On the Importance of Organization Modeling for IS Education

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Abstract

This paper investigates the importance of organization modeling in the study of information systems design and construction. Specifically, we emphasize the role of a suitable architecture in the development of an organization's information systems (IS) supporting the specific mission of today's electronic organization (e-Organization). The paper describes our architectural initiatives to substantiate IS education in terms of expositing the architectural way to support the design and construction of appropriate IS's continually evolving over selected business domains. To realize the various IS services in an organization, whose activities are increasingly being virtualized (Web-enabled) over the Internet, we also introduce the idea of virtual-organizing the respective eOrganization initiatives. The paper emphasizes the importance of developing IS services not from the limitations of current technologies, but from the reality of fulfilling organizational goals. Thereby, we present our evaluation underlying the chosen pedagogical context of IS study in support of the argument that it is important to involve organizational concerns to steer the IS-efforts in electronically transforming (e-Transformation) the organization.

Keywords: Organization Modeling, Information System Architecture, Action Learning

1. INTRODUCTION

In the emerging knowledge economy (OECD 1996), as the possibilities of the information revolution challenge traditional business logic, organizational transformation has become one of the most popular subjects on business management and information-systems (IS) design. According to (Hammer and Champy 1993), this is the fundamental rethinking and radical redesign of business processes to achieve dramatic organizational improvements. Organizations are being compelled to question and redesign their entire existing operation in a way that uses new technology to serve their business better. Meanwhile, they are experimenting with a wide array of strategic alternatives including different organizational forms. For example, learning organizations (Garvin 1993; Kim 1995; Levine 2001; Senge 1990) aim to continuously transform themselves by developing the skills of all their people and by achieving what Chris Argyris has called double-loop learning (Argyris 1990). These organizations are designed to create mechanisms, which should transfer learning from individuals to a group, provide for organizational renewal, keep an open attitude to the outside world, and support a commitment to knowledge. The key structural element in these mechanisms is the use of organizational networks, clusters, projects, teams and taskforces, where the underlying assumption is the arrangement among different organizational units, which should leverage their separate competencies and capabilities. The basis of this new form of organization is knowledge conversion from individual tacit to communal tacit to explicit knowledge (Nonaka and Takeuchi 1995; Spender 1993), and its technological requirements are characterized by the construction of an IS infrastructure based on the organization's e-Transformation objectives. We believe that an organizational model, which facilitates knowledge conversion by capturing, organizing, disseminating and reusing the knowledge created by organization members, is essential to construct the specific information system support to realize the necessary knowledge conversion process. Our idea of the *learning organization information system* (LOIS) (Williamson and Lliopoulos 2001) represents the conglomeration of different IS's respectively dedicated to achieve some peculiar services of knowledge development and transfer. In particular, we adopt the framework of virtual organizing (Venkatraman

and Henderson 1998) to guide our architectural design efforts in realizing the LOIS services. Besides, we consider the notion of virtual organization not as a distinct structure. Instead, we treat the implementation of LOIS in terms of the degree of virtualness achieved for the organization. In fact, virtual organizing carries the connotation that virtuality considered as an organizational dimension, is a strategic characteristic applicable to every organization. Often, the architectural design of an organization model for e-Transformation, using virtualness as a strategy, reflects three distinct yet interdependent vectors: virtual encounter for members' interaction, virtual sourcing for asset configuration, and virtual expertise for knowledge leverage. Thereby, the idea of organization modeling cannot be neglected from the study of IS design and construction. An organization model helps capture the critical requirements needed to build the supporting IS, which should realize the e-Organization services. We propose the pedagogical use of *action learning*, to help our students understand the importance of organization modeling in their education of IS design and construction. Action learning has its roots in a branch of active learning whose implementation could be substantiated by a maturing pedagogy known as problem-based learning, a process approach to encourage students to work cooperatively in-groups to solve problems.

2. MODELING ORGANIZATIONS FOR E-TRANSFORMATION

The primary purpose of organization modeling is to reduce the risks of failure involved with performing organizational e-Transformation. Such risks fall roughly into two categories: risks associated with the change process, and risks associated with the technology used. The former risks refer to such soft factors as motivation, management commitment, leadership, and the need for expert guidance. The latter risks refer to the misalignment between information technology (IT) applications and organization objectives. We believe organizational e-Transformation can have a better chance of success if we have a systemic re-engineering process in place. This process preferably includes the following (Jacobson et al. 1994):

- A description that specifies every activity and deliverable involved. This process description must be adaptable to the transformation project. For example, the size and maturity of the organization and the type of process we are transforming will influence the process description.

- Deliverables, in the form of business models, that focus on the organization's architecture and dynamics. These are different from traditional business models, which fail because they model the organization as a computer with a database and a program that manipulates the database. The business models should be presented in an engaging language so that stakeholders involved – the CEO, executives, process owners, resource owners and customers – can understand them, not just the transformation team.

- A process for the development of an IS truly integral to the transformed organization. A truly integral information system is one that is developed in parallel with new business processes. A tight, seamless relationship is required between the process that develops the business model and the process that develops the information system. Establishing this relation enables business people to communicate with IT people and IT people with end users. It also eliminates the separation between the business models and the information system's requirements-models and tears down language barriers.

In the first place, this systemic process of organization transformation includes a set of techniques a company uses to design its business according to specific goals. Typical techniques might include: step-by-step procedures to design the business, notations that describe the design, and heuristics or pragmatic solutions to find the right design, measured in terms of the specific goals. In practice, this process is needed by the transformation team to be able to redesign the organization. They need to create their special, expressive models of the redesigned company, which can be used (by the IT/IS people) to build information systems. Also, the technical team must be able to build models of the IS support understandable by the transformation team; otherwise, there is a significant risk that we do not achieve the transformation effects desired.

3. SCULPTING ARCHITECTURAL CONTEXT FOR IS EDUCATION

Our discussion of the architectural context for IS education is centered about several themes: first to clarify why we need architecture to build IS solutions. Second is to define what constitutes the word architecture in the IS context; and third to provide a high-level introduction to the architectural approach to building IS-solutions. Of particular interest is our applying architectural discipline in building IS solutions in support of organizational e-Transformation.

3.1 The Why of Architecture in IS

The key technical issue in developing an information system – be it a conventional IS or a Web IS – is why we need an architecture in IS construction. We could resort to the insight and intuition of a building architect to extrapolate to the IS world and propose a list of requirements to be fulfilled by our architecture in the context of IS solution building. Essentially, the function of a building architect can be summarized as follows (Buffam 2000):

The architect creates in his or her mind a concept of the overall form of the building to fit the intended purpose. This same architect creates a tangible set of blueprints that express his or her concept with sufficient clarity and rigor that the building owners can verify that the design satisfies their needs. Also, the architect – before committing to construction – can verify, through inspection, simulation, and calculation, that the building will stand up to its anticipated load, withstand environmental conditions and requirements, and meet regulatory standards. Tellingly, craftsmen can construct a building fulfilling that concept.

Accordingly, in the IS context, we could provide a number of reason to support the provision of an architecture. First, we need this architecture to ensure that the IS environment is aligned with the organization's imperatives. Namely, this architecture provides the basis for IS professionals and organizational leaders to ensure that the proposed system is properly aligned with the mission, objectives and processes of their business. Such an alignment supports typical organizational goals as enhancing the capabilities of existent information systems and taking advantage of new strategic opportunities. Second, we need the architecture to help build an IS environment that can be easily changed and extended, so as to retain its alignment with changing business imperatives in the organization. Third, we need architecture to communicate appropriate views of the solution to, and among the various stakeholders so as to ensure that the solution gets built, on time, within budget, while fulfilling the intended requirements. Fourth, we need architecture to help keep our IS environment (and its supporting processes) intellectually manageable. We recognize that information systems are very complex. The control of complexity, and through it the ability to keep our systems understandable, is the biggest single challenge in the IS construction. One of the most important functions of the architecture is to support a "divide-and-conquer" approach. Other functions include to provide a framework for making and communicating technology choices, to give us freedom of choice of information technology (IT) components through component interoperability and through component portability, and to maximize our efficiency in building and evolving the IT environment through reuse of earlier work. In other words, it is too important for IS/IT professionals to neglect the essence of architecture – the very reminder of a whole sequence of organizational and technological concerns.

3.2 The What of Architecture in IS

The architectural approach to IS solution building could best be considered as a set of principles acting on and intimately integrated with, the total process of creating IT solutions. This process is formulated in several distinct focuses such as the common-component sense, the design sense, the blueprinting sense and the framework sense.

- The *Common-Component Sense.* This sense is based on the idea of reusability; namely, design is based on leveraging of reusable standard components, sub-assemblies, frameworks, patterns, and idioms. To understand its significance, we can compare a traditional IS design with one guided by architectural principles. Traditional IS design involves such activities as understanding the business domain, abstracting models for this domains, and crafting application components to realize the models. Often, we attempt to excavate reusable components from previously developed systems. In contrast, the architectural way of IS design involves the following: understand the business domain, match the business domain to standardized architectural models, and adapt the components associated with these models to meet domain requirements.

- The *Design Sense.* This sense is based on a number of requirements for architecture to ensure that the IT environment is aligned with the business imperatives. First is the mission of designing a solution to meet a client's needs. Second is the conscious imposition of principles and guidelines into the design activity, governing the structure of design. Third is the formulation of standards to be observed in implementing the design. Fourth is the activity dealing with the higher levels of abstraction in design. In this sense, what is important is the discipline we bring to the design process, the principles and guidelines that impose order so as to shape and constrain the design in ways that will ensure its ultimate success. To achieve elegant designs, as opposed to those that are merely adequate, the software architect's challenge is to create systems that are in perfect harmony with their intended purpose. The word 'elegance'

captures this quality most aptly because it represents a clear, intuitive mapping between a function and its implementation. Elegance is desirable because it brings intellectual manageability in the design activity.

- The *Blueprinting Sense.* The blueprinting sense of the word architecture is to produce blueprints that are comprehensible at appropriate levels of abstraction, to fulfill the needs of different stakeholders viewing the system from different angles. In current practice, the blueprinting function is effectively integrated into the modeling activity. We model the business, and we model the information systems that support its business processes. The methods that we use in these modeling activities incorporate the blueprinting function.

- The *Framework Sense.* The framework sense denotes a finished design of some kind. Where architecture in the finished-design sense is helpful, is where we can abstract some more generalized, or completely domain-independent, behavior that can serve as a framework for other solutions. Indeed, the word architecture used in this sense is supportive of the common-component sense. Namely, by applying architectural principles in our solution building, we tend to produce designs that reuse proven frameworks.

3.3 The How of Architecture in IS

Following our discussion of a set of requirements that the word "architecture" has to fulfill, and a set of meanings that are commonly attached to this word, we are to characterize briefly the approach of IS solution building that we have come to call the architectural way as follows:

- *Targeting for client needs.* The most fundamental characteristic of architecture is that we design a solution to fit our client's needs.
- *Using validated principles*. The architectural way conducts design according to vital principles that have been found to be common to successful systems. Examples include a clear separation of concerns between interface and implementation, and construction based on a hierarchy of well-defined layers of abstraction.
- *Reusing components, patterns and frameworks.* As far as possible, we assemble our systems from available pre-built components, in commonly understood and well-recognized patterns, structured around familiar frameworks.
- *Achieving elegance in all things*. We strive always for the elegant solution, for the simple and obvious. We should be adhering to implementation principles covering any topic required to provide the proper guidance in decision making, including those for technology selection and for requirements governing non-functional attributes of the system to be built (such as scalability, performance and manageability).
- *Adopting formal description for records*. We use a formal description and recording discipline that represents the requirements for the IS system and its functional and environmental characteristics at various levels of abstraction. All the stakeholders in the system can relate to one or more representations of the system specification to verify their needs are being fulfilled and that they understand how to advance the realization of the system to the next level of refinement.

4. ADOPTING THE PEDAGOGY OF ACTION LEARNING

To facilitate students' investigation of IS design and construction, and to understand the way organizations learn to improve themselves, we selected the 1998 Special Issues of *Performance Improvement Quarterly* (PIQ), on Action Learning (PIQ 1998) as our companion in the excursion of e-Transformation among enterprises. Action learning (Dean 1998) is a voluntary, participant-centered, evolutionary process to solve real, systemic, and pending organizational problems in the workplace. Its central goal (Dilworth 1998b) is to increase the capacity of individual learners and the learning of the organizations they are associated with, to adapt to a rapidly changing environment. Revans (1998), widely known as the principal pioneer of action learning suggests that action learning is eclectic, cutting across many fields. It emphasizes action, reflection, the need for critical thinking and a climate of trust and authenticity. In particular, the learning component has primacy, with the real problem solving serving to fuel the learning process. To translate Revans' description of action learning into terms applicable to IS students' exploration, we have provided the following interpretations from problem-based learning (PBL) (Albanese and Mitchell 1993; Engel 1991; Ryan 1993):

1) Students are encouraged to perceive themselves as managers of their own in terms of time, material resources, and complexity of the problems that can be handled one at a time by the group.
2) Students are made aware that initially they will not possess enough prior information to solve the problem at hand or to clarify the scenario immediately.
3) Students are challenged to construct a solution to an

often ill-structured problem chosen according to some concrete, open-ended situations.

4) Students are reminded that they must identify, locate, and use appropriate resources, and ask questions referred to as "learning issues" on the various aspects of the problem. These learning issues help the IS students realize what knowledge they require, and thus focus their learning efforts and establish a means for integrating the information they acquire.

It is expected that the IS students generally have to iterate through some relevant stages of activities: analysis, research, and reporting, with discussion and feedback from peers and the facilitator (instructor) at each stage.

· *Analysis.* Throughout this stage, students organize their ideas and prior knowledge related to the problem, and start defining its requirements. This helps them devise a specific statement of the problem. Meanwhile, they are encouraged to pose learning issues, defining what they know and what they do not know. This helps them assign responsibilities for research, eliciting and activating their existing knowledge as a crucial step in learning new information.

· *Research.* Throughout this stage, students collect necessary information on specific learning issues raised by the group. They may conduct library searches, seek sources on the Internet, collect data, and interview knowledgeable authorities. More importantly, students teach themselves as they research their learning issues. It is intended that when they come to realize the complexity and texture of the problem, they may often see that information is a means to the ends of managing problems effectively.

· *Reporting.* At this stage, students report their findings to the group. Individual students become "experts" and teach one another. Subsequently, their discussion may generate a possible solution, or new learning issues for the group to explore further. Final solutions are constructed, and the facilitator's feedback should help students clarify basic information, focus their investigations, and refine their problem-solving strategies, besides addressing whether the original learning issues were resolved and whether the students' understanding of the basic principles, information, and relationships is sufficiently deep and accurate.

Indeed, a frequent formula (Dilworth 1998a) that action learning uses is L = P + Q + R: Learning (L) equals Programmed Instruction (P) plus Questioning (Q) plus Reflection (R). Here P represents the knowledge coming through textbooks, lectures, case studies, computer-based instructions, and others. This is an important source of learning but carries with it an embedded caution flag. Namely, P is all based in the past. Q means continuously seeking fresh insight into what is not yet known. This Q helps avoid the pitfall of imperfectly constructed past knowledge. By going through the Q step first, we are able to determine whether the information available is relevant and adequate to our needs. It will also point to areas that will require the creation of new P. R simply means rethinking, taking apart, putting together, making sense of facts, and attempting to understand the problem. Following the use of this formula, action steps are planned and carried out with constant feedback and reflection as the implementation takes place. In short, what action learning can provide for the IS student-groups is elevated levels of discernment and understanding through the interweaving of action and reflection.

5. INNOVATING THE LEARNING SCENARIO FOR E-TRANSFORMATION

It is increasingly obvious that e-commerce (EC), conducted in and around the global marketplace, has presently become one of the most exciting trends in business. Yet, it has been observed that the long-term potential of e-commerce requires prudent contemplation and planning on the part of management. The formulation and implementation of e-commerce strategies, applications, and services involves many business issues that the traditional IS/IT department could not handle singly on its own (Kalakota and Whinston 1996; McCarthy 1999). Instead, the emerging consensus is to develop cross-functional teams composed of technical staff as well as "techno-illiterates" who may not know much about technology but who understand the core business. It is believed that such teams could integrate efforts and streamline cooperation among different functional departments to create business processes that are efficient, effective and responsive. To start the e-commerce excursion, our IS students are given the following contexts for further exploration:

5.1 Modeling Virtual-Organizing for EC

The basis of the organizational context for e-Transformation for electronic commerce is to facilitate knowledge sharing among organizational members so that business processes both inside and outside the organization could be streamlined. The three vectors of virtual organizing attributed to (Venkatraman and Henderson 1998), include virtual encounter, virtual

sourcing, and virtual expertise. Virtual encounter deals with the new challenges and opportunities for organization to provide Internet-based interactions to its members. IT now allows organization members to remotely experience products and services, actively participate in dynamic customization, and create mutually reinforcing members' communities. Virtual sourcing focuses on the organizational requirements to be virtually integrated in a business network (intra- or inter-organizational). Organizations using the Internet for various services can structure and manage a dynamic portfolio of relationships to assemble and coordinate the required assets for delivering value to members (Dieng 2000). Virtual expertise is concerned with the opportunities for leveraging diverse sources of expertise within and across organizational boundaries. IT now enables knowledge and expertise to become drivers of value creation and organizational effectiveness. Accordingly, these three vectors are inter-dependent, and they could be considered as the respective architectural channels to accommodate the e-Transformation initiatives. It has been commented that virtual organizing as a concept focuses on the importance of knowledge and intellect in creating value. The strategic logic behind this new business model is to craft an organization architecture which is singularly focused on creating, nurturing, and deploying key intellectual and knowledge assets in a network of human relationships.

5.2 Moving Closer to Organizational Architecture

The primary purpose of organization modeling is to propose a suitable organizational architecture (Morabito, Sack and Bhate 1999; De Hoog, et al 1994, 1996) targeted for e-Transformation context, and thereby makes organizational design disciplined. The idea that an organization can be understood as a set of behavioral specifications is useful. Each specification represents a view designed to characterize the organization premised on some set of core concepts known generally as the organizational constructs (Daft 2001), such as people, structure, process and technology. The proposed architecture typically incorporates a schema produced by applying information modeling ideas to an organization's various constructs, each of which has its own meta-model typically represented in the form of an object constrained by its specific contextual business rules specifying its behavioral properties. Each instance of a behavior is usually specified in a contract. Typical contracts consist of such assertions as: a precondition (which is the situation before the contract can be executed), a post-condition (which is the situation after the contract is executed), and the constraints imposed by a corresponding invariant (which are the rules followed during the transition from pre- to post-condition). Further, a contract does not simply materialize, but must be triggered by a particular event. In an organizational context, contracts provide a dynamic aspect to modeling objects of interest. They represent dynamic interactions among organizational constructs: people, strategy, structure, process, information, power, environment and tool. Basically, we maintain that organizations can be described in a relatively stable fashion with a constant set of objects, representing the core organizational constructs as enumerated. Still many other management notions are advanced every day, which represent variations of existing constructs. So, we call such variations the derived organizational constructs. In general, an organizational model categorizes constructs into two types: the stable core constructs and the derived constructs. Together, they represent the individual domains of an organization, and such an *organizational domain* is a principal area of the organization that forms a distinct but integral part of an organization's overall architecture. To facilitate the description of the organization architecture, a meta-model is created from the various organizational domains, which serves to create specific organizational design from core constructs such as strategy, processes, and information, to derived constructs such as power, learning, and culture.

5.3 Contextualizing Meta-Models for IS Solutions

For each of the architectural components suggested in the overall organization model, we have to conceive the appropriate IS services to support its mission. The alignment issue among different organizational domains thereby becomes important. Typically, the meta-models created for individual IS subsystems, encompassing different sets of specific services, have to be identified, perhaps through a use-case analysis. Nonetheless, there are generally three important contexts: automating, informating, and knowledging, worthy of our attention. In the past decade, we have witnessed the organization's continuous move from a principle of automation to one of integrative processes. While automation involves the removal of the individual from a process, the principle of *informating* (Zuboff 1988) suggests a form of process abstraction and integration between the individual and the computer system. Basically, informating refers to the effect IT may have on the understanding and transparency of a process. It makes people more productive through their use of, and process integration with IT. It serves to increase the capacity of people to understand the entire value-adding business process. Thus, informating concerns itself with the connection

people have with their specific tasks as well as the whole flow of work. On the other hand, the idea of *knowledging* (Savage 1990), refers to individual and organizational learning, and is characterized by the process of knowledge creation and the active involvement of the individual with his or her work. Knowledging includes a dynamic interaction between the explicit and the tacit forms of knowledge. Each successive organizational progression from automating to informating to knowledging, as required in today's knowledge organization, requires higher levels of process abstraction and a broad range of process integration and alignment. Therefore, the creation of a meta-model for a specific LOIS subsystem must be situated in a context of adaptability. This organizational concern is always a big challenge for today's information systems architects. And we need the cooperation of the organizational architect, a new figure whose role should become increasingly important. In a typical organization, the organizational architects are essentially responsible for designing structures across organizational boundaries, engineering processes into strategic capabilities, developing individual competencies into a learning organization, aligning information technology with business strategy, and integrating the disparate pieces that constitute the organization.

6. REMARKS FOR CONTINUING CHALLENGE

The training acquired by the IS student-groups largely depends on the problem selected. The criteria for selection might include the following. First, the problem is real rather than hypothetical. Second the problem is one for which an answer has not already been determined for the IS groups. Third the problem is one that participants care about and feel will make a difference. Fourth the problem is systemic rather than a purely technical problem. And it is intended that the IS student-groups could be developed as a *self-directed work team* (SDWT) (Fisher 2000) through implementing action learning as a progression of phases. First, in order to induce fresh questions from the IS groups, we often place individual students in unfamiliar settings and have them work on unfamiliar problems. It is expected that when they ask fresh questions, they begin to unfreeze and reshape their underlying assumptions – a sort of transformative learning. Second, as assumptions come into questions, they are, either confirmed, modified, or rejected. When the IS groups ends up changing the texture of their assumptions, they then begin to create new mental models. These new models, together with the shifts in the underlying assumptions, which prompted them, cause assessment of the programmed knowledge (P) at their disposal. This causes the IS groups to reject some of the "P" available and replace it with new "P". Subsequently, it is believed that the learning capacities and performance levels of the IS groups could be enhanced by the renewal accompanying generation of new knowledge and questioning insight (Q). The SDWT, thus developed from the IS groups, is striving to continuously upgrade their intellectual capital in terms of adapting to change and sustaining a competitive edge. In addition, the training received by the IS group, can be defined as a planned learning experience designed to bring about change in an individual's knowledge, attitudes, skills, or behavior (Wesley and Latham 1991). The transfer of training from the SDWT to the IS/IT work, can be defined as the extent to which the changes in knowledge, attitudes, skills or behavior learned during the training, are applied by the participants in their actual job environments (Holton, Bates and Leimback 1997). It is convinced that our IS students whose fundamental expertise lies in technical innovations, also requires competencies in the areas of interpersonal communications, teamwork, trust, conflict management, and leadership skills. These are nonetheless important constituents of professional IS/IT personnel in any learning organizations.

7. REFERENCES

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