Beyond Flexible Information Systems: Why Business Agility Matters

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Abstract: Today, organizations need to act and perform in increasingly dynamic environments. Current research on flexibility of information systems aims to provide answers to this fact. Yet, we show that the concept of flexibility alone does not suffice to address this challenge. Therefore, this paper introduces the notion of business agility that extends the concept of flexibility and describes further necessary areas of research. We identify a perception gap which argues that current concepts of flexibility do not actively search for challenges or opportunities of change in the environment. Instead, flexibility is commonly perceived to be a rather passive characteristic. Based on this observation, our contribution introduces an exemplary instrument that addresses the identified perception gap and aids organizations in achieving higher degrees of business agility and thus, increases the capability of organizations to act and perform under uncertain conditions. The overall contribution of this paper is an extended perspective on the concept of flexibility, the identification of further necessary areas of research and the introduction of an instrument that addresses aspects of the identified issues.

Motivation

Flexibility of information systems has been a research topic for more then a decade. A major area of research on information systems flexibility focused on exploring the effects of change on the alignment of organizational systems and information systems [KJ94]. Flexibility is defined as the *capability to adapt to new, different, or changing requirements* [MW05] or in other words, flexibility is regarded to be the capability of reacting to perceived stimuli [KJ94]. Thereby, the concept of flexibility itself neither searches for changes (or opportunities) nor is it oriented towards a goal. Therefore, flexibility can be regarded to be a fundament rather than a solution for dealing with change. Adequate (re-)actions to change in organizational contexts *require* flexibility of information systems but more than that, these actions need to be *embedded in an active and goal-oriented process* to direct organizational efforts into desired directions. Organizations not only need to maintain flexibility of information systems, but they need to search for opportunities in their environment and employ concepts and instruments for deciding how to leverage flexibility for organizational success.

Based on that argumentation, we introduce a novel concept of business agility [SR05] that is based on the cybernetics thinking approach [HJ01, Förs93] and strengthens the aspect of goal orientation. Business agility is defined to be a triadic problem that consists of the three dimensions time, control and information systems. In addition, business agility is oriented towards specific goals. In this contribution, we frame information systems flexibility within the broader concept of business agility and relate existing concepts of information systems flexibility to the business agility approach. The result of this investigation leads to increased understanding about the benefits and facets of information systems flexibility in organizational contexts and to new and challenging questions, such as the "perception gap". Finally, we introduce B-KIDE, a framework and a tool that aids organizations in their attempt to be agile. Overall, the main contribution of this paper is an extended perspective on the concept of flexibility, the identification of necessary improvement areas and the introduction of an exemplary instrument that addresses certain aspects of the identified areas.

Types of Flexibility

[NN97] define flexibility as an ability to adapt (information systems) to both *incremental* and *revolutionary* changes. Thereby, flexibility is a latent construct, a characteristic of an information system that can not directly be discerned by observing the system at runtime [BCK98]. We define *incremental* change to be the change that can be performed by employees right at their workplace while *revolutionary* change requires experts such as an information technology (IT) department or external consultants to adapt information systems to new situations. Although this distinction depends on (changing) skills of employees, the distinction is necessary to better understand the different perspectives and requirements of important groups of actors.

Furthermore, two main dimensions of flexibility can be distinguished: *Structural and process flexibility* [NN97]. *Structural flexibility* refers to characteristics of information systems themselves, such as modularity, acceptance of change or consistency while *process flexibility* refers to the ability of organizations to adapt information systems to new situations. This includes the skills necessary for adaptation such as programming, change management or coordination of activities. Here, the focus is on the process of change and its main actors (the employees, the IT department, etc). While structural flexibility was given extensive attention in the past, process flexibility has been covered insufficiently from research on IS flexibility [KJ94].

The Concept of Business Agility

In order to broaden the perspective on flexibility, we introduce the notion of business agility. Business agility represents a new concept that aims to enable *timely* and *adequate* (re-)actions to/for the unexpected [Vers04, SR05]. Both, timeliness and adequateness of actions is determined by a control system through an evaluation with goals. Based on the cybernetics thinking approach [HJ01, Förs93], the business agility

concept introduces four main processes (see Figure 1): perception, decision making, action and impact. *Perception* describes the control system's activity that deals with perceiving and recognizing its environment (e.g. change stimuli). The control system thereby only perceives what represents a potential disturbance to its goal [HJ01][1]. *Decision making* is the activity that is concerned with interpreting the developed representations of the environment (e.g. performance or change indicators). The output of this activity is a set of decisions (e.g. a plan to modify the existing information system) that contributes to the control system's goal. The decisions themselves lead to *actions* (the actual process of modifying the information system) that subsequently evoke changes in the environment. The last process element *impact* represents the impact of taken actions (e.g. information systems modification) in the environment. At this point, the control loop starts over and iterates through the first activities.

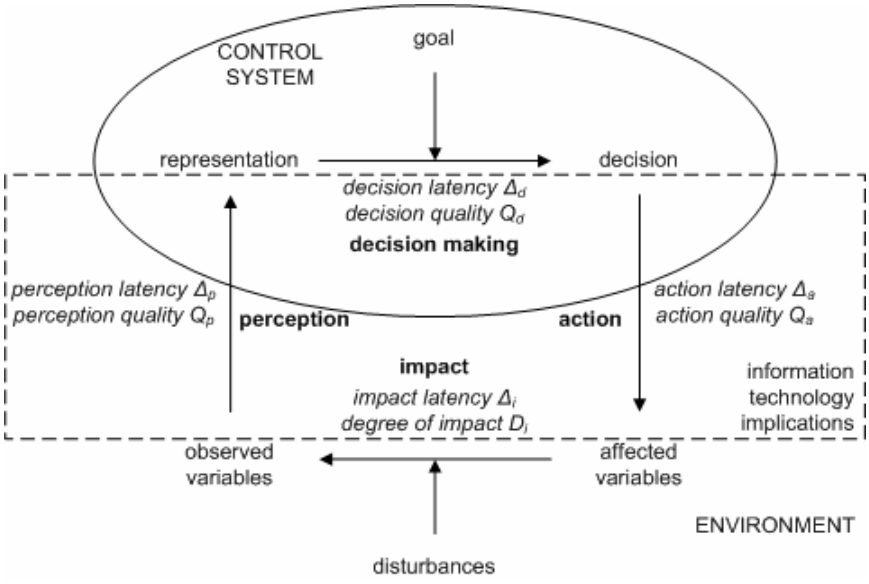

Figure 1 The Concept of Business Agility [SR05]

An organization can be assessed to be agile if the activities perception, decision making, action and impact are concerted in a *timely* and *adequate* manner, contributing to its set of goals.

The degree of business agility can be determined by the following set of parameters: The parameters Q_p, Q_d and Q_a represent the quality of perceptions, decisions and actions with respect to the targeted goal of the control system. The parameters Δ_p, Δ_d,

[1] This fact, among others, represents a significant difference between business agility and existing conceptualizations of flexibility (such as [KJ94] or [NN97]) that do not include aspects of goal orientation

Δ_a and Δ_i represent the latency of perceptions, decisions, actions and impact. The additional parameter D_i represents the degree of impact of taken actions in the environment [SR05]. Business agility thus is a function of: f (Δ_p, Q_p, Δ_d, Q_d , Δ_a, Q_a , Δ_i, D_i). By relating the parameters of business agility to existing organizational instruments (such as established information system (IS) adaptation processes or IS maintenance systems), one is able to assess an organization's ability to be agile.
Based on this notion of business agility, we relate the two existing dimensions of flexibility to the introduced concept.

Flexibility and Business Agility – The Perception Gap

The business agility concept can now be utilized to set the concept of information systems flexibility in context: Figure 2 illustrates the two dimensions of information systems flexibility [NN97] related to the core processes of business agility. While *process flexibility* is concerned with the process of reacting to perceived changes and coordinating derived actions, *structural flexibility* stands for the flexibility of information systems themselves.
The assignment of the two introduced types of flexibility to the concept of business agility in Figure 2 reveals that the process of perceiving changes represents an improvement potential for current conceptualizations of flexibility. At this level, flexibility would be concerned with activities such as the active screening, monitoring or modeling of environments for potential changes that may trigger, require or even demand information system adaptations. While flexibility is the capability to react to perceived changes, the concept of business agility broadens the view and suggests to even pro-actively search for changes (or opportunities) in the environment, to be able to swiftly and adequately reconfigure an organization's constituting elements (e.g. its information system) possibly even before damage may occur[2].
In contrast to flexibility, goal orientation integrated in the concept of business agility allows for conscious management of and pro-activity in the perception process. At this point, we define the identified gap between the concepts of flexibility and business agility to be the "perception gap".

[2] From a cybernetics perspective, this mechanism of control is described as Feedforward (vs. e.g. Feedback or Buffering) [HJ01]

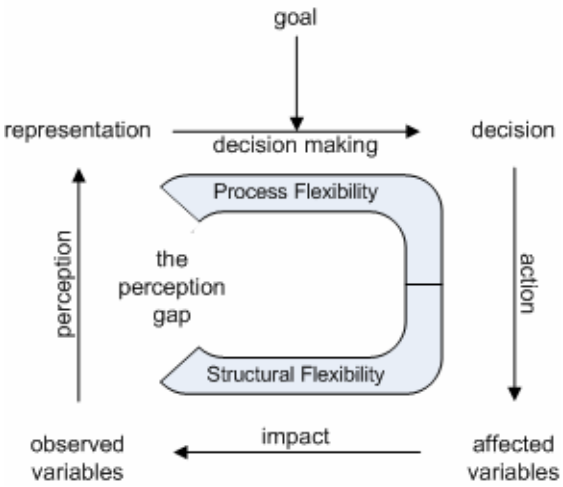

Figure 2 Flexibility related to the Concept of Business Agility

Beneath that, the introduced parameters of business agility apply here as well: *Process flexibility* can be determined by observing the parameters Q_d, Δ_d, Q_a, Δ_a of a control system[3]. A high degree of process flexibility requires adequateness of decisions and short decision cycles, supported by e.g. decision support systems [Hers99]. Beneath that, it requires adequateness of derived actions and short implementation time frames supported by e.g. the utilization of skilled experts, agile methods or streamlined implementation processes. Similarly, the degree of *structural flexibility* can be determined by the parameters Δ_a, Q_a, Δ_i, D_i.[4]. An information system architecture that supports timely implementation of derived actions through e.g. integrated software development environments and allows for quick enactment of performed changes through e.g. service-oriented systems architectures is regarded to have structural flexibility.

To address the identified perception gap, we introduce a framework and a tool that lays a strong focus on the pro-active perception of organizational work through modeling.

Addressing the Perception Gap with B-KIDE[5]

B-KIDE represents a framework and a tool that allows for business process-oriented modeling of organizational knowledge work [Stro04]. The developed models together with the B-KIDE Method enable organizations to design business process

[3] These parameters generalize and solidify the parameters of process flexibility introduced by [NN97] which are 1) rate of response 2) expertise and 3) coordination of action

[4] Again, these parameters generalize and corroborate the parameters of structural flexibility introduced by [NN97] which are 1) modularity, 2) change acceptance and consistency.

[5] B-KIDE: Business Process Oriented Knowledge Infrastructure Development

supportive knowledge infrastructures [Siv01]. B-KIDE itself is designed to be employed in situations of *revolutionary change* assuming significant changes in an organization's environment. Based on our definition of revolutionary change, experts (vs. the employees themselves) are required to initiate and conduct the change process.

We do not believe in the hypothesis that in the future the majority or even all of information system adaptation activities will be carried out by employees themselves. There is strong evidence that rather strengthens the role of revolutionary change: Experts are increasingly needed because of the diversity and complexity of the software systems available today. Also, they take a more global perspective on IT challenges (e.g. vendor evaluation) and pursue more long term objectives (e.g. sustainability). Therefore revolutionary change, beneath incremental change, will remain an import factor in change processes. The B-KIDE framework and tool provides experts with a profound instrument to pro-actively and swiftly scan the environment for change stimuli and opportunities to subsequently design business process supportive information systems.

The B-KIDE Framework

The B-KIDE Framework as depicted in Figure 3 aids in aligning information systems comprising innovative knowledge management functionality (so called knowledge infrastructures) to organizational business processes.

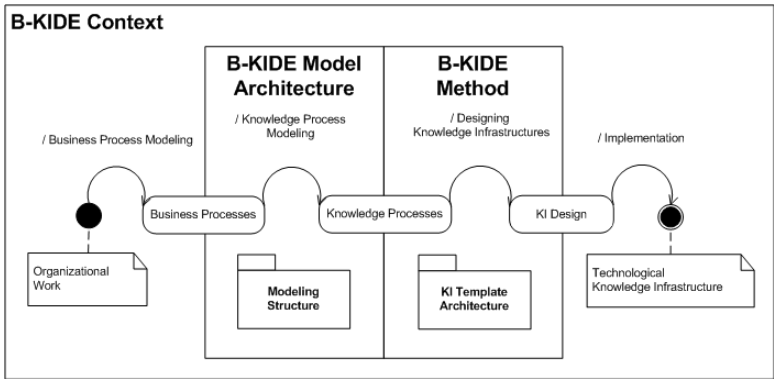

Figure 3 B-KIDE Framework Components

Based on models of organizational work, the B-KIDE Framework introduces a way (the B-KIDE Model Architecture) to identify knowledge processes within and between business processes. First, the B-KIDE Context describes general conditions of applying the B-KIDE Framework in organizations. Because a successful improvement of knowledge intensive business processes is regarded to be stronger related to the improvement of knowledge flows rather than work flows [RL00], the identification of knowledge processes (that are considered to run within or across business processes) represents a profound fundament for subsequent actions. The identified knowledge processes themselves represent the basis for designing

technological knowledge infrastructures that visibly support the execution of knowledge–intensive business processes. During B-KIDE application, experts (so called knowledge analysts) conduct business process-oriented interviews with employees that conform to a defined modeling structure to construct models of organizational work. Subsequently, the B-KIDE Method deduces requirements for knowledge infrastructures based on the knowledge processes identified to integrate these requirements into anticipated knowledge infrastructures that themselves are aligned to knowledge intensive business processes.

The B-KIDE Tool

The B-KIDE Tool schematically depicted in Figure 4 represents an instrument for conducting structured interviews with employees of an organization. Knowledge analysts utilize the B-KIDE Tool interview forms to raise process-oriented questions and structure corresponding answers in accordance with the B-KIDE Modeling Structure. Based on the gathered data, the B-KIDE Tool allows for generating a broad range of analysis reports that represent the fundament for deducing requirements for business process supportive knowledge infrastructures.

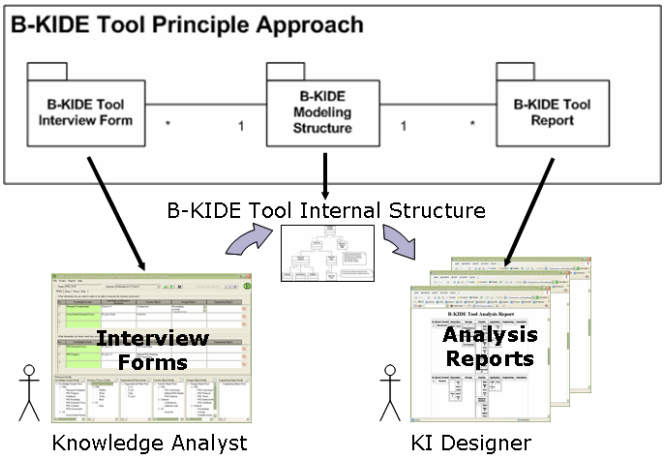

Figure 4 The B-KIDE Tool

The B-KIDE Tool thereby streamlines the process of modeling and effectively supports knowledge analysts in their modeling efforts.

B-KIDE and the Perception Gap

The application of B-KIDE contributes to increasing the business agility of organizations. B-KIDE addresses the introduced perception gap to a certain extent by supporting the process-oriented modeling of knowledge work in an effective and

efficient way. It thereby not only decreases perception latency Δ_p but also increases perception quality Q_p[6]. Empirical evidence for this hypothesis can be found in three studies that were performed with industrial partners [Stro04]. B-KIDE thereby enables organizations to adequately and timely adapt their information systems to changing requirements with a strong focus on the perception process. The goal aspect of business agility is especially emphasized in the B-KIDE approach as well since all undertaken actions are aligned to organizational business processes, which can be regarded to implement organizational goals on a concrete level. With B-KIDE, changes in an organizational environment can quickly be identified and addressed through iterative application of the B-KIDE Framework. Although the execution of structured interviews with B-KIDE strongly contributes to narrowing the perception gap, we see the need for a series of complementary measures (such as online user feedback, log analysis, improvement suggestion systems, etc) to close the identified gap satisfyingly.

Conclusions

This paper motivated the need for extending current concepts of flexibility. With the introduction of the concept of business agility, the necessity for goal-orientation in business process supportive information systems was motivated and strengthened. Flexibility itself represents a fundament rather than a solution for agile organizations. We identified a perception gap in current flexibility concepts that emerged by relating the two dimensions of flexibility (process and structural flexibility) to the concept of business agility. The introduced B-KIDE Framework and Tool address certain aspects of this gap by extending the current understanding of process flexibility and integrating and improving aspects of perception. Yet, since B-KIDE exclusively focuses on revolutionary change, further research needs to focus on closing the perception gap at the level of incremental change as well. However, B-KIDE represents a first important step towards conscious and proactive management of perception processes in organizations.

Because of imposed space limitations we refer to [Stro04] for more comprehensive details and background information about the B-KIDE Framework and Tool.

Acknowledgments

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[6] Quality of models in general can be assessed by the following aspects: 1) self consistency, 2) uniqueness of model elements and 3) model accuracy (based on [KS98, p.103-104]).

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