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Enterprise Modeling and Organizational Learning: An Interpretative Study

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ABSTRACT

Organizations often employ process improvements and reengineering efforts to achieve operations efficiency. In this context, the enterprise modeling (EM) approach is used to facilitate process analysis and design. This paper discusses how EM tools and techniques have been applied to an airport passenger check-in domain to augment management decisions in operations and to address organizational issues. Our results demonstrate the usefulness of EM as a systematic and scientific approach to support knowledge-intensive work in operations analysis, management and planning, as well as organizational learning (OL).

INTRODUCTION

To remain competitive in this ever-changing environment, organizations have a vested interest in enhancing their overall performances in terms of operational efficiency and customer service by improving their organizational processes. To do so, organizations are actively seeking to improve their processes through business process reengineering (BPR) which aims to eliminate non-value adding processes through streamlining or re-evaluating existing core processes. Scofield (1996) pointed out that the main culprit for complexity in organizations lies in growth. Organizational growth can cause the fracturing of corporate knowledge. An organization must therefore first understand the causes of enterprise complexity in order to build better organizational models and longer-lasting architectures.

Enterprise modeling (EM) technology could be used as a tool to model these aspects of the enterprise. It allows BPR participants to perform model analysis for organizational decision-making and planning, such as the design and construction of new process models based on existing models. The new model can be further developed into an operational model serving as a tool for the execution of the new system. Besides enabling users to grasp the inherent behavior and complexity of business systems and processes, EM also serves as a means for the management to understand the social complexities and interdependencies of different components as these models are disseminated and made available. Such levels of improved business understanding could serve as a distinct competitive advantage for the enterprise by enabling it to be responsive to changes. It would also bring about a greater degree of communication, coordination and cooperation within and among enterprises.

This paper explores the usefulness of EM for business process analysis and innovation, and illustrates the importance of EM for organizational learning (OL). It describes an EM application experience in an air transportation domain. Our results demonstrate the usefulness of EM as a systematic and scientific approach to support operations analysis, management and planning activities in process innovation and BPR efforts. EM is also effective in promoting processes related to knowledge conversion and flow. These positive side effects for EM have important implications for OL. The side effects of this application will also be discussed from an interpretative and reflective perspective.

RELATED RESEARCH

Enterprise Modeling in the Context of Business Process Reengineering

Organizations seek to improve processes through BPR, by eliminating non-value added activities, streamlining and/or changing its core processes. BPR aims to create customer-oriented business processes focusing on core business processes. Its main objective is to minimize time and cost required. With increased interest from researchers and practitioners, several methodologies, techniques and tools have been proposed for BPR projects (e.g. Venkatraman 1994; Davenport 1993). To-date, there is no formal theory or methodology for BPR. Organizations undertaking BPR practices are often confronted with the difficulties and issues of formal process representation and measurable impacts of the proposed changes. Kettinger et al. (1997) generalize a BPR framework based on a number of BPR practices. The framework outlines key stages in a typical BPR process, and attempts to map these stages to related activities, tools and techniques. The framework reveals the importance of modeling as a tool, for mapping various aspects such as processes and decisions, and reinforces the position that EM technology is important in supporting and enabling process innovation and BPR practices (Brown and O'Sullivan 1995).

According to Vernadat (1996), the purposes of EM are to facilitate a better understanding of the enterprise operation; capitalize on acquired knowledge and know-how for sharing; simulate the behavior of some part(s) of the enterprise; improve decision-making, communication, co-ordination and monitoring tasks. Process models, for instance, serve as the primary vehicle for describing existing ("as-is") and envisaged ("to-be") views of the enterprise. The analysis of processes within and outside an organization facilitates a shared understanding of the enterprise operation.

Information technology (IT) has been hailed as an essential enabler for BPR (Davenport 1993; Venkatraman 1994), particularly in the design, implementation and deployment of new business processes. With the high risk associated with IT investment, EM is regarded as an appropriate off-line method to model and analyze the effects of new, redesigned processes, during the earlier phases of the BPR process itself, prior to the actual implementation of new processes (Jacobson et al. 1995).

Organizational Learning

Organizational learning (OL) can be defined as the process within the organization by which knowledge about action-outcome relationship and the effect of the environment on these relationship is developed. It must involve an organizational process in which the learning done by an individual can be shared, evaluated, and integrated with that done by others (Duncan and Weiss 1979). "Learning organizations" are organizations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free,

and where people are continually learning how to learn together (Senge 1990). OL occurs through information content and the sense-making behavior of participants. According to Senge (1990), a learning organization possesses the following attributes:

(a) promotes the development of personal visions
(b) promotes the development of a shared vision
(c) surfaces, tests, and improves causal maps
(d) promotes team learning
(e) adopts systems thinking.

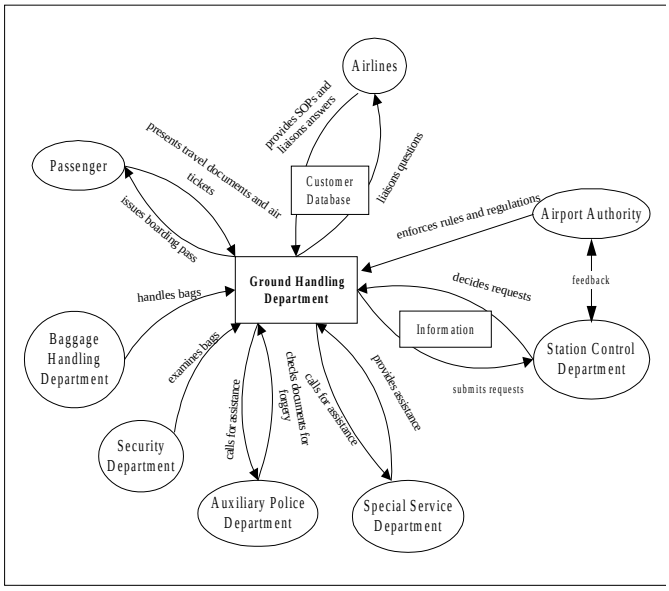
These elements collectively emphasize OL's use of envisioned and shared goals to promote examination of current practices and experimentation with new practices. Teamwork has the effect of reconciling personal visions with shared visions. System thinking highlights interdependence between organizational elements. Cognitive or causal maps serve as ready platforms for evaluating implicit group assumptions, surfacing unclear issues, and decisions evaluation through simulation.

According to Argyris and Schön (1978; 1996), there are two types of learning models. Single-loop learning occurs when the outcome confirms the validity of the interpretative framework, where the diagnosis of and intervention in problems occurs without changing the underlying policies, assumptions, and goals. Double-loop learning takes place when a mismatch occurs between the outcome and the interpretative framework, where the diagnosis and intervention require changes in the underlying policies, assumptions, and goals. The mismatch is corrected by first examining and altering the governing interpretative framework, and then the actions. The intrinsic nature of double-loop learning tends to lead to a higher propensity to induce the creation of new knowledge (Argyris and Schön 1996). Results from this form of learning change interpretative frameworks and have long term effects and impacts on the individual or the organization. In reality, such mode of learning is usually difficult because interpretative frameworks are resistant to change.

OVERVIEW OF APPLICATION DOMAIN

To remain competitive in today's challenging business environment, air transportation industries all around the world are continuously striving to improve their critical business processes. In order to create value and provide total customer satisfaction, service providers need to adopt a holistic approach in defining the service encounters between them and their customers (both internal and external). In order to achieve this, organizations have to provide products and services that are of the highest value and quality through customization and technological advancement.

Figure 1: Context Diagram of Airport Passenger Departure Check-in Process



Airport management is a complex operation with functions involving both terminal (e.g. passenger handling) and airside operations (e.g. on-ramp aircraft servicing). In the passenger terminal operation, departure formalities of air transportation are perhaps the most complex of any mode of public transport. Due to its complexity, airport passenger check-in operations require inputs from various parties working together, including the airport authority, airlines and ground handling agencies as shown in Figure 1. Hence, there is a constant need for improvement in passenger check-in procedures in order to enhance service efficiency.

PROBLEM DEFINITION AND RESEARCH OBJECTIVES

This paper discusses our research project focusing on the motivation to reconcile EM and OL concepts and practices. The issues can be conceived at two levels: the need for some form of sense-making at the conceptual level; and the practical desire to explore the effectiveness of EM as both an OL implementation vehicle and a strategy to minimise any associated organizational barriers.

Reconciling Enterprise Modelling and Organizational Learning

There are not many literature which explicitly relate the concepts and practices of EM to those of OL. In practice, EM and OL initiatives are often implemented separately and organizations often perceive them as non-related sets of activities. As researchers and practitioners continue to wrestle with the ambiguous concepts and principles of OL, the underlying mechanisms of OL remains elusive.

We attempt to address this issue in perspective. To begin with, we adopt the position that BPR could be one of the effective vehicles used by organizations to achieve OL goals. On the other hand, at a more micro level, EM tools and techniques are found to be highly knowledge-intensive in nature. The common acceptance that EM plays a central role in supporting many key aspects of the BPR process, suggests strong links between EM and OL.

Therefore, in the context of related work (Senge 1990; Argyris and Schön 1978, 1996; Kettinger et al. 1997), a set of theoretical propositions has been conceived. This framework serves as a sense-making structure to explore the inherent nature and mechanisms of existing organizational activities and practices, such as EM, in the context of OL. Our preliminary hypotheses are summarized below, which will be evaluated against our EM action research experience described in this paper.

Proposition 1: EM is an effective mechanism for facilitating OL in organizations.

EM tools and activities exhibit effects and characteristics similar to those of OL in organizations. These include the development of personal and shared visions; facilitating the creation and refinement of causal maps and models; and promoting the adoption of team learning and systems thinking.

Proposition 2: EM serves as a good platform for putting learning models into practice.

EM tools and activities facilitate the exercise of single-loop and double-loop learning models at both the individual and enterprise levels.

RESEARCH METHODOLOGY

The following main phases were used to study the check-in operation:

- *Pilot study* where a preliminary investigation was first undertaken at the airport terminal with the aim of understanding and familiarizing with the domain, i.e. the check-in area at the departure hall as well as the check-in process itself.
- *Field study* was adopted to collect data on the check-in process. It was conducted by: (i) observation at the check-in counters, and (ii) interviews with about 20 ground operation personnel involved

at various aspects of the check-in process, including the supervisors, officers and agents. This was done to clarify any doubts that arose during the data collection process and to collect relevant information that enabled the building of enterprise models.

- *Secondary data* (such as standard operating procedures (SOPs) for check-in process, organization charts, observation data previously gathered by external surveying agent and passengers' feedback forms).
- *Application development* (e.g. development of enterprise models) involved the analysis, design and modeling of the check-in process through the construction and verification of static and dynamic enterprise models, followed by the subsequent deployment of these models to support management decisions in process study and analysis, process simulation, innovation and scenario planning (this part of the study is not emphasized in this paper).

DISCUSSION AND FINDINGS

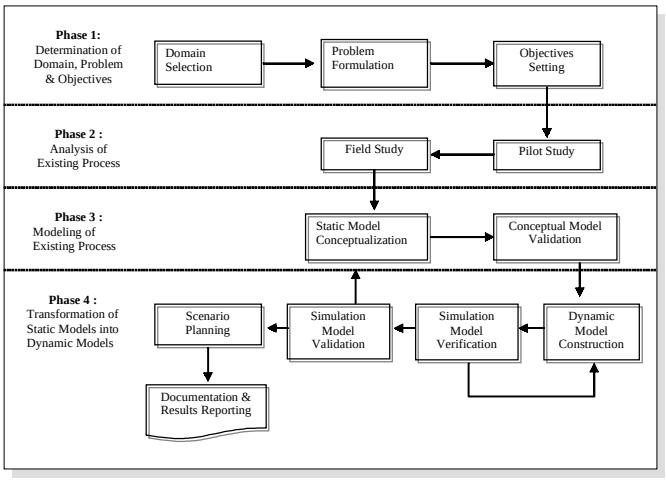
Organizational Insight into the Airport Check-in Domain

Table 1 summarizes some aspects of the airport check-in domain, providing empirical insight into the existing working culture, politics, attitudes and relationships among staff and management. Some of these characteristics may be viewed as not so favorable conditions for the adoption of OL. These aspects are typical of traditional organizations with rigid governing structures and frameworks. Some of the issues discussed here were partly responsible for the difficulties encountered during the execution of the project itself.

Effectiveness of Enterprise Modelling Approach for Organizational Learning

In promoting OL in organizations, several practical issues need to be raised. First, in order to ensure successful OL, a right mix of positive cultures, attitudes, mindsets and organizational structures may be necessary. Second, organizations are generally unclear about OL concepts and how to go about initiating related programs in the absence of implementation frameworks and guidelines. Third, as with the introduction of any new or unfamiliar program in an organization, staff may not necessarily appreciate the immediate benefits of OL and may be too preoccupied with their heavy work responsibilities. Fourth, OL practices may often entail a deliberate and conscious effort, on the part of organizational staff, in the contribution and sharing of knowledge. In reality, such initiatives may not be easy to implement because the motivation to share knowledge is generally lacking in most organizational cultures. As a result, an explicit new OL activity could possibly be perceived as an unwelcome chore or work burden. With these issues in mind, we shall evaluate the validity of our propositions against our findings from the action research experience.

Figure 2: Research Methodology Framework



Proposition 1: EM is an effective mechanism for facilitating OL in organizations.

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The process of EM was found to be highly "knowledge-intensive" in nature. In order to construct a set of EM models of the airport check-in domain, there was a need to tap into all available existing knowledge resources in the organization, especially the knowledge and experience of airport staff assuming various types of responsibilities. Such knowledge were partly documented and partly conceptualized internally as tacit mental models. A set of EM models could serve as a platform to incorporate and represent some of these tacit knowledge models, which to a certain degree, might be subjective depending on personal visions, worldview and perceptions of the domain. As these models were circulated to several staff for verification and feedback, the staff actually found themselves learning from the models as well, and this phenomenon has evolved into a form of "indirect learning" among themselves. In the course of validating and verifying a set of enterprise models, we came across a new manager who was intrigued by the rich insights gained from the models in relation to the check-in domain, all within a short period of time during the evaluation process of the models. These models were contributed indirectly from his more experienced colleagues as they verified the models individually or in small groups. Another manager was surprised to learn from the models that her colleague's mental perception of a portion of the work domain did not quite match that of hers, as reflected in the slight differences in both their model representations. In any case, project participants who were involved in the process of model development and verification have begun to view their own work processes and domains from a fresh perspective, and in a more holistic and structural manner. This encouraged them to reflect upon their work routines, generate queries, bounce ideas and make suggestions. A dynamic and systematic manner for the exploration and testing of new ideas and suggestions were enabled with the creation of simulation models. As enterprise models were created and refined by the respective staff, at different work platforms of the check-in domain, mutual understanding and sensitivity occurred. A shared vision emerged. Such mode of establishing a common understanding of the business operation facilitated the streamlining of existing processes and designing of new processes, products or services through process innovation or reengineering. Bits of new experiences and knowledge have been incorporated into the models, filling in knowledge gaps and increasing the level of consistency and accuracy of the models. Moreover, their involvement in the modelling of their own work domain and evaluating the outputs for possible future improvements all appeared to have a way of fostering a sense of ownership, involvement and pride among the organizational staff who participated. In summary, our observations and findings lend support to the proposition that EM practices have intrinsic elements and characteristics which closely resemble OL attributes in many ways.

Proposition 2: EM serves as a good platform for putting learning models into practice.

EM tools and activities facilitate the exercise of single-loop and double-loop learning models at both the individual and enterprise levels.

Our findings support this view, especially during the model development and verification phase of the EM process. When a set of enterprise models was presented to a staff for analysis and evaluation, these two types of learning paradigm were exercised simultaneously. The staff would first compare the structure of the enterprise models with their internalised understanding and mental map of the work domain. If a mismatch occurred, he would have to decide whether to regard the enterprise models as the more "standard" or "accurate" models by which they may have to make changes to their own work processes accordingly (single-loop learning). On the other hand, if he was convinced that there

were some errors or inconsistency in the enterprise models, he would make suggestions for changes (double-loop learning). These changes, if ultimately implemented, would make an impact at the enterprise level, with respect to the work domain concerned. A related issue is the credibility of the enterprise models. When the models were verified by most of the staff and project participants, a commonly agreed view of the models was reached (shared vision), and the credibility of these models was perceived high. Progressively, the rate of change of the models stabilised and the occurrence of double-loop learning during model verification decreased.

CONCLUSION

As organizations struggle to adapt in a dynamic business environment, their processes and operations inevitably evolve into large and complex structures. This means that important information could be concealed and information feedback delayed. To be successful, organizations need to understand the complexity of their businesses. EM is found to be an effective approach in promoting the understanding of an organization's systems behavior and complexity through the mapping of its own structures, processes and relationships.

This paper describes the successful action research prototyping of an EM application related to an airport passenger departure check-in process within the air transportation industry. It illustrates the usefulness of EM for process analysis and innovation, exploring the relationships among concepts and practices such as EM, BPR and OL, and highlighting the resemblance of the intrinsic characteristics of EM to OL attributes. The findings demonstrate the effectiveness of EM as a systematic and scientific approach to support management decision making during operations analysis, management and planning, in the context of process innovation and BPR. During the course of the project, various aspects of the airport work domain were revealed, providing empirical insight into the existing working culture, politics, attitudes and relationships among staff and management, some of which may be unfavorable for OL. Despite these, the findings confirmed our initial propositions about the positive effects of EM and further establish sufficient grounds for extending our initial theoretical underpinnings with fresh propositions and insights. We advocate that EM has the potential to be adapted and transformed into a formal methodology for OL.

REFERENCES

Argyris, C., and Schön, D. *Organizational Learning: A Theory of Action Perspective*, Addison-Wesley, Reading MA, 1978.

Argyris, C., and Schön, D.A. *Organizational Learning – II: Theory, Method and Practice*, Addison-Wesley, Reading MA, 1996.

Brown, J. and O'Sullivan, D. (eds). *Reengineering the Enterprise*, Chapman and Hall, London, 1995.

Davenport, T. H. *Process Innovation: Reengineering Work Through Information Technology*, Harvard Business School Press, Boston, 1993.

Duncan, R., and Weiss, A. "Organizational Learning: Implications for Organizational Design," in *Research in Organizational Behaviour*, B.M. Straw (ed), JAI Press, vol.1, 1979, pp. 75 - 123.

Jacobson, I., Ericsson, M. and Jacobson, A. *The Object Advantage: Business Process Reengineering with Object Technology*, ACM Books, 1995.

Kettinger, W. J., Teng, T. C. J., and Guha, S. "Business Process Change: A Study of Methodologies, Techniques, and Tools," *MIS Quarterly*, 21(1), 1997, pp. 55 – 80.

Senge, P. M. *The Fifth Discipline: The Art and Practice of the Learning Organization*, Doubleday, New York, 1990.

Scofield, M. "Enterprise Models: Anticipating Complexity," *Enterprise Reengineering*, January/February, 1996. (URL http://www.reengineering.com/articles/janfeb96/entmodl.htm)

Venkatraman, N. "IT-Enabled Business Transformation: From Automation to Business Scope Redefinition," *Sloan Management Review*, Winter 1994, pp. 73 – 87.

Vernadat, F. B. *Enterprise Modelling and Integration: Principles and Applications*, Chapman and Hall, London, 1996.