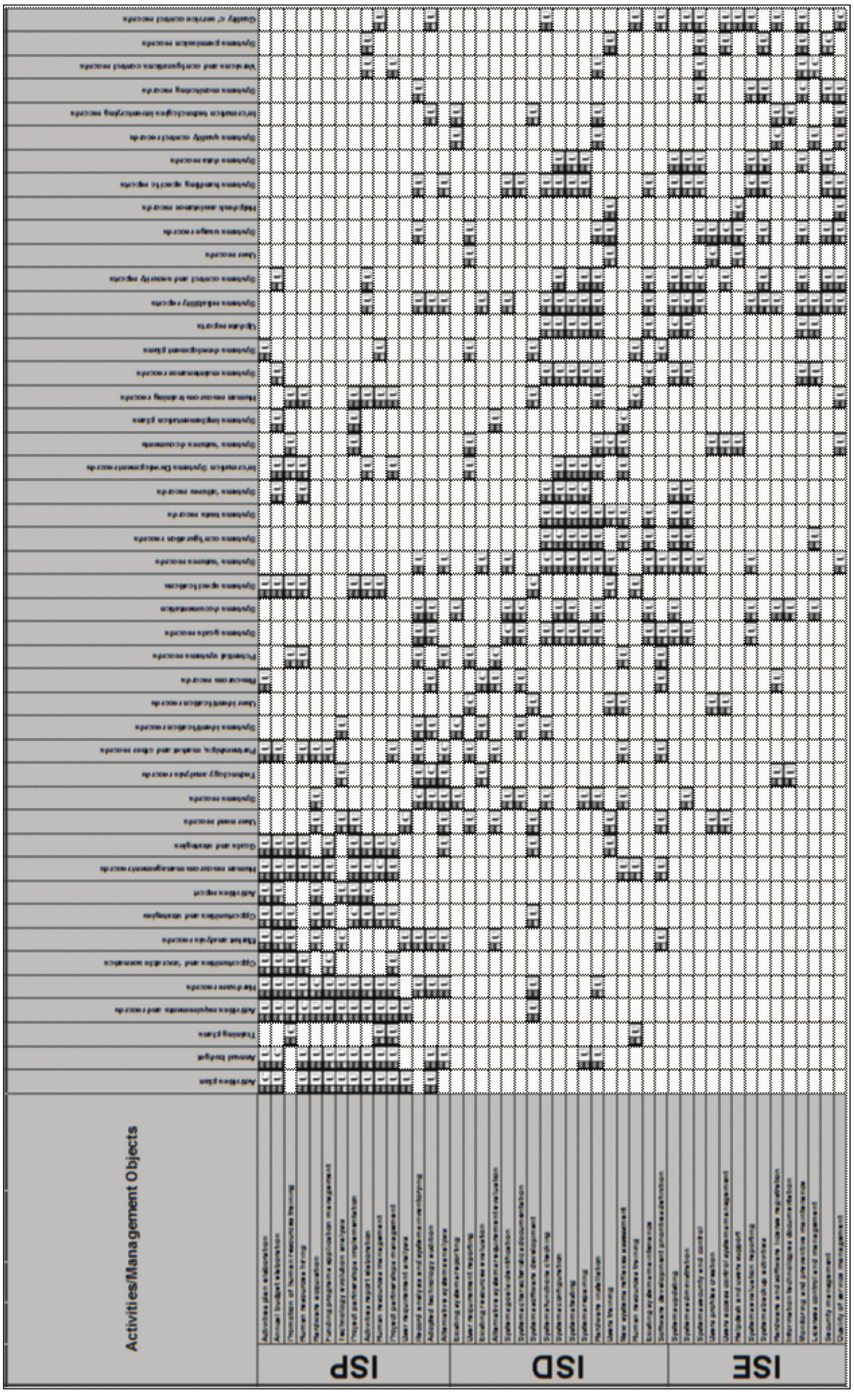
The most relevant contributions of IAISF construction to the IS comprehension can be enumerated as follow:

- Determination of the integration/alignment of ISP, ISD and ISP group of activities that constitute de ISF, and the evaluation of their complementarity, continuity and interdependence;
- Identification of activities and the management objects created by them, allowing to improve the overall ISM, as well as the management of each one of the activities;
- Clarification of the actual role and position of the ISM inside the organisation, with positive reflexes on strategic alignment;
- Removal of some redundant tasks inside the organisation, facilitating the identification of relationships and interdependences among activities;
- Creation of unknown/not used management objects, that are important for the ISD;
- Improvement of the communication between the business areas and the ISM.

It is important to mention that some difficulties were encountered as the work was being developed. For example, since most of the activities involved ICT which are deeply disseminated in the organization, sometimes it was difficult to identify which activities laid within the ISF scope and which not.

It must be underlined that the IAISF development does not end after its initial construction. Like the ISF, it is a continuous and an ongoing process. The IAISF has to be constantly re-evaluated and improved in order to reflect, at any time, a true image of the ISF of the organisation (Varajão, 1997).

Figure 1. IAISF for CI-UT



7. CONCLUSION

In response to the increasingly competitive environment, organizations are under pressure to become more agile in their operations, accelerate their innovation process, and deliver products within shorter cycles while minimizing cost (Mikalef et al., 2014).

In this context ICT can be an important ally since it is one of the main drivers of changes and innovations in corporations (Bach, Zoroja et al., 2013), being important that organisations improve permanently the use and the management of information as a resource. It is the role of the ISF, usually materialized in the Information Systems Departments, to guarantee that IT are adopted and managed in a contextualised and customised way to serve efficiently the purpose of the organisation (Varajão, 2006).

The IAISF of CI-UTAD allows the visualization of ISF as a whole, constituted of clearly described, integrated and interdependent activities, as well as the management objects related and used by them.

The process that was followed in the construction of the IAISF of CI-UTAD was considered essential for the comprehension and positioning of the ISF. Therefore top management considered it an important contribution for ISM and for the organisation's improvements. This process resulted in the recognition of the IAISF as a relevant instrument of diagnose and planning of the ISF activities within the organisation.

IAISF proved to be a useful management tool for the CIO, allowing him to have a deep understanding of ISF activities and their integration. It is also a valuable tool for the other IT professionals because it enables a better understanding of the activities being developed at several levels (ISP, ISD, ISE, ISM) and of the management (informational) objects.

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