THE EVOLUTION OF ROUTINES UNDER FLEXIBLE IN-FORMATION TECHNOLOGY

Research in Progress

Lehrig, Tim, University of Bern, Bern, Switzerland, tim.lehrig@iwi.unibe.ch

Krancher, Oliver, University of Bern, Bern, Switzerland, oliver.krancher@iwi.unibe.ch

Dibbern, Jens, University of Bern, Bern, Switzerland, jens.dibbern@iwi.unibe.ch

Abstract

Many technological developments of the past two decades come with the promise of greater IT flexibility, i.e. greater capacity to adapt IT. These technologies are increasingly used to improve organizational routines that are not affected by large, hard-to-change IT such as ERP. Yet, most findings on the interaction of routines and IT stem from contexts where IT is hard to change. Our research explores how routines and IT co-evolve when IT is flexible. We review the literatures on routines to suggest that IT may act as a boundary object that mediates the learning process unfolding between the ostensive and the performative aspect of the routine. Although prior work has concluded from such conceptualizations that IT stabilizes routines, we qualify that flexible IT can also stimulate change because it enables learning in short feedback cycles. We suggest that, however, such change might not always materialize because it is contingent on governance choices and technical knowledge. We describe the case-study method to explore how routines and flexible IT co-evolve and how governance and technical knowledge influence this process. We expect to contribute towards stronger theory of routines and to develop recommendations for the effective implementation of flexible IT in loosely coupled routines.

Keywords: Flexible Information Technology, Organizational Routines, Governance, Team Learning.

1 Introduction

Many technological developments of the past two decades come with the promise of greater information technology (IT) flexibility, i.e. the improved capacity to adapt IT (Allen and Boynton, 1991, Duncan, 1995, Orlikowski, 1996, Golden and Powell, 2000, Byrd and Turner, 2000, Byrd and Turner, 2001, Tallon and Pinsonneault, 2011). For instance, workflow management systems allow organizations to configure the IT-embedded plans that coordinate recurrent activity (Bertino et al., 1999). Service-oriented architectures may enable organizations to flexibly combine elementary IT services to solutions (Papazoglou and Georgakopoulos, 2003). Software ecosystems offer a multitude of such services (Jansen et al., 2009). The common thread of these developments is that they promise higher IT flexibility because people are enabled to change IT not by modifying source code, but by configuring or assembling IT from elementary services. Modern collaboration software packages, such as Microsoft SharePoint ®, combine such workflow configuration and service combination capabilities.

This trend towards more flexible IT has been paralleled by a trend towards more IT-proficient end users. The knowledge workers (Drucker, 1999, Davenport, 2010) in modern business departments often not only use, but also shape IT by assembling and configuring IT that meets their specific requirements. As business users are increasingly able to create their own IT solutions without mandating

changes to information systems (IS) departments, the traditional demarcation line between those who create IT and those who use it is beginning to blur.

Increasing technological flexibility and end user proficiency may introduce exciting but little understood dynamics into routines, i.e. into how teams or organizations accomplish what they repeatedly do. Routines have been defined as "repetitive, recognizable patterns of interdependent action, carried out by multiple users" (Feldman and Pentland, 2003, p.95). Examples of routines include fulfilling customer orders, hiring, creating reports, and providing customer support[1]. Although the link between IT and routines has attracted much scholarly attention, most work sheds light on either ends of a continuum and is relatively silent about the question how routines evolve under flexible IT. The one stream of research has focused on the routines at the core of an organization's value chain and on the highly integrated technologies, such as enterprise resource planning (ERP) systems, which often accompany such routines. This perspective has emphasized that IT constrains routines, is hard to change, and therefore introduces inertia (Boudreau and Robey, 2005, Rettig, 2007). In this perspective, routines change most often not because people change IT, but because people modify the way how they enact or by-pass hard-to-change IT (Boudreau and Robey, 2005). Although this perspective has yielded important insight into the relationship between IT and routines, its explanatory power is uncertain in settings where technology is easy to change and end users have some control over IT. The second stream is research on computer-supported collaborative work (CSCW) (Zigurs and Buckland, 1998, Majchrzak et al., 2000). This research has often focused on group problem-solving or decision-making activity, which is more one off than recurrent. CSCW researchers have produced significant knowledge about how groups appropriate technology. But they have less often focused on how repetitive collective behavior such as routines evolves over time. Yet, much organizational activity is recurrent enough to qualify for routines, but only loosely coupled to highly integrated, hard-to-change IT systems. Such loosely coupled routines are increasingly supported by flexible IT that is shaped over time by the actors who perform the routine (Kallinikos et al., 2013). The result is a process of co-evolution of routines and IT that scholars are only beginning to understand (Leonardi, 2011).

Our research aims at a better understanding of how routines evolve under flexible IT. Pioneer work has explored how routines and flexible IT are interwoven and co-evolve in path-dependent ways through specific mechanisms (Leonardi, 2011). Less is known, however, about when and how such co-evolution moves towards directions of higher efficiency. For instance, user groups may fail to adapt flexible IT because they are cognitively overloaded by the adaptation choices in unfamiliar IT and the interdependencies of these choices with the countless potential configurations of a specific routine. This suggests that knowledge issues play an important and little understood role in the coevolution of routines and flexible IT. Moreover, user groups may fail to adapt flexible IT because managers or IS departments constrain the spectrum of possible IT adaptations, be it to avoid cognitive overload, to reduce variability, or to maintain power. Governance choices such as the amount of discretion allowed to end users may thus also critically shape change. This paper theorizes why knowledge and governance may play crucial roles and it describes the case-study method that we undertake to explore how and why knowledge and governance shape the evolution of routines under flexible IT. The research is expected to contribute to the theory of routines and to inform practitioners how they can fruitfully implement flexible IT to improve routines.

The remainder of this paper is organized as follows. We next review the theory of routines, the conceptual framework of this study, and discuss the roles played by governance and knowledge. We then summarize the planned case-study method and the expected contribution.

---

[1] Some readers may be more used to refer to these phenomena as business processes. Although there may be subtle differences between routines and business processes (cultivated by largely isolated streams of research), both concepts refer to patterns of recurrent collective interdependent activity (Beverungen, 2013). We use the term routine throughout this paper.

2 Routines

Much organizational activity is organized in routines. It is therefore not surprising that routines have attracted high attention in popular writings and in organizational and IS research. Well-known examples of routines include issuing credits at IBM Credit (Hammer and Champy, 1993), hiring people at a university (Feldman and Pentland, 2003), and providing customer support at a software company (Orlikowski, 1996). Common to these activities is that they consist in patterns of interdependent and recurrent actions by multiple people. They are thus what scholars call routines (Feldman and Pentland, 2003, Becker, 2004). Routines are critical because they foster efficiency and legitimacy (Feldman and Pentland, 2003, Becker, 2004). Yet, although routines are omnipresent, they remain little understood (Pentland et al., 2010). We next review major developments in the theory of routines and discuss the role of flexible IT in their evolution.

2.1 Routines as Programs

Early work on routines often conceived them as programs (e.g. Cyert and March, 1963, Nelson and Winter, 1982), i.e. as the patterns of interdependent, recurrent actions that managers or technologists programmed into artefacts such as a standard operating procedure or a workflow management system. The implications of the program metaphor were that routines are relatively stable, but that managers or technologists can change the routine by changing the artefact (Pentland and Feldman, 2008). Yet, people may not always follow procedures, they may execute work in different ways than envisioned during artefact design (Orlikowski, 1996, Boudreau and Robey, 2005, Hales and Tidd, 2009), and they may constantly adapt their actions even without any change of formal procedures or IT.

2.2 Routines as Generative Systems

The seminal work by Feldman and Pentland (Feldman and Pentland, 2003) extended the concept of routines to account for these issues. Drawing on actor-network theory (Latour, 2005), practice theory (Bourdieu, 1977), and structuration theory (Giddens, 1984), they conceived routines as generative systems consisting of two distinct aspects, an ostensive and a performative one. The ostensive aspect is the idea of the routine. It is stretched across the existing mental models held by the performers of the routine (D'Adderio, 2011). Whereas the ostensive aspect thus captures mental abstractions, the performative aspect denotes the concrete actions that concrete people perform at concrete times. The performative aspect is often distinct from the ostensive aspect because performance is at least partially improvised. People improvise during the performance of routines because the abstractions that form the ostensive aspect are necessarily incomplete, because external change requires deviating from prior performance patterns, or because learning enables more efficient performance patterns (Feldman and Pentland, 2003). Importantly, programs of action codified in artefacts, such as standard operating procedures, flowcharts, or IT, are neither the ostensive aspect nor the performative aspect of the routine (Feldman and Pentland, 2003, Pentland and Feldman, 2008, D'Adderio, 2011). Reducing routines to these programs would disregard the distributed, tacit, and subjective qualities of the ostensive aspect. It would also understate the role of human agency in the performative aspect of the routine (Feldman and Pentland, 2003, Pentland and Feldman, 2005).

The theory of routines as generative systems is useful to understand how and why routines change. Through this lens, routines change simply because they are performed. During performance, the partially improvised performative aspect constantly creates, maintains, or modifies the ostensive aspect, while the ostensive aspect directs, legitimizes, or constrains the performative aspect (Feldman and Pentland, 2003). Different labels have been used to refer to this intrinsic propensity for change of routines, such as routines as generative systems (Feldman and Pentland, 2003), drift (Ciborra, 2000), endogenous change (Feldman, 2000, Pentland et al., 2011), and team learning (Edmondson et al., 2001). Routines may thus change even in absence of intentional efforts to change the routine such as management-led improvement initiatives and technology implementations. Conversely, improvement initi-

atives or technology implementations need not entail the changes to the routine that have been envisioned by managers or designers (Orlikowski, 1996, Edmondson et al., 2001, Boudreau and Robey, 2005, Pentland and Feldman, 2008). Indeed, routine theorists explain the failures of many such initiatives with the wide-spread views of routines as things or mechanistic programs for action embedded into artifacts. These views mistake artefacts for routines, assuming that change to the routine can be dictated by design of the artefact (Cohen, 2007, Pentland and Feldman, 2008, D'Adderio, 2011).

If routines are generative systems that do not obey to IT design, how can we explain the striking changes that IT has brought to organizations and their routines over the past decades? And how can organizations harness the uncontested potential of IT to increase the efficiency of routines? While the theory of routines as generative systems has rendered valuable services in cautioning against too narrow views of routines as mechanistic programs, it may have overstated agency and understated the impact of IT on routines in many modern organizations. This is the point made in the artifactual turn in routines theory, which is explained next (D'Adderio, 2011, Leonardi, 2011).

2.3   The Artifactual Turn in Routines Theory

The artifactual turn sees the two so far discussed views of routines as two extremes that either assume full mechanistic prescription and technological determinism (routines as programs) (Cyert and March, 1963, Nelson and Winter, 1982) or full interpretive flexibility and unconstrained human agency (routines as generative systems) (Feldman and Pentland, 2003). Although these extremes are helpful lenses, neither is particularly likely. When new IT is introduced, people may neither immediately perform the routine as per design nor may they enduringly by-pass new IT and stick to former routines (Boudreau and Robey, 2005). Instead, routines and IT co-evolve (D'Adderio, 2011, Leonardi, 2011, D'Adderio, 2008). IT does thus not determine, but shape the performances of the routine. Unlike the view of routines as programs, the artifactual turn does not ignore human agency, but assumes distributed agency (D'Adderio, 2011) or combinations of human and material agencies (Leonardi, 2011). These notions assume that people embed agency in artefacts and that artefacts hence reflect the history of the performances and ideas of those that have created and used the artefact. Much like organizational cognition is distributed in the mental models spread across multiple people, so is agency because intentions and knowledge become inscribed into artefacts that shape the collective performance of routines (D'Adderio, 2011). This idea moves artefacts such as IT from outside the routine to its center.

The dotted box in figure 1 shows how routines and its artefacts co-evolve according to the artifactual turn. Artefact designers selectively inscribe elements of the ostensive views into the configurations of the artefact. The process is selective because what is inscribed may depend on the intentions and, we add, on the knowledge of those who control design. Artefacts, in turn, shape the performative aspect of the routine because they promote habituation of behavior, because they are entangled into a thick web of social relationships that is difficult to escape from, and because they make information visible to others (D'Adderio, 2011).

This sketch sees IT as a mediator that selectively translates collective knowledge about the routine into specific performances. IT thus participates in the co-creation of knowledge about the routine. It serves as a boundary object (Carlile, 2002) in the process of team or organizational learning that underlies change of routines (Edmondson et al., 2001). Since routines are social action embedded into a context and since IT mediates this embedded social action, routines and IT are tightly entangled (Pentland et al., 2012). Because of this tight entanglement, claims about how IT generally shapes routines may be short-sighted. Yet, despite the need for careful generalization, a recent review suggests that routine research could develop explanations of how particular contexts shape the interplay of routines and IT (Parmigiani and Howard-Grenville, 2011). The specific interplay of routine and IT may thus depend on contextual conditions such as IT flexibility.

2.4 Flexible IT and Routines

If IT serves as a mediator or boundary object in the collective learning directed at more efficient routines, then IT characteristics may influence how learning unfolds (Volkoff et al., 2007). We suggest that it is in particular the flexibility associated with specific IT that may matter. Prior research has often focused on IT that is hard to adapt, such as large, tightly-integrated ERP systems (Boudreau and Robey, 2005, Rettig, 2007). If changes to IT take long, then such IT may be a poor mediator or boundary object in collective learning processes. Hard-to-change IT may introduce stability (D'Adderio, 2011) or inertia (Rettig, 2007) to routines because change of IT then "requires the deployment of resources (i.e. time and software programming skills), which are often unavailable" (D'Adderio, 2011, p. 216).

Yet, what if IT can be changed not only by IS departments through time-taking code modifications, but also by the performers of the routine through relatively quick configuration changes and service assemblage? If IT is the mediator in the collective learning that surrounds IT-supported routines, then quicker IT changes seems to entail quicker feedback cycles and thus more learning in a given time. User groups may quickly inscribe incremental learning from their ostensive understandings into revised IT configurations, they may perform the routine using the artefact, and they may use the observations from the resulting performances to update their ostensive understandings. This view is consistent with the perspective of digital artifacts as being "constantly in the making" (Kallinikos et al., 2013, p. 366). When IT is flexible, then the conclusion of the artifactual turn that IT will stabilize routines may rest on shaky ground.

While the developments of routines theory have thus produced a useful lens to make sense of routines and IT, how routines evolve under flexible IT remains an open question. This is for two reasons unfortunate. First, the question is practically important as organizations increasingly adopt flexible IT packages to improve routines that are loosely coupled to tightly integrated, hard-to-change IT. Second, contexts of high and low IT flexibility may be informative contrasts for moving towards stronger theory of routines and artefacts. Our research aims at a better understanding of the evolution of routines in the context of flexible IT. We next propose two constructs that may influence this evolution.
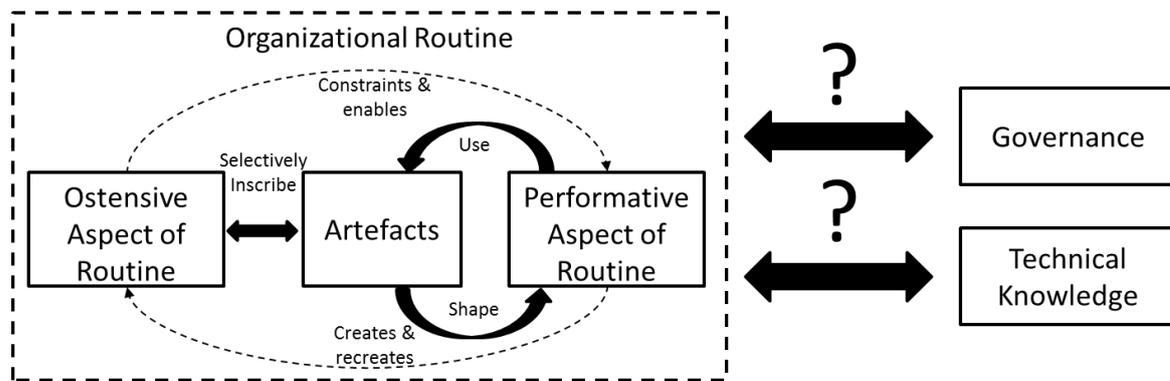

Figure 1   Proposed Model (adapted from D'Adderio, 2011)

3 Proposed Framework

Figure 1 shows the framework that will serve as a sensitizing device to explore how routines evolve under flexible IT. The left-hand part of the figure reflects artifactual turn of routines theory. The artifact is in the center of the organizational routine. While the artifactual turn does not theorize about specific artefacts, our study focusses on flexible IT artefacts. The artefact interacts with the ostensive aspect (the idea of the routine) and the performative aspect (the performance of the routine) through the mechanisms reviewed in the previous section. The right-hand part of Figure 1 shows two constructs, IT governance and technical knowledge, which are yet to be theoretically linked to the routine.

We do not hypothesize specific relationships between these constructs and the routine. But we discuss why these constructs are likely to play important roles and should therefore be included as a-priori constructs into our empirical analysis (Eisenhardt, 1989).

3.1 Governance

The term IT governance has carried various meanings in various contexts, but it often refers to rules that define decision rights and accountabilities associated with the use of IT in organizations (Weill, 2004). When organizations deploy flexible IT to support routines, rules may regulate who can make what adaptations to the IT. In particular, rules may regulate the extent to which end users are allowed to adapt the IT, i.e. to change the configuration of the IT or to assemble new services. Some organizations or parts of it may reserve the right to adapt the IT entirely to IS departments. Others may grant end users full decision rights. Still others may grant some configuration rights to end users and reserve others to IS departments or they may dynamically revise the amount of discretion left to end users. Finally, routines may involve multiple business teams and governance rules may specify how adaptation decisions are made across those departments.

IT governance decisions are likely to play an important role in the evolution of routines under flexible IT. In essence, IT governance help regulate IT flexibility, i.e. the capacity to adapt IT. If configuration changes are denied to end users, then this reduces their capacity to adapt application functionality, one important dimension of IT flexibility (Byrd and Turner, 2000). IT governance can therefore reduce the IT flexibility that a given IT affords, but it cannot directly enhance it.

If organizations choose flexible IT because of the improved capacity to change the application, why should organizations constrain this feature? There may be at least two reasons for regulating flexibility. First, individuals may be cognitive overloaded by having plenty of adaptation options available (Miller, 1956, Simon, 1991, Baddeley, 1992). Limited human working memories may find efficient combinations of few given IT adaptation options with potential adaptations of the routine. But as the amount of adaptation options increases, cognitive overload may reduce the combinations identified by inexperienced individuals from few to zero. Inexperienced users may also introduce faults into the IT because they do not oversee the consequences that arise from complex configuration options. These arguments suggest that organizations may change the discretion afforded to end users over time as end users acquire more technical knowledge about the IT and as teams pass through learning cycles along the arrows that connect the ostensive aspect, the performative aspect, and the artifact.

A second reason for why organizations regulate IT flexibility through IT governance may be political. As D'Adderio (2011) notes, those that change artefacts inscribe intentions and rationales into them. Routines and artefacts are thus embedded into specific contexts (Howard-Grenville, 2005, Volkoff et al., 2007, Edmondson et al., 2001). What "dominant interest" (D'Adderio, 2011, p. 212) is inscribed or embedded in an artefact may therefore depend in part on the political struggles that surround the implementation (Markus, 1983). Governance may thus not only be a rational tool against cognitive overload, but also an instrument to prevent or enforce the power shifts that may come with the introduction of more flexible IT. The more people or departments are involved into a routine (i.e. the broader the routine is embedded into the organization), the more restrictive may governance be.

In sum, governance may influence the learning process that unfolds in the co-evolution of routines and the artefact. Moreover, it may reflect the context into which the routine is embedded and therefore constrain the paths along which routines and IT can co-evolve. Governance will often not be a static context factor, but may change endogenously as it participates in the co-evolution of routine and artefact.

3.2 Technical Knowledge

Different implementations of flexible IT in a routine may not only differ in governance choices, but also in the technical knowledge that is available during the process. Technical knowledge is

knowledge about the technologies that are being or have been implemented such as knowledge about a software package, programming languages, or operating systems insofar as they are relevant in the given context. Some teams may be experienced with a technology because they have been using the technology in a different routine. Other teams may lack experience with the IT, but they may (or may not) involve technology experts from internal IS departments or consultancies, who train team members (Nelson, 1991) or provide direction (Grant, 1996) on the implementation of the technology.

The amount of available technical knowledge is likely to be an important factor in the co-evolution of routines and flexible IT. The literature on IT flexibility suggests that "human infrastructure" such as people knowledgeable in the specific IT is one dimension of IT flexibility because it enables organizations to adapt IT (Byrd and Turner, 2000). Especially flexible IT with a multitude of options may require that users have significant IT knowledge to efficiently and effectively use and adapt the software. Additionally, the software package, such as Microsoft SharePoint ®, may also change over time due to updates, which may make effective use and adaptations of the system more difficult.

The idea that more technical knowledge boosts the appropriation of IT is straight-forward. If users do not understand the artefact, they are unlikely to conceive effective adaptations and to use it as an effective boundary object with which team members can negotiate mutual understanding. Yet, how technical knowledge influences the co-evolution of routines and artefacts may need a more nuanced answer than a course-grained main-effect statement allows. First, the timing of external technical knowledge infusions may matter. For instance, organizations may plan significant trainings and extensive direction by consultants at the beginning of a project. Alternatively, they may plan small amounts of training and direction, but at multiple times with some time in between. The second scenario allows for the internalization and socialization of technical knowledge between trainings by adapting the artifact between the knowledge infusions, whereas the first does not. The resulting dynamics may therefore differ (Nonaka, 1994, Raelin, 1998). For instance, regular external infusions may prevent that routinized, unreflective use leads into competency traps (March, 1991). Second, there may be interactions between the amount of required technical knowledge and the ostensive aspect of the routine. If people have rich understandings of the routine and if these understandings are relatively uniform, then they may more easily see how they can use the available IT to conceive more efficient combinations of routine and IT configurations. Put in more theoretical terms, if the routine itself imposes low cognitive load on individuals, they may have more mental resources for the delicate task of integrating knowledge about the routine (the ostensive aspect) with technical knowledge. They may hence require less technical training or direction as a prerequisite.

These ideas suggest that technical knowledge may play an important role in the co-evolution of routines and artefacts. They also suggest that dynamic research designs may be appropriate to uncover the causal mechanisms that connect the concepts. We next describe the method that we adopt to this end.

4 Research Method

We conduct a longitudinal multiple-case study. We chose the case study research strategy (Yin, 2003) because it allows us to observe how routines and artefacts evolve over time in organizations. We strive to build theory (Eisenhardt, 1989) of how routines evolve under flexible IT and how this interacts with governance and technical knowledge. To grasp the micro-dynamics of this process, our data collection will be in real time (Langley, 1999).

Our unit of analysis is the routine (Pentland and Feldman, 2005). One case is thus the implementation and use of a flexible IT in one routine in one organization. We purposefully select cases to allow maximum variation (Flyvbjerg, 2006) along governance and technical knowledge while minimizing variation in other factors. The case studies will be based on the same IT package, Microsoft SharePoint ®. We consider Microsoft SharePoint ® as flexible IT because it allows ample configurations of workflows and assemblage of services by users. The focus on one package helps control for tool-specific influence factors. The first case study, which started in November 2014, is conducted at a medium-

sized organization, which uses the platform for collaboration tasks and small workflows in project management. This pilot study will be used to refine the set-up for subsequent case studies, which we are planning to conduct over the next two years. The context of project management is suitable because routines in this area, such as creating reports, are only loosely embedded in the overall organization. Routines are therefore assumed to be especially vivid in this context. This promises unique insight into the dynamics of routines.

We collect data by semi-structured interviews, archival data extracted from the artefact, and observation by the first author. The main source will be semi-structured interviews, which will be conducted with interview partners from IT departments, i.e. administrators of the platform and help desk members, power users, i.e. users which have deepened knowledge of the technology, and users, i.e. members of the organization that work in functional departments and use the platform. Open interview questions are designed to have project participants narrate about how they perform routines at specific times and what changes they and others make to the artefacts. The interviews also grasp what mental models the participants have of the routine, how and when they are trained in adapting and using the artefact, how technology experts direct them in adapting the artefact, and what governance choices are made. The interviews are initially conducted every two months. This schedule will be revised after the first two iterations. Additionally, anonymized usage data will be extracted from the package. These data will allow triangulation, but they may also be the basis for sequence analysis methods that go beyond the insight from interview data. One author, who is involved in the implementation of the package, will make observations during trainings and meetings, which are linked to the platform. We plan to analyze data by coding, visual maps (Langley, 1999), and sequence analysis methods such as process mining (Abbott, 1995, van der Aalst et al., 2007). Coding will be guided by the a-priori constructs discussed in this paper, but will be open to inductively identify unexpected concepts. Sequence analysis methods will help describe change of routines over time. While the focus of our analysis is on explaining endogenous change of routines and artifacts, we will also consider the role of change introduced from the environment, such as by product updates, new plug-ins available on marketplaces, or knowledge exchange with communities beyond the teams that are in the focus of our analysis.

5 Expected Contribution

Although routines and IT are economically highly important and omnipresent organizational activities, we are only beginning to understand how routines and IT co-evolve. Some research has examined this co-evolution in contexts where IT is highly integrated and hard to change. Yet, organizations increasingly use IT that is easy to change in settings that are loosely coupled to the organizational core. Our research aims to contribute to stronger theory of the co-evolution of routines and IT by seizing the context of flexible, easy-to-change IT. We expect that this context is fertile to uncover whether and how IT mediates the learning processes that lead to more efficient routines over time. We also expect to uncover how technical knowledge and governance influence these processes. Furthermore, the analysis of technical knowledge change over time can provide insights to IS education. Our research shall contribute towards more robust theory of routines and, in particular, the role of artefacts in routines. It shall also provide important guidance to the increasing amount of practitioners that use flexible IT to support loosely coupled routines.

References

Abbott, A. (1995). "Sequence-Analysis - New Methods for Old Ideas", *Annual Review of Sociology* 21, 93-113.

Allen, B. R. and Boynton, A. C. (1991). "Information Architecture - in Search of Efficient Flexibility", *Mis Quarterly* 15 (4), 435-445.

Baddeley, A. (1992). "Working memory", *Science* 255 (5044), 556-559.

Becker, M. C. (2004). "Organizational routines: a review of the literature", *Industrial and Corporate Change* 13 (4), 643-678.

Bertino, E., Ferrari, E. and Atluri, V. (1999). "The specification and enforcement of authorization constraints in workflow management systems", *ACM Transactions on Information and System Security* 2 (1), 65-104.

Beverungen, D. (2013). "On the Design of IT Artifacts and the Emergence of Business Processes as Organizational Routines", In: *Proceedings of the 34th international conference on information systems (ICIS)*, Milan, Italy.

Boudreau, M. C. and Robey, D. (2005). "Enacting integrated information technology: A human agency perspective", *Organization Science* 16 (1), 3-18.

Bourdieu, P. (1977). *Outline of a Theory of Practice*, Cambridge: Cambridge University Press.

Byrd, T. A. and Turner, D. E. (2000). "Measuring the flexibility of information technology infrastructure: Exploratory analysis of a construct", *Journal of Management Information Systems* 17 (1), 167-208.

Byrd, T. A. and Turner, D. E. (2001). "An exploratory analysis of the value of the skills of IT personnel: Their relationship to IS infrastructure and competitive advantage", *Decision Sciences* 32 (1), 21-54.

Carlile, P. R. (2002). "A pragmatic view of knowledge and boundaries: Boundary objects in new product development", *Organization Science* 13 (4), 442-455.

Ciborra, C. (2000). *From Control to Drift: The Dynamics of global Information Infrastructures*, Oxford: Oxford University Press.

Cohen, M. D. (2007). "Reading Dewey: Reflections on the study of routine", *Organization Studies* 28 (5), 773-786.

Cyert, R. M. and March, J. G. (1963). *A behavioral theory of the firm*, Englewood Cliffs, NJ: Prentice-Hall.

D'Adderio, L. (2008). "The performativity of routines: Theorising the influence of artefacts and distributed agencies on routines dynamics", *Research Policy* 37 (5), 769-789.

D'Adderio, L. (2011). "Artifacts at the centre of routines: performing the material turn in routines theory", *Journal of Institutional Economics* 7 (2), 197-230.

Davenport, T. H. (2010). "Process Management for Knowledge Work", *Handbook on Business Process Management 1,* Ed. by Brocke, J. and Rosemann, M., Berlin Heidelberg: Springer, pp. 17-35.

Drucker, P. F. (1999). "Knowledge-worker productivity: The biggest challenge", *California Management Review* 41 (2), 79-94.

Duncan, N. B. (1995). "Capturing Flexibility of Information Technology Infrastructure: A Study of Resource Characteristics and Their Measure", *Journal of Management Information Systems* 12 (2), 37-57.

Edmondson, A. C., Bohmer, R. M. and Pisano, G. P. (2001). "Disrupted routines: Team learning and new technology implementation in hospitals", *Administrative Science Quarterly* 46 (4), 685-716.

Eisenhardt, K. M. (1989). "Building Theories from Case-Study Research", *Academy of Management Review* 14 (4), 532-550.

Feldman, M. S. (2000). "Organizational routines as a source of continuous change", *Organization Science* 11 (6), 611-629.

Feldman, M. S. and Pentland, B. T. (2003). "Reconceptualizing organizational routines as a source of flexibility and change", *Administrative Science Quarterly* 48 (1), 94-118.

Flyvbjerg, B. (2006). "Making Organization Research Matterr: Power, Values and Phronesis", *The Sage handbook of organization studies,* Ed. by S. R. Clegg, C. H., T. B. Lawrence and W. R. Nord, 2nd Edition, Thousand Oaks, California: Sage, pp. 370-387.

Giddens, A. (1984). *The Constitution of Society*, Cambridge: Polity Press.

Golden, W. and Powell, P. (2000). "Towards a definition of flexibility: in search of the Holy Grail?", *Omega* 28 (4), 373-384.

Grant, R. M. (1996). "Toward a knowledge-based theory of the firm", *Strategic Management Journal* 17 (S2), 109-122.

Hales, M. and Tidd, J. (2009). "The practice of routines and representations in design and development", *Industrial and Corporate Change* 18 (4), 551-574.

Hammer, M. and Champy, J. (1993). *Reengineering the Corporation: A Manifesto for Business Revolution*, New York: Harper Business Books.

Howard-Grenville, J. A. (2005). "The persistence of flexible organizational routines: The role of agency and organizational context", *Organization Science* 16 (6), 618-636.

Jansen, S., Finkelstein, A. and Brinkkemper, S. (2009). "A sense of community: A research agenda for software ecosystems", In: *Proceedings of the 31st International Conference on Software Engineering - Companion (ICSE-Companion)*, Vancouver, BC, pp. 187-190.

Kallinikos, J., Aaltonen, A. and Marton, A. (2013). "The Ambivalent Ontology of Digital Artifacts", *Mis Quarterly* 37 (2), 357-370.

Langley, A. (1999). "Strategies for theorizing from process data", *Academy of Management Review* 24 (4), 691-710.

Latour, B. (2005). *Reassembling the Social - An Introduction to Actor-Network-Theory*, Oxford: Oxford University Press.

Leonardi, P. M. (2011). "When Flexible Routines Meet Flexible Technologies: Affordance, Constraint, and the Imbrication of Human and Material Agencies", *Mis Quarterly* 35 (1), 147-167.

Majchrzak, A., Rice, R. E., Malhotra, A., King, N. and Ba, S. L. (2000). "Technology adaptation: The case of a computer-supported inter-organizational virtual team", *Mis Quarterly* 24 (4), 569-600.

March, J. G. (1991). "Exploration and Exploitation in Organizational Learning", *Organization Science* 2 (1), 71-87.

Markus, M. L. (1983). "Power, Politics, and Mis Implementation", *Communications of the Acm* 26 (6), 430-444.

Miller, G. A. (1956). "The magical number seven, plus or minus two: some limits on our capacity for processing information", *Psychological Review* 63 (2), 81-97.

Nelson, R. R. (1991). "Educational-Needs as Perceived by Is and End-User Personnel - a Survey of Knowledge and Skill Requirements", *Mis Quarterly* 15 (4), 503-521.

Nelson, R. R. and Winter, S. G. (1982). *An Evolutionary Theory of Economic Change*, Cambridge, MA: Belknap Press/Havard University Press.

Nonaka, I. (1994). "A Dynamic Theory of Organizational Knowledge Creation", *Organization Science* 5 (1), 14-37.

Orlikowski, W. J. (1996). "Improvising organizational transformation over time: A situated change perspective", *Information Systems Research* 7 (1), 63-92.

Papazoglou, M. P. and Georgakopoulos, D. (2003). "Introduction: Service-oriented computing", *Communications of the Acm* 46 (10), 24-28.

Parmigiani, A. and Howard-Grenville, J. (2011). "Routines Revisited: Exploring the Capabilities and Practice Perspectives", *Academy of Management Annals* 5 (1), 413-453.

Pentland, B. T. and Feldman, M. S. (2005). "Organizational routines as a unit of analysis", *Industrial and Corporate Change* 14 (5), 793-815.

Pentland, B. T. and Feldman, M. S. (2008). "Designing routines: On the folly of designing artifacts, while hoping for patterns of action", *Information and Organization* 18 (4), 235-250.

Pentland, B. T., Feldman, M. S., Becker, M. C. and Liu, P. (2012). "Dynamics of Organizational Routines: A Generative Model", *Journal of Management Studies* 49 (8), 1484-1508.

Pentland, B. T., Hærem, T. and Hillison, D. (2010). "Comparing Organizational Routines as Recurrent Patterns of Action", *Organization Studies* 31 (7), 917-940.

Pentland, B. T., Hærem, T. and Hillison, D. (2011). "The (N)Ever-Changing World: Stability and Change in Organizational Routines", *Organization Science* 22 (6), 1369-1383.

Raelin, J. A. (1998). "Work-based learning in practice", *Journal of Workplace Learning* 10 (6/7), 280-283.

Rettig, C. (2007). "The Trouble with Enterprise Software", *MIT Sloan Management Review* 49 (1), 21-27.

Simon, H. A. (1991). "Bounded Rationality and Organizational Learning", *Organization Science* 2 (1), 125-134.

Tallon, P. P. and Pinsonneault, A. (2011). "Competing Perspectives on the Link between Strategic Information Technology Alignment and Organizational Agility: Insights from a Mediation Model", *Mis Quarterly* 35 (2), 463-486.

van der Aalst, W. M. P., Reijers, H. A., Weijters, A. J. M. M., van Dongen, B. F., Alves de Medeiros, A. K., Song, M. and Verbeek, H. M. W. (2007). "Business process mining: An industrial application", *Information Systems* 32 (5), 713-732.

Volkoff, O., Strong, D. M. and Elmes, M. B. (2007). "Technological embeddedness and organizational change", *Organization Science* 18 (5), 832-848.

Weill, P. (2004). "Don't just lead, govern: How top-performing firms govern IT", *Mis Quarterly Executive* 3 (1), 1-17.

Yin, R. K. (2003). *Case Study Research - Design and Methods,* Third Edition, Thousand Oaks, London, New Dehli: Sage Publications, Inc.

Zigurs, I. and Buckland, B. K. (1998). "A theory of task/technology fit and group support systems effectiveness", *Mis Quarterly* 22 (3), 313-334.