A Game Theoretic Perspective on Business Processes

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Abstract: It has been recognized that in times of digitalization and rapidly changing business environments business process management will need to question and evolve its core ideas to stay innovative and relevant. Thus, the presented research project aims to synthesize existing theoretical perspectives on business processes into a novel and unified conceptualization of business processes inspired by game theory. This may help to integrate the diverse fields of "process-related" research into a common framework. Initial theoretical considerations are presented.

Keywords: Business Process Management, Game Theory, Institutions, Organizational Routines

1 Introduction

Business process management (BPM) is *"a body of methods, techniques and tools to discover, analyze, redesign, execute and monitor business processes"* [Du13]. Traditionally, this has implied a focus on business processes that are relatively stable, core to the business and, thus, can reasonably be made explicit [vdAtHW03]. However, more recently BPM has been evolving towards a more embracing perspective, considering "all work [as] process work" [Ha15a] and subsuming activities that cannot easily be made explicit, for example, non-routine creativity- or knowledge-intensive activities [SR08, vdAWG05, Se15] under the umbrella of business processes. Consequently, Dumas et al. [Du13] define a business process very broadly as *"a collection of inter-related events, activities and decision points that involve a number of actors and objects, and that collectively lead to an outcome that is of value to at least one customer"* (p. 5).

As this shift in perspective is occurring there has been a recognition that existing BPM methods, techniques and tools are not easily transferable to this broader definition of business processes [SR08, vdAWG05, SRH12, HJ09]. Thus, it has been argued that BPM will need to strengthen and evolve its core ideas to stay innovative and relevant [Re14], especially in times of digitalization and rapidly changing business environments.

Existing BPM research has tackled this challenge in a variety of ways. A non-exhaustive list could include, for example, examining the flexibility of process-aware information systems [RW12], developing the case-metaphor into a new paradigm for business process support [vdAWG05] or investigating declarative approaches to business process modelling [Zu13]. While all of these approaches provide useful and interesting insights, they remain mostly practical and are seldom embedded in an encompassing and grounded theoretical perspective of business processes in their organizational context. A shared underlying

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conceptualization of what a business process is or is not still remains elusive and poses a barrier to integrative research across "process-related" fields [Re14].

This research project aims to help address this challenge by investigating the following basic research question: *How should business processes be conceptualized?* In particular, the focus is set on *developing a theoretical perspective that allows for the analysis and design of not only well-defined and established but also emerging, complex, non-routine, creativity- or knowledge-intensive business processes and supporting methods, techniques and tools*. Towards this end, the research project pursues a two-staged research design. In the first stage of the research project a narrative literature review [BCK14] and case study research [Yi09] are employed to develop and initially evaluate a theory of business processes (i.e., theory type IV. [Gr06]). In the second stage a design science research (DSR) project is planned with the intention of evaluating the practical utility of this new understanding of business processes as kernel theory in the development of a design theory (i.e., theory type V. [Gr06]) for BPM systems. Consequently, the research project is expected to make meaningful theoretical as well as practical contributions.

2 Theoretical Background

A core theme underlying traditional BPM methods is the attempt to control the flow of work and optimize the division of labor and the associated effects of differentiation and integration of work practices in the context of business processes [Du13, Ha15a, Ha15b]. However, this mindset becomes severely challenged when creativity-, knowledge-intensive or simply non-routine activities are considered, where the predictability of inputs, resources or outputs is low [SR08, vdAWG05, SRH12, HJ09, Li03]. When work is increasingly unpredictable, simply the act of accomplishing it successfully becomes a major challenge and the main objective [Li03]. Optimizations regarding the control flow become less durable and quickly turn into possible sources of conflict and waste [HJ09, Li03]. Accordingly, existing BPM research has proposed to conceptualize business processes including such activities as consisting of well-structured sub-processes as well as *pockets of creativity*, which in turn can again be decomposed into multiple levels of abstraction [SMWR10].

A key insight not address by this perspective is that the *routineness* or *creativity-intensity* of business processes is not static but a dynamic relation between the environment and the resources (i.e., workers, machines, etc.) of any given business process [Li03]. *Business processes evolve*; non-routine can become routine and established routine or standard processes can turn non-routine or even chaotic as the environment or resources change [Li03]. A deeper understanding of what business processes are and how they emerge and evolve will be critical in today's times of ever quicker changing business environments and increasing competitive pressures [Ba08, Te07, Pl14].

Most BPM research, however, has focused on investigating innovative technical and practical approaches to deal with non-routine business processes (e.g., [RW12, Zu13, Pe07, VBB13, Mü11, AW14]) and generally neglected to provide or build a coherent theoretical perspective of businesses and their processes [Re14, Di13]. Enterprise engineering (EE)

[Di13, Di06], on the other hand, is an emerging discipline that has focused on building a comprehensive and integrated set of theories which aim to provide a solid foundation for the systematic engineering of organizations. EE builds on the language action paradigm and conceptualizes business processes as transaction types that consist of steps through a universal pattern of communicative acts between two actor roles (sic., one initiator and one executor role) [Di06]. Business processes where multiple actor roles are required to work together to deliver a service or a product are represented as a tree of causally related and nested transaction types [Di06] (p. 99-103). Although there is no doubt that EE is a well-grounded discipline, it has to be noted that even EE's conceptualization of business processes does not explicitly address their evolving nature. Several open questions remain, for example: How and why do business processes emerge and evolve? How are non-routine and routine business processes related? How can non-routine business process be effectively supported?

The emerging literature on the dynamics of organizational routines started to address similar questions [Fe16, FP03, Pe12, PF05, PH15]. In this literature stream business processes are viewed as emergent sociomaterial phenomena that can be conceptualized as patterns or networks of action [Fe16]. Viewed through this lens business processes evolve "in the form of a recursive cycle of performative aspects (specific performances in specific times and places) and ostensive aspects (enacted patterns)" [Fe16] (p.506) which can be manifested in the form of artifacts [PF05]. Mathematical modelling and simulation of patterns of actions has demonstrated that *retention*, *variation* and *selection* of actions seem to be the necessary and sufficient conditions that enable the emergence of four major dynamic properties also observed in business processes, namely, formation, inertia, endogenous change and learning curves [Pe12]. However, how this retention, variation and selection of actions comes about remains outside of the scope of current theoretical models in this research area.

Building on game theory[2], Aoki [Ao10] develops a conceptualization of corporations as institutions that emerge and evolve quasi-endogenously from the recursive play of linked and, thus, coevolving games in different (e.g., social or economic) domains (p. 132-143). In his work, institutions and individual agents are conceptualized as actors who interact in *emergent quasi-environments* that consist of multiple linked, thus, *coevolving games across different domains*. The *strategies* of actors then jointly construct an *emergent state of play* which manifests itself in *salient public indicators* that are perceivable by actors and shape their *beliefs* which in turn may lead to the adjustment of their strategies. To escape the inherent problem of infinite regress, he argues for the need to acknowledge the historical past and, thus, the evolutionary process (p. 121).

[2] In essence, game theory posits that any interaction involving two or more actors can be viewed as a game. The rules of the game and the actions taken by the actors determine the outcome of a game. The set of actions selected by an actor is called his strategy. A central idea of game theory is the Nash equilibrium. A Nash equilibrium is a point where all actors' strategies are best responses given the rules of the game and the choices of the other actors. [YZ14]

3 Research Design

The research project aims to synthesize the aforementioned research streams into a comprehensive theoretical perspective of business processes as evolutionary phenomena that is rooted in game theory. More specifically, it is designed to develop the hypothesis that *business processes are meaningfully conceptualized as emergent phenomena that evolve as pattern representations of the recursive play of coevolving games in different domains* into a useful theory of business processes. Recognizing the underlying epistemological implications of this hypothesis, this project follows a generally design-oriented research approach.

In the first stage, which is currently ongoing, the research hypothesis is being developed into an initial theory of business processes. A narrative literature review [BCK14] is being conducted to identify and synthesize literature streams that provide different perspectives on how business processes are best conceptualized. Moreover, case study research [Yi09] is employed to juxtapose and refine theoretical considerations synthesized from the literature with empirical observations in the field. At the moment, a single, embedded case study design [Yi09] is planned. The unit of analysis is BPM system use in organizational units within the critical case of an enterprise with a strong record of BPM adoption. This design will ensure at least initial empirical validation for the emerging theory.

In the second stage, the emerging theory will be used to derive design guidelines for BPM systems. These guidelines are planned be instantiated in the form of IT artifacts that may be evaluated experimentally or in the context of action design research [Se11]. Although theory development is still on going, an intriguing initial design proposition can already be formulated: *If a business process can reasonably be conceptualized as the outcome of the recursive play of coevolving games, should BPM not focus on the general notion of providing methods, techniques and tools that support process stakeholders in their quest towards (hopefully Pareto-efficient) evolutionary stable equilibria?*

4 Expected Outcomes

Existing BPM research has neglected to integrate their mostly practically oriented endeavors into a comprehensive theoretical perspective of business processes. For example, there is no consensus on what a business process is or is not [Re14]. The research project is expected to provide a novel theoretical contribution in the form of an emerging theory of business processes rooted in game theory that aims to provide a coherent explanation of how and why business processes evolve as a consequence of the recursive play of linked and coevolving games in different domains. If successful, this would strengthen the core of BPM and could help to integrate the diverse field of ”process-related” research into a common framework [Gi07]. Expected practical contributions include new insights in the form of theory derived and empirically evaluated design guidelines for BPM systems.

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