NEW TRENDS IN ORGANIZATION INFORMATION SYSTEMS DEVELOPMENT

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An organization's architecture is the rigorous description of its structure that includes organization components (entities), their features, as well as the relationships among them. This description must be comprehensive and include organization goals, mechanisms, and rules, internal and external processes, as well as technology. The architecture must be structured by layers and the interaction among these contributes to achieving organization goals. In this respect, specialized literature provides several approaches depending on the perspective taken on an organization: the management/owner perspective, organization process designer view or process administrator view. One of these is actually the mix of business process view and information view, with the following components for the latter in most cases: data architecture, application architecture, technological resources architecture.

Key words: *information systems, enterprise architecture, information flow, Intranet.*

1. ORGANIZATION INFORMATION ARCHITECTURE

An organization is an entity that uses and combines human, financial and material resources in order to reach a set of goals [1]. There is a wide range of organizations such as: plants, corporations, governments, government authorities, defense and intelligence establishments, academic and educational institutions, etc.

Regardless of their field, all organizations follow universal principles like establishing a set of goals, setting up a hierarchical structure based on authority levels and decision making power, delineating roles and responsibilities of every component within the hierarchy, identifying the means to ensure communication among these components, as well as the methods to facilitate goal accomplishment.

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The reference model of organization architecture clearly distinguishes among the architecture levels in **Figure 1.**

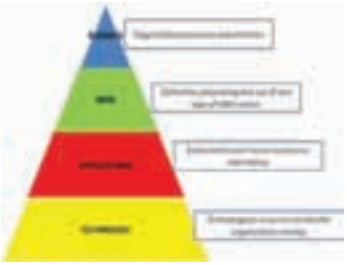

Figure 1: Organization architecture [2]

These levels can be further divided in several subdomains as follows [3]:

i) Organization processes architecture with the following main subdomains:
- Requirements of organization processes;
- Organization processes rules;
- Organization structure;
- Organization mission/vision;
- Goal accomplishment indicators;
- Organization processes modeling and design.

ii) Data/information architecture with the following main subdomains:
- Data/information architecture;
- Data/information management;
- Data/information quality;
- Data/information security;
- Business intelligence;
- Data/information dissemination.

iii) The application/integration architecture subdomains is divided in:
- Components for organization applications integration;
- Organization services defining;
- Organization stakeholders' applications development.

iv) The technological architecture comprises:
- Hardware resources;
- Software resources;
- Communication services;
- Security.

An overview of organization architecture and its domains and subdomains is presented in **Figure 2.**

Figure 2: Domains and subdomains of organization architecture [3]

As it results from the figure above, the information system is the "backbone" of the enterprise.

2. FEATURES OF AN ORGANIZATION INFORMATION SYSTEM

An information system is defined as the number of technical and procedural resources aimed at collecting, processing, storing and using an organization's data and information. Its goal is to ensure the supply to every user within the organization the knowledge the latter is entitled to access. Such a system must allow the flow of information to the various functional levels of an organization in an operational manner, information selection based on certain criteria, adaptability to structural changes in information or in its processing methods. In this respect, the information supplied by such a system must be [4]:
- Relevant – it offers the knowledge needed by decision makers to undertake their tasks;
- Accessible – it enables users to use it and pass it on;
- Accurate – it can be replicated as close as possible to the initial context;
- Concise – it brings added value through its objectivity and as a result of removing irrelevant elements;
- On time – the user can access it in due time so that the decision made is well grounded;
- Costs incurring – all financial resources generated by information acquisition, processing and dissemination to the user generate costs.

An information system is composed of:

i) Data and information – these are the primary components of an information system and they characterize organization activities and processes. In this respect, the major difference between data and information is worth reminding. Thus, as a result of data processing within the information system information renders added value. This increases organization knowledge and underpins the actions of the decision makers;

ii) Information flows – these are all the data, information and decisions related to one or several specific activities and that are conveyed via pre-established paths at a given speed, frequency and using certain information resources;

iii) Data and information collection, processing, distribution and use techniques and resources – these are composed of all hardware and software resources, communiction services and infrastructure, as well as specific organization procedures that allow primary data to gain the added value needed to reach organization goals in a swift manner.

The future of an information system is connected to the concept of knowledge management. The latter is to allow organizations to move from working with data to working with knowledge, as presented in the figure below.

Figure 3: Knowledge management architecture

Specialized literature offers a number of definitions of "knowledge management" and the one preferred for this article belongs to Y. Malhotra [5]. According to this specialist, knowledge management provides the elements necessary to solve critical problems related to an organization's adaptation, survival and competence when confronted with changes in its environment. It basically includes organizational processes that are oriented towards a harmonious mix of data, information processing capacity rendered by information technology, and people's capacity to create and innovate.

Thus, as it results from such a definition, **data** are the basis of the pyramid from **Figure 3.** They are collected in a given context and do not have a meaning by themselves. When their context is identified or when they acquire meaning data are organized and summarized becoming information. Hence, **information** is next in the pyramid and it turns into knowledge when its user is able to understand its patterns and to employ it immediately or in the future in order to achieve organizational goals. The main methods to transform information into knowledge are analysis and synthesis.

Some authors add one more level to the pyramid and they call it "wisdom". This concept involves understanding the principles needed to make judgments and it is used in the decision making process.

1.3. Features of information architecture in the military field

Despite their features, military establishments are not any different from other organizations. As a result, their success or failure depends on the ability to encapsulate the dimensions underlying the organization architecture concept and to rapidly absorb the improvements in information systems in order to preserve the distinguishing features of the armed forces: swiftness, responsiveness, efficiency and steadiness.

A military operation's success is rendered by the extent to which the information collected at tactical

level enable various command layers to make decisions in a short time frame and to control forces in order to accomplish assigned missions. The battle field has become more demanding than ever lately. The new types of asymmetric warfare, the concept of *network-centric warfare*, force mobility, the increasing space between battle groups, the armament that is electronically controlled require new solutions to ensure information flow at tactical and strategic levels.

The C4I concept – *Command, Control, Communication, Computers and Intelligence* (some alternatives of the aforementioned concept can be found in the intelligence field) alongside its derivative C4ISR – *Command, Control, Communication, Computers, Intelligence, Surveillance and Reconnaissance* represent the backbone of military operations conduct.

In December 1997, the US Department of Defense released the C4ISR system architecture that can be applied to all force categories [6]. The model, displayed in **Figure 4** described three architectures: operational, system and technical, as well as the relationships among these. Its goal is to ensure a high level of consistency, correlation and integration of the information derived from the three architectures with a view to supporting tactical and strategic decisions made at the command level from within each main force category.

As it results from the figure below, the **operational architecture** describes the tasks and activities, the operational elements and information flows needed to support or to finalize an operation. The type of the information that is transferred, the frequency and type of changes are specified in sufficient details in order to establish the desired level of interoperability. The **system architecture** converts this interoperability level into a set of capabilities needed by the system and compares the current and foreseen implementations in terms of the capabilities required, including the services, functions and interface standards in order to achieve the performance level required within specified constraints.

The **technical architecture** defines the criteria that govern the implementation of each system capability and consists in identifying the physical components of system architecture and their arrangement in a manner that describes each component's physical structure, technical functions, design features and technical characteristics available within specified constraints.

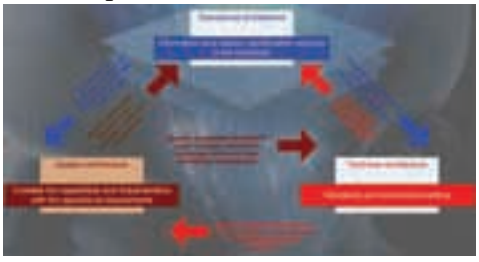

Figure 4: DoD C4ISR system architecture model [6]

Based on the model released by the DoD, a number of C4I system implementations were developed by specialized literature both in the military field and in the intelligence area. One of these is displayed in Figure 5. This adds to the three architectures described by the initial model other components that contribute to the C4I system functionality [7]:

• Military command systems – they are integrated systems of doctrines, procedures, organization structures, personnel, equipment and facilities that collect, examine, integrate, analyze, evaluate, interpret information from various military areas in order to support the activity of command and decision making bodies.

• Defense resources management system – consists of all resources needed to manage human resources, acquisitions, budget planning, logistics, the health and legal system.

• Armament control system – is defined as one or several force category specializations endowed with the needed equipment, materials, services and facilities.

• Training system – expands upon the Distributed Interactive Simulation (DIS) concept and is aimed at simulating diverse and numerous military operations in a virtual manner. Thus, a larger number of active entities and range of battle and environmental effects are represented. Such a virtual environment allows for a more thorough representation of the battle field and hence the conduct of both conventional and asymmetric military operations.

• Information system – refers to all the means, methods and procedures that contribute to the collection, processing, storage and use of data and information in a military system. It includes the resource management system that belongs to the information and communications field, the database management system, the data collection and distribution system, as well as the "business intelligence" system.

Figure 5: C4I systems general architecture [7]

In conclusion, the military and intelligence fields align to the requirements of the information society. In this respect, the parallel between the concepts of e-defense and e-bussiness can be representative for running the military organizational processes.

2. TRENDS IN THE DEVELOPMENT OF ORGANIZATION INFORMATION AND COMMUNICATIONS SERVICES

2.1. A generic model of organisation services structure

Generally, an organization's requirements dynamics in terms of information and communications services is high due to its need to swiftly adapt to new business opportunities or to stakeholders' requests.

Organization information and communications services are aligned to organization information structure which corresponds to the following zones:

i) The front office zone where the organization's link with its external stakeholders is established;

The main features of this zone are related to the management of the organization's relationship with its customers and beneficiaries. Its most important elements are the quality of the data supplied to beneficiaries and the security of their access to an organization's data and information.

ii) The back office zone where all internal structures of an organization interact;

This zone is focused on ensuring data integrity, availability, and processing and use swiftness. As with the previous zone, data security (under the form of physical, access policies and personnel security) is a salient component.

In most cases organization services are similar regardless of organization field and more often than not an organization process is supported by two or more services. In this respect, **Table no. 1** presents a number of applications and services characteristic of some organizations as examples.

Table no. 1. Examples of applications and services characteristic of some organizations

SERVICES	APPLICATION/PROCESSES								
	Trade	Production	Call center	Banking system	Information supply	Governance	Education	Health	Defense and intelligence
Voice	√	√	√	√		√	√	√	√
Videoconference		√				√			√
Interactive video	√						√	√	
Traceability	√	√							
E-mail	√	√	√	√			√		√
Portal	√			√	√	√	√	√	√
Access database	√		√	√	√	√		√	√
Document management	√	√		√		√			√
Enterprise Resources		√				√		√	√
Management (ERP)	√	√		√		√			
Client relations (CRM)	√	√		√		√			
Help desk	√	√	√	√	√	√	√	√	√
Internet[1] access	√	√	√	√	√	√	√	√	√

[1]It is the framework within which the organization uses the service in its primary form to supply its own services and not as a support for communications

At first sight the range of organization services would require the development of an infinite number of information and communications resources at technological level. However, the great advantage of technologies consists in the standards that contribute to their grouping/ structuring within services, as well as to their interoperability.

The next subchapter is to focus on a brief and yet not limited description of the services supplied within an organization, as well as on the protocols and standards underlying these.

2.2. Voice and multimedia services

The voice and multimedia services are increasingly used within organizations. The multimedia experience is the mix of information and communications technology that ensures maximum satisfaction to the final user and is characterized by transparent data access, storage, processing and communication.

A general definition of multimedia services is *"the combination of two or several initial media (images, graphics, audio files, video files, animation, files) in order to create, store, supply and access an integrated content"*.

Some significant examples of multimedia services that can be applied in various organization fields are:

- Static images used for e-commerce, e-banking or e-government applications in various resolutions (from small ones used for consulting to high ones needed for detailed images). Some of this require in their turn adding some other images (for example a payment form to which images of document copies are attached);
- High resolution images used in specific situations like medical imaging (X-rays, CTs and other types of scanning) or military applications (detailed maps with 3D terrain configuration);
- Static and moving images used in e-learning to ensure a direct teacher-student relation or in the so called "live books" that, besides the regular content of a book, also contain animations or external links;
- Moving images used by organizations in video conferencing or connections.

Depending on the goal underlying the use of multimedia services, a video file can be combined with an audio file or with data files.

As far as the traditional voice service (telephone), it can be supplied as such or it can benefit from added value services like voice mail, interactive voice response (IVR), etc.

Due to the nature of primary signals and the means to approach them in an integrated manner, there is an ongoing concern worldwide for the identification of standards and protocols that ensure undistorted coding of these signals, uniform processing and compatibility with transport protocols associated with communications networks.

Audio-video and multimedia services require focus on the quality delivered to customers. In this respect, the applications used to deliver these services are underpinned by standardized quality control mechanisms.

2.3. Organization portal

Within any organization there is a wide range of data and information that, if they are not adequately structured, filtered and supplied to users can lead to processing delays and even to mistaken decisions that can negatively impact an enterprise.

An organization's portal is a concept that enables the search, interaction and use of the data and information from an organization so that its goals are accomplished. This is based on information resources that are similar to the ones used in the Internet to ensure access to sites. The strength of such an instrument is derived from the following key parameters:

- organization data and information structuring;
- swift use of data and information by users;
- users' ease of access to the various sections of the portal by relying on friendly graphic interfaces;
- a safe environment for information supply underpinned by the "need to know" principle.

A model of an organization portal (see **Figure 6**) that can be adapted to the requirements of any enterprise must have the following capabilities [8]:

i) Classification (taxonomy) – is the process of labeling the information owned by an organization based on their content and the relations they establish with other types of information. For example, taxonomies by subject, functions, organization groups, project, products, etc. can be developed. It is important for these classifications to meet organization requirements so that their use generate added value. Once a taxonomy developed, an information indexing process must be defined for it. In this respect, one way of accomplishing this is through metadata (i.e. data about data);

ii) Content management – is the regular updating of information content as a result of which information acquires new value or is archived;

iii) Integrated search – information is stored in different places and therefore mechanisms for simultaneous search in several data storage places (databases, emails, forums, applications, etc.) must be developed;

iv) Personalization – is the process as a result of which information search and use is done based on its relevance to users or groups of users. It must be flexible so that it allows subsequent changes of user groups or of other information to which the latter have access. One of the strengths of this process is its interaction with the user via the creation of a specific graphic interface that allows for a swift and easy search of needed information;

v) Integration – is the characteristic that determines a unified version of available information within an organization. In this respect, it is necessary to define an information architecture that allows the processing and use of the data that belong to both structured and unstructured storage places;

vi) Collaboration – is the feature that allows information to be shared among several users based on the "need to share" principle. There are two collaboration methods: the asynchronous mode that includes services like email, forums, etc. and the synchronous one that uses multimedia services. With the latter, the applications from within the portal must meet the quality requirements of these services;

vii) Scalability – is a plug-and-play feature that allows for subsequent development of services;

viii) Security – is an extremely important dimension of an organization portal that must ensure users' access based on some security policies that should not excessively slow down the process of information use. In this respect, a current security implementation is the Single Sign On access that allows a user to employ those parts of the application based on the "need to know" principle.

Figure 6: Model of an organization portal architecture [8]

Taking into account the variety of services and technologies that underlie an organization portal, it is pretty difficult to measure the overall level of service quality. However, a new conceptual model based on performance measurement can be identified [9], [10]. This is divided in two categories: the one of information that can be valued by using the portal, and the one associated of information resources supporting the portal, as presented in **Table 2.**

Table no. 2. Measurement of service quality provided by organization portal

	Quality parameter	Capabilities
Information	Content usefulness	Value Accuracy Consistency Up-to-date
System	Accessibility	Availability Responsiveness
	Feasibility	Robustness Finality
	Transactional	Atomicity Consistency Segregation Durability
	Security	Authorization Authentication Confidentiality Non-repudiation

2.4. Services for organization processes integration

In large organizations information is spread out in all its components by using heterogeneous resources. Even if each of these "information islands" can tackle specific activities, at overall organization level there is a lack of correlation among the

information originating from these components which thus leads to decreased organization performance.

In order to eliminate this disadvantage several solutions aimed at standardizing organization processes, as well the defining, processing and use of the data belonging to this integrated environment have been made. Nowadays, the solution that facilitates information exchange within organization and also contributes to developing a consistent outlook on it is known as Enterprise Resource Planning (ERP).

ERP enables the relationship between an organization and information technology through planning the four factors that impact the accomplishment of organization goals: human, financial, technical and logistic. In order to allow for a decentralized processing environment, its architecture is the client server type and it consists of three levels:

i) Presentation level – refers to the mechanism used to access ERP functions and is made of user graphic interfaces or access software resources;

ii) Application level – is defined by the logic underlying ERP and consists of information resource sharing between the users and the database;

iii) Database level – responsible for managing organization data and the information associated to the latter (metadata).

Even though the adoption of ERP as an organization tool involves high costs (in this respect, some studies estimate the costs of such an instrument at hundreds of millions of Euros for an organization with complex information flows), the advantages of using ERP are multiple. Some of these are listed below:

• Data standardization and elimination of undesirable overlaps as a result of introducing data/ information into a database in a consistent manner;

• Supply of functions necessary for inter-modular interaction, which is a very important factor contributing to ERP scalability;

• Supply of comprehensive reports on the status and trends associated with organization goals which thus leads to an increase in efficiency;

• Information management in an accurate and consistent manner as a result of removing information overlap resulted from organization entities using different instruments;

• Increased efficiency assurance in the human resource field as a result of optimizing the information flows in this field and correlating them with the flows of other organizational entities.

The ERP can be molded for all activity fields of current society like the economic, financial, banking or military one. As far as the latter is concerned, the implementation difficulties are higher given the system's two-fold orientation and inherent features: resource management (which is the current purpose of the ERP) and C4ISR related characteristics. Figure 9 presents by comparison an ERP architecture used in the civil environment and the US Navy ERP architecture [11].

Figure 7: Comparison between civil ERP (left) and the US Navy ERP (right) [11]

Taking into account the role that the process integration services play at organization level, it is obvious that the ERP related information flows require higher performance parameters compared to those associated with an organization's portal.

3. CONCLUSIONS

The future of organization information systems is indissolubly connected to the foreseen transformation of current industrialized economy into a knowledge based one. Concurrently, organizations need to adapt their information flows so as to be able

to generate new knowledge based on the existing one. Activities based on design, research, innovation are to play an dominant role in ensuring organization competitivity in an ever demanding society. The policies and strategies concerning the development trends of a knowledge based information society have already been framed by the programmatic documents of the European Union. In this respect, the Digital Agenda for Europe and its subsequent documents are worth reminding.

The action plan for a knowledge based society for the next 5-10 years is to be found in a study elaborated by SCF Associates Ltd. for the Swedish government entitled "A Green Knowledge Society" [12] and consists of the following guidelines: Knowledge based society: participation for all; Information and communication "green" technology: a support for an efficient and ecological economy; Future generation infrastructure: balancing investment and competition; Soft infrastructure: social capital investment; ITC field and small and medium enterprises; One information market: activating cohesion and development; E-government revolution: reviewing the concept of public service delivery; On-line trust: a safe digital world; Coherent management: reviewing the European decision making process.

In conclusion, information processes from within organizations increase in complexity by day as a result of the global economic and social environment. The principles underlying information flows are similar regardless of organization field and they are related to the contribution made by information and communication services to achieving organization goals in an efficient and economic manner. The new requirements made by information society correlated with organization strategic goals lead to an increased dynamics of these flows and consequently place increasing demands on the responsiveness of organization technical resources in general and of the available communication and information resources, in particular. Organization Intranet is a real "backbone" supporting the entire information system of an enterprise as a result of resource convergence. Some of the direct benefits generated by organization Intranet are: increase in productivity, ensuring a collaborative work environment, significant decrease in costs, as well as promoting a cohesive corporate culture.

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