

# Enterprise, Organization, Modeling, Simulation: Putting Pieces Together

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**Abstract.** The research literature of recent years has been witnessing resurgence of interest in socio-technical systems to which enterprise, its organization, and underlying business system belong. The same has been happening in regard to business process management, as a component of this overall study, regarded as “the third wave”. Also the interest of the researchers has been focused on the search for methods and tools to understand, analyze, design and redesign the structure, function, processes, roles, responsibilities that take place in socio-technical systems. In the view of these trends, it becomes a standard practice that companies adapt modeling and simulation as two complementary tools to manage, improve, and redesign as the environment demands. In this introductory paper, we try to put these pieces (enterprise, organization, modeling and simulation – EOMAS) together and discuss their relevance.

**Keywords:** enterprise modeling, enterprise simulation, organizational modeling, organizational simulation, business process modeling, business process simulation.

## 1 Introduction

EOMAS is a forum first and foremost about Information Systems in a broader sense: Information Systems Analysis, Design, Engineering, Application, Organizational Impact, Business Systems, etc. Information systems do not operate in isolation; they are designed, developed, and deployed in specific organizational context (settings). They are designed for certain objectives and tied to particular organizational processes (situations), e.g., order processing, product development, patient management, student registration, and so on. In its turn, an organization is an arrangement of human actors purposefully organized to carry out a certain mission, which, in its turn, adds a social dimension to the study. Hence, an organization is a social system, whose elements are human actors. Through the purposeful actions and interaction of these actors, while carrying certain tasks, business processes are evolved. In modern enterprises, these interactions and processes are enabled, linked and interwoven via information infrastructure (information systems, information technology, software applications) such as Enterprise Information Systems (e.g.,

Enterprise Resource Planning Systems, Human Resource Information Systems, Accounting Information Systems). For the engineering and reengineering of these systems, among other tools, modeling and simulation (M&S) is getting increasing prominence.

While simulation has evolved into a mature discipline in engineering, manufacturing, military, traffic and control, in the context of enterprise, its organization, and underlying business processes, which collectively constitute a complex socio-technical system, application of modeling and simulation is just taking its momentum. Unlike traditional domains (manufacturing, logistics, traffic and control), where the practice of simulation has been long established, socio-technical systems are complex and versatile, which is one of the reasons that modeling and simulation is on one hand a useful tool, on the other hand faced with challenges. These challenges are, in part, posed by the informality of the environment where social individuals interact as they perform their tasks. In contrast to traditional domains, where modeling and simulation practice is based on quantitative approaches, enterprise modeling and simulation is dominantly drawn on qualitative approaches, which is rather driven by more descriptive, animative, and artistic qualities.

## 2 Enterprise and Organization

We start the reader off with mutually relative definitions of enterprise and organization. From the myriad of definitions, we explain the notion of enterprise and organization using the construction-oriented or ontological notion [1], according to which the collective services that an enterprise provides to its environment are called the *business* of the enterprise. This definition represents the function perspective of an enterprise. The collective activities of an enterprise in which these services are delivered along with the human actors that carry out these activities are called the *organization* of an enterprise. Thus, an *organization* is a social arrangement of roles and responsibilities of human actors and rules and norms by which the actions of these actors are governed. Thus, an organization is formed and aligned according to the goals of its enterprise.

As these notions imply, an *enterprise* has an organization and a business system created for certain purpose and provides service or delivers goods to its environment. The work of an enterprise is supported by adequate technology to enable and improve its efficiency and effectiveness. Collectively, the business processes and their interrelationships that enable to deliver service to customers or produce goods constitute the enterprise *business system*. As becomes obvious, these notions establish that an enterprise by its virtue is a complex socio-technical system.

This all brings us to the recognition of the importance of the organizational context and enterprise scope, in which enterprise information systems are deployed, utilized and set. Subsequently, it reveals the understanding that enterprise information systems are not merely technical, but a socio-technical phenomenon, where organizations (people, process, structure) are integral to them.

Now, how do we go about the study of these phenomena (organization, enterprise, business process) using corresponding theories, methodologies, frameworks and concepts? We can develop systems (in a smaller size, prototype) and study their behavior; we can build mathematical models and abstractions of systems and study them; we can draw systems static pictures using diagrams and then study the diagrams; for process improvement and organizational change, we can introduce a change and then observe its affects and impacts as the changed process is enacted in reality. Each of these approaches has their advantages and disadvantages, and organizational changes may have consequences if not properly studied.

For example, building a system would be very expensive, time consuming, and especially risky if a wrong system is built and the organization will be forced to demolish it and build another one. Even if the system was built in a smaller proportion, it will still be a huge waste of investment (money, time, resources). Similarly, mathematical abstraction will be on one hand very difficult, if not impossible, as we are dealing with informal reality, on the other hand for users it will be challenging to comprehend the models. Making a change without studying its impacts and deliverables in a controlled environment may cause severe consequences.

An alternative approach, widely accepted, adapted and used is modeling and simulation. What does it mean? The modeling and simulation theories, methodologies, and approaches allow analysis, design and study of the systems and processes using artifacts that are designed for this purpose (diagrams, notations, languages, tools). The experiments and comparison of different alternatives are conducted in a controlled environment. Over the past decade, the practice of modeling and simulation has become a popular, attractive, and widespread. The current technological and tools developments facilitate very close to reality experiments, of course with the understanding that modeling and simulation will always remain as an approximation and simplification of reality.

Application of modeling and simulation to enterprise, its organization and business system could facilitate the creation of enhanced understanding of the business domain (healthcare, banking, commerce) and processes of the extended enterprise (inter- and intra-organizational relationships) and significant improvements of the underlying processes.

### **3 Modeling and Simulation**

Simulation techniques benefit many of the traditional areas in helping to mitigate design flaws, learning system behavior, providing training, and becoming a standard practice for building complex systems. Following the analogies of traditional domains, application of simulation in the context of socio-technical environment (enterprise, organization, business process) has attracted a huge interest among researchers from diverse perspectives [2, 3, 4, 5, 6, 7]. The practice of modeling and simulation is opening a promising research field as the potential and full capacity of enterprise modeling and simulation still have yet to be revealed.

For example, traditionally, modeling and simulation have been endorsed as instruments to observe dynamic behavior of systems, measure IT impacts on

organizations, and outcomes of changes. In the current context of open-source software development, service-oriented architectures (SOAs) and business process outsourcing (BPO), modeling and simulation assume even more significance in assessing business process management effectiveness, alignment between business process models and corresponding SOAs, alignment between the client and vendor business strategies in a BPO contract, etc. using embedded simulation in enterprise and organizational models. But for these benefits to happen, modeling and simulation ought to be viewed as an integrated tool and method.

In contrary, often modeling and simulation are used as two separate tools in isolation from each other. Best practice in the field proves that for a thorough analysis and study of an enterprise, both modeling and simulation should play in concert as their deliverables are complementary. Only modeling may not reveal sufficient information about the processes. On the other hand, only simulation tools may provide little help if there is no profound conceptual modeling preceding it. It would be like *expedition without a map*. Consequently, like an expedition carried out without a map, simulation without a profound concept (conceptual model) is possible, but it would be very hard, if not impossible, to hit the target – achieve accurate and reliable results. Therefore, it is imperative that analysts adapt modeling and simulation as a holistic tool in the study of an enterprise, especially its business processes as the main object of engineering and reengineering.

The core of any enterprise is its business processes. With the system design shift from data-centric to process centric, the interest and focus on business process modeling and simulation is especially reinforced.

#### **4 Business Process Simulation Need**

Why business process modeling and simulation should matter for organizations in the first place. Although the answer should be evident, it is explained by the fact of ever changing business drivers (supporting technology, business models, mergers and acquisitions, customers, etc). Continuous competition, increasing capabilities and features of emerging technologies and growing customer demands require organizations to keep current and be swift to changes. Obviously any change is risky and may invoke serious consequences for organizations. Early mitigation of these risks is undoubtedly a prerequisite of success and survival, especially in the situations of multi-variables. Here is where business process modeling and simulation play a significant role to study, analyze, optimize, compare different scenarios, and measure the affects before consequences become irreversible disaster. Simulation is a safe and inexpensive way of studying the impact of changes and revealing hidden behaviors of a complex system. The current trends in business process management, information system design, and IT application development show that processes oriented approaches are paid increasing attention in analyzing and designing business processes. Consequently, whether discussing changes, designing new processes or comparing alternatives, process modeling and simulation play a crucial role in this respect.

Basically, the recursive activities of *adapt-change-improve* would be a driving force for the 21st century enterprises, and therefore business process modeling and simulation is not a question of “to be or not to be”, but a navigational compass to set the right course for sailing into the storms of frequent changes.

## 5 Concluding Remarks

The aim of this introductory article was to explain and discuss the relevance between the notions of enterprise, its organization and business system, and the role of modeling and simulation as two prominent and complementary methods and tools in the study of these phenomena. For this purpose, the EOMAS forum was established.

EOMAS was founded with the aim to become a major forum to foster discussion and exchange on theoretical and practical aspects, an outlet for publication, and a meeting for networking among researchers, practitioners, and educators interested in the application of modeling and simulation pertaining to various aspects of enterprise, organization, business processes, information systems, enterprise information systems.

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