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Work, workflow and information systems

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1. Introduction

This volume brings together several perspectives on the nature of work processes in enterprises and how information systems can best support these processes. The genesis of this idea was the shared interests of the authors (17 in all) in how enterprises improve and change. The shared belief is that change of enterprises relates to change of work processes and the success of such changes relates to how work processes are supported by information systems. Thus, the papers in this volume address both the nature of work and the design of information systems to support work.

Our interest in bringing together these authors stemmed, at least in part, from ongoing research in fundamental change of complex organizational systems [4,5]. Such complex systems can be societies, economies, markets, infrastructures or, in this volume, business enterprises. The phrase enterprise transformation is often used to denote fundamental change of business enterprises in both the private and public sectors.

1.1. Work processes

Over the past few years we have developed a theory of enterprise transformation [3]:

> *Enterprise transformation is driven by experienced and/or anticipated value deficiencies that result in significantly redesigned and/or new work processes as determined by management's decision making abilities, limitations, and inclinations, all in the context of the social networks of management in particular and the enterprise in general.*

This theory has been evaluated and elaborated via research into fundamental changes in domains ranging from retail to aerospace to academia [5].

With regard to this volume, the central element of this theory is work processes. Over the past 10-15 years, there has been increased emphasis on business processes via business process reengineering [2] and lean production [9]. More recently, there has been a recognition that this process orientation calls for a re-emphasis on the nature of work [1]. The term "re-emphasis" reflects the fact that the roots of industrial engineering, operations research, and other disciplines were in the nature of work activities and how these activities can be supported and enhanced. However, this emphasis was lost in the rush to package research in terms of mathematical theorems and proofs, requiring that much of the complexity of systems be assumed away.

1.2. Information systems

In parallel, the primary nature of work and the support of work has changed. Information workers now far outnumber workers primarily valued for their physical labor in many modern enterprises. Thus, the focus of work-oriented research is more related to information flow than physical activities, and enhancements address information support rather than physical fit and safety. Further, contemporary information systems typically support organizations and enterprises, not just individuals. While the displays on the physical manufacturing equipment may now be digital, a larger challenge is the design of the information networks that connect all the machines, all the factories, the whole enterprise, and all the enterprises in the supply chain.

One of the key issues is the fact that the overall system is better characterized as a system of systems rather than a traditional monolithic system [7]. This is due to the tendency of component systems to have their own purpose and objectives besides being an element of the larger system. For example, an enterprise that is an element of an integrated supply chain can also be an element of other supply chains, perhaps even competing supply chains. In such situations, command and control operating procedures are often replaced by policies and incentives for cooperation and collaboration.

The design of information systems to support networked systems of systems can be facilitated by thinking in terms of enterprise architectures [6,8]. There are many available definitions of the term "architecture." The central constructs in all of these definitions are entities, relationships, behaviors, and performance. It is useful to contrast architectures with the means used to create them (i.e., architectural frameworks) and the activity of creating them (i.e., architecting). From this perspective, an architecture is an instance of what is created by architecting using one of several possible architectural frameworks. The notion of architecture provides a compelling overarching construct. However, it should be kept in mind that constructs such as frameworks, representations, models, and so on have long been the stock and trade of systems thinkers, engineers, and computer scientists.

1.3. Overview

This volume is divided into two main sections: work and workflow, and information systems. There are three papers in each section. The disciplines represented across these six papers include management, engineering, computing, and architecture. These four disciplines pursue work, workflow, and information systems from quite different perspectives – management to represent business practices and processes, engineering to represent the physical flows in the system, computing to represent the information flows, and architecture to represent human flows within and among physical spaces. Enterprises, of course, include all these types of flows.

2. Work and workflow

Mark Lewis, Brett Young, Lars Mathiassen, Arun Rai, and Richard Welke of the Robinson College of Business at Georgia State University address "Workflow Assessment Based on Stakeholder Perceptions." They are concerned with representation of differing enterprise stakeholder perspectives and interests in business process innovation. They present an approach that focuses on multiple stakeholders with differing and potentially conflicting perceptions of the state of current practice and directions for future innovation. Their approach can be used to capture, synthesize, and reconcile multiple stakeholder perceptions to yield a comprehensive foundation for business process innovation.

Rather than being constrained by pre-conceived formalisms, this approach begins with subjective perceptions of involved stakeholders. The approach results in an informal as-is model, and includes assessments of its strengths and weaknesses, and recommendations for how to innovate the business process. The approach encompasses four stages: *engage* process stakeholders; *collect* process data; *explicate* process knowledge; and, *design* process innovations. They draw upon a case study of process innovation in a knowledge-intensive enterprise that provides practical lessons for how to organize and support business process innovation based on stakeholder perceptions.

Baabak Ashuri, William Rouse, and Godfried Augenbroe from the School of Industrial and Systems Engineering and College of Architecture at Georgia Institute of Technology consider "Different Models of Work in the Modern Services Enterprise." They note that there is a substantial amount of evidence that shows national economies to be shifting to services. The nature of work has changed dramatically during that shift. However, they argue, the extent of research aimed at the better understanding and design of work has not increased.

This is particularly true at the cross section of different organizational perspectives on work. Consequently, researchers in different domains lack a foundation to communicate and collaborate with each other when they organize and design new modern work systems. To address this need, they present a categorization of eight major stakeholders that make managerial decisions that impact overall enterprise performance when making the inevitable shift towards a services economy. These stakeholders include business analysts, the organization as a whole, workflow designers, workflow managers, project managers, human resource managers, facility managers, and real estate analysts. For each stakeholder, they summarize the nature of their view, as well as methodologies, models, and tools they employ to study and manage work.

James Caverlee, Joonsoo Bae, Qinyi Wu, Ling Liu, Calton Pu, and William Rouse of the College of Computing at Georgia Institute of Technology address "Workflow Management for Enterprise Transformation." They describe workflow management as a core component of modern enterprise information technology infrastructure that automates the execution of critical business processes. Since enterprise transformation typically introduces changes to the corresponding business processes, it is important for workflow management systems to provide effective support for seamless incorporation of these changes. They examine a collection of selected workflow concepts and techniques that are significant for dealing with transformational changes. They focus on notions and techniques that are directly relevant to enterprise transformation, such as workflow patterns, workflow adaptation, and workflow data mining and merging. The discussion includes summaries of business process management, the fundamental concepts of workflow management, and workflow support for enterprise transformation.

3. Information systems

Stephen Stephenson and Andrew Sage of Dell Computer and the Department of Systems Engineering and Operations Research at Georgia Mason University, respectively, address "Architecting for Enterprise Resource Planning." They introduce an enterprise resource-planning architecture that helps ensure organizational success through operational velocity attainment. Operational velocity is a measure of effectiveness defined as speed in delivering products or services to market, meeting all customer expectations in a timely manner, and decreasing time for the appearance of a positive revenue stream as much as possible. This new architectural model, the evolutionary Enterprise Resource Planning Architecture Framework, may be used to enable an enterprise to tailor its organizational process lifecycles by addressing the operational environment throughout its evolution. Operational velocity attainment

requires an evolutionary approach to address the operational challenges that will be associated with a new emerging enterprise which is launching new technologies into the marketplace, or with an established mature enterprise seeking to transform itself. The enterprise resource-planning model will vary between organizations and organizational units, since it will need to be tailored to address the specific operational situation extant. The enterprise resource planning model may be used to define the organizational structure of the enterprise and its complementary enterprise resource planning architecture in order to address the operational needs of the enterprise. They focus on five key areas: operational velocity attainment needs, evolutionary enterprise resource planning model, enterprise resource planning architectures, organizational process lifecycle, and the associated measures of effectiveness.

Leon McGinnis of the School of Industrial and Systems Engineering at Georgia Institute of Technology considers "Enterprise Modeling and Enterprise Transformation." He suggests that the epitome of the modern enterprise is a large scale, geographically dispersed, complex entity. It interacts with other enterprises, perhaps large numbers of them, in many different locations, often with great frequency. It serves highly competitive markets, which may shift in a matter of days or weeks. Designing, planning, managing, and controlling the modern enterprise requires a supporting infrastructure that is capable, adaptable, understandable, and usable. While not all enterprises share all these characteristics, almost all enterprises are affected by the associated business processes and technologies. Over the past decade, Enterprise Modeling (EM) has emerged as a response to the needs of those charged with designing and maintaining the enterprise infrastructure, and EM could well become the platform for developing not only enterprise infrastructure, but all enterprise decision support. As a result, EM may be a powerful enabler (or inhibitor) of enterprise transformation. He provides an introduction to EM, a brief history of its evolution, and an assessment of EM from an enterprise transformation perspective.

Mark Mykityshyn and William Rouse of the School of Industrial and Systems Engineering at Georgia Institute of Technology address "Supporting Strategic Enterprise Processes: An Analysis of Various Architectural Frameworks." They argue for introducing a strategic layer as separate and distinct from an operational layer found in traditional business architecture frameworks. Their motivation for so doing is to better understand the unique processes of such a layer so that these processes can be better supported by the enterprise. Several architecture frameworks from various domains are analyzed in order to gain insights and test the potential viability and applicability of a strategic layer in the context of a high-level enterprise system architecture. Each is reviewed and assessed in terms of its potential contribution and/or applicability to a strategic layer. Architectures of human behavior and performance are also reviewed since they may impact the execution of strategic layer processes.

They show that while some of the frameworks have applicability and may indirectly support the processes contained within a strategic layer, none of the architectural frameworks appear to explicitly support a strategic layer. However, analysis of these frameworks can inform how processes contained within a strategic layer might be better represented and controlled, and how this layer might be made more interoperable with the operational layer of an enterprise system. These findings lead to an elaboration of several research issues that should be addressed to better enable and support those executives tasked with leading and managing an enterprise system.

4. Conclusions

This volume considers work and workflow at all levels of enterprises, as well as the information systems that support this work. This is an ambitious endeavor that inherently must be transdisciplinary in nature. The disciplines represented in this volume include management, engineering, computing, and

architecture. Of course, disciplines such as the behavioral, social, and policy sciences are also highly relevant to this endeavor. Finding common ground among such varied perspectives requires substantial energy and commitment. Nevertheless, the importance of the complex systems being addressed merit such investments.

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