A Framework for Service Oriented Teaching Programs *

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Abstract: The science of services constitutes a breakthrough in the traditional way of thinking of the place of informatics in the economic development of a State, a Region, an enterprise and consequently in the teaching programs. The question is no more only a question of computer science. We are in front of a more complex situation, which requires not only a multidisciplinary approach, but an interoperable approach at the intellectual level. This paper is an introduction to this complexity and it is also an attempt to propose crucial questions about the new bachelor programs and master programs.

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1 Introduction

At the beginning of computer science there was the domain of data processing. This domain was very important to sort data and to realize some fundamental applications for enterprises. Then it became business computing with an extensive use of file management systems. Due to the development of the technology of database management systems, it was transformed into the domain of information systems (IS). The stakes were no more to implement computerized applications for business but mainly to create new workspaces for managers, with various competencies and various responsibilities, inside a same enterprise or inside a network of enterprises working together. Now we enter a new domain: the services. The terminology is not stable and it is difficult to find a common understanding of this term. But it is clear for all that the domain of Science of services is no more only a sub-domain of computer science[1-2]. The persons coming from the IS domain know that for a long time that the IS domain cannot be reduced to a simple sub-domain of computer science. Nevertheless, even for them, it is necessary to understand that something important is coming.

In this paper, we use the following conceptual framework of the IS domain, that we introduced before[3]. An Information System, at the intellectual level, is a complex composed of five domains[4], which are autonomous: they have their own characteristics, their own concepts and ways of reasoning, their own rules, their own criteria of pertinence, sustainability and quality, their own dynamics, their own meanings about the IS utility and the IS usability.

Each part raises questions about contents of teaching programs. Then we propose a definition of service and its importance in teaching programs.

2 Informatics

Even if in the past any institution had an "information system" by means of paper documents, we speak now about IS only if it is implemented by means of informatics. So informatics plays an important role in the IS development. But what kind of informatics? All the parts of computer science are not relevant to develop an IS. For instance, we can agree that there is a big difference between the knowledge backgrounds of a specialist of hardware and of an IS developer. But — may be the agreement could be less easy to find — must a data base developer master the same knowledge that a specialist of a data base management system (DBMS) for developing new functionalities in a DBMS? If not, what is the DBMS knowledge that an IS developer must master? Furthermore, is there any knowledge about databases that is compulsory for an IS developer and useless for a DBMS specialist? For any kind of information technology as DBMS, these questions must be put and find answers in order to develop IS teaching programs. Another kind of important similar questions concern the computer environment and the methods to be used for IS developing. Probably some sustainable answers to

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such questions can be obtained only after considering the roles of informatics in the IS development.

3 Activities

Activities are done only by human or group of humans, not by execution of artificial processes. Nowadays, there are a lot of IS implemented in all the sectors of economic activities. Of course, there is a common agreement that an IS must be useful and usable for the persons who exercise professions in the area of activities where the IS is implemented. In fact, the following generic tacit situation can be observed: some IS specialists have to know something about the involved activities and some persons in the activities have to conduct the work of IS specialists. Except for IS specialists, this situation is considered officially as satisfactory by the authorities both of the domain of involved activities and of the domain of informatics. Nevertheless, this situation is not sustainable. The IS stakes for the development of enterprises are too important to leave this part in the shadow; it must be understood in particular in terms of responsibility. Where is the intellectual difficulty? The knowledge behind activities was developed for a very long period, and not oriented at all towards IS. For instance, in the area of management, this knowledge is classified in several domains: production, logistics, finances, accounting, marketing, commerce, strategy, organization, and human resources... The development of the Society cannot consider as sustainable the following behavior: an IS specialist to develop a useful and usable IS in an area of activities must master the same knowledge as specialists of this area of activities. Thus, the breakthrough of the IS development requires to put the following questions and to work on their answers:

— what is the knowledge of the involved activities that an IS developper must master?

— is there any knowledge of the activities that an IS specialist must master, even if this knowledge is useless for persons inside these activities?

— is there any IS knowledge that persons inside the activities must now master?

4 Information and communication

This part is at the origin of the IS scientific domain. It is its main part. For instance, the series of the CAISE[5] conferences (the 20th conference this year) has developped continuously this part. Its master concept is the conceptual model. Nevertheless it is often the forgotten part in teaching programs but also in methods, professions, IS project management. It disappears behind simplistic visions such that users must be satisfied and informatics can (or has to) resolve problems of activities. However, at the scientific point of view, it is the major cornerstone between activities and informatics. Its concepts, its properties, its ways of reasoning are not only useful, but compulsory, in order to set up a table of negotiations between several parts of activities and several parts of informatics. We don't have another intellectual space, which provides us an articulated chain of concepts from the world of activities to the world of informatics. Without it, there is always an intellectual lack, where a lot of visions and of manipulations can be concealed. This part is essential to transform the world of activities and the world of informatics into interoperable worlds[6]. Generally, due to historical customs in informatics, information is considered in the mind of the designers as encapsulated in programs, in applications and now, may be in the future, if we don't care, in services. For the IS domain, such a position is a kind of cognitive pollution. Indeed, it is impossible to foresee all the situations where given information will be precious to face it. In IS, an information must be accessible to any person who needs it for face a situation, even if it was not designed before. Information must be freed from this narrow mindedness. Then, accessible information is the first stage of communication.

This part of information and communication provides us to the previous questions. The interoperable part between the part of information and the part of activities is made of enterprise models, process models, use cases, IS requirement analysis, roles, cognitive interfaces, access rights, correspondence between business rules and integrity constraints. In the other hand, the interoperable part between the part of information and the part of informatics is made of schemata of treatments, information or data, informatics is in charge of performances, security at the level of informatics, reliability, distribution and the part of information and communication is in charge of the complete information and communication schemata. The core question is the fidelity between results between the parts of activities and of information and the fidelity between the parts of information and informatics. This fidelity must be kept despite of the situations of evolution, which will be happen coming from activities or information or informatics. That is a real challenge.

5 Ontology

The term "ontology" is used with several senses, for instance knowledge bases, repository and encyclo-

pedia... We define IS ontology as a structured set of the conceptual elements, which are mandatory to be taken into account in the IS development, and which cannot be modified by its development. For instance, we use it in the context of e-government[7] and we establish ontology from laws and regulations to create a kernel of IS. With this approach, the ontology does not represent all the legal knowledge contained in the law. It contains all the conceptual elements, which must be taken into account on IS dedicated to activities processed in the framework of this law. In particular many elements about the organization of the work processes don't belong to the ontology, except those, which are explicitly mentioned in laws or regulations. Ontology is a sustainable part of the IS.

This part of IS ontology raises the following questions concerning teaching programs:

— Is it important to teach IS ontology in the disciplines, the activities of which are supported intensively by IS, like management, engineering, medicine, public administration...?

— Is it important to teach IS ontology in informatics?

6 Governance

The IS governance plays two important roles:

— to assure the concordance between the dynamics of all the various IS parts: indeed, these parts obey to independent dynamics each other and the IS governance must keep the IS unity and the IS identity inside the enterprise;

— to assure the concordance between the developments of the enterprise and of the IS: it is impossible that this concordance could be only "alignment".

In particular the IS governance has to manage the activities of IS development, to choice the methods, to determine the style of management of IS development (participatory, federal, hierarchical, confederal...).

For informatics teaching programs and for management programs, is the underlying knowledge of IS governance important to be taught?

7 IS transversal aspects

There are several transversal aspects in the IS domain, which have to be taken care and we will mention some of them.

— Security: this aspect concerns all the IS parts and each part has its own view to assure it; all these points of view are consistent in their context but if one of them is forgotten, then security globally can be failed.

— Compliance between the various IS models: the activity models, the information models, the ontology models, the informatics models, these models in order to be able to validate their compliance together must be established thanks to meta-models which must be interoperable together. Thus, for instance, a meta-model for IS ontology cannot be a semantic meta-model without any correspondence rules with a conceptual meta-model adapted to IS implementation by means of IT technologies.

— Sustainability: it concerns all the IS parts and their interwoven relations. The first stage concerns the quality of the models, the IS implementation, the organization of the activities, which is oriented towards the IS possibilities, the continuous IS exploitation and the continuous watch of the IS immersion inside the activities. The second stage concerns its pertinence towards the stakes of the enterprise, its activities and the potentialities of information technologies. The third stage concerns its plans to take into account situations of anticipated evolution.

8 Services

As mentioned previously the term of "services" does not have a rigorous sense. We can observe that some services are independent on IS: they are like a black box, which has an entry and which produces a result from this entry. Entry and result are information or not. If yes, we call them local information services: an example of such a service is the service of currency converter at a given time. We define an information service as a special IS, which is an IS component specified and implemented over a more important IS. Generally an information service is much more complex than a simple black box. In the context of the IS of a University an example of such an information service could be the service concerning the student exchange programs with the continuous administration of the dossiers of the involved students.

An information service is an extension of the IS upon which it is implemented. But this extension can take several forms:

— it can be integrated into the IS;

— it can stay outside of the IS;

— it can be federated to the IS: it is outside, but it is strongly coupled with the IS.

Furthermore, the design of a service, its implementation, the organization of activities around it can be decided locally, without reconsidering the whole architecture of the IS. Often the service was not foreseen during the IS design process. In the next future, that

way of doing will be no more exceptional, but on the contrary will become the new method to design an IS.

Finally the idea of "service" conducts to surmount the following situation: the person has to face to an unusual situation and, of course, the IS is not designed to support such a situation. Thus, to surmount the situation, the person must be able to seek for a service, or to adapt a service to the characteristics of the situation, or to compose several services, or to realize a new service on the fly. In all these cases, the used services can become an extension of the IS and their results have to be integrated in the IS.

9 Conclusions

The teaching programs in the domains of activity (management, industrial engineering, economy, public administration...), of information systems and of informatics must take into account this breakthrough coming from the services. At the first stage it seems important to develop an IS teaching program and then to transform it in a second stage into an information service teaching program. The Department of Information Systems of the University of Geneva follows this way. A first "Licence" (240 European credits) in Information System for undergraduate students was created in 1981, and then we created the DEA MATIS (a Ph. D. program in management and technology of information system) in 1985 with the participation of, in a first hand, the University of Grenoble UJF for computer science and, in the second hand, the University of Grenoble UPMF and the University of Savoie for management science. Now, because of the new European rules, we transform the "Licence" into a Bachelor and a Master of Information system and we prepare to transform the Master into a Master of Service Science (Sept. 2008).

Note

[1] "enterprise" must be understood in a wide signification: company, institution, which can be public or private.

[2] Chesbrough H. Towards a new science of services[J]. Harvard Business Review, 2005, 83.

[3] Léonard M. Information System engineering: getting out of classical system engineering[C]. 5th International Conference on Enterprise Information Systems, ICEIS2003, Angers, France, April 23—26, 2003.

[4] a whole composed of interwoven parts.

[5] http://www.caise.org/

[6] http://interop-vlab.eu/

[7] Abdelaziz Khadraoui, Nicolas Ami-Bloch, Michel Léonard, Jolita Ralyté. Laws-Based Ontology for E-Government Information Systems. 2nd International Conference on Innovations in Information Technology, IIT'05, Dubai, Sept. 2005.