Case Studies on ISD Agility

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Abstract. Much attention is paid to information systems development (ISD) agility, which has positive consequences for ISD projects, teams, and their organizations. ISD agility enables organizations to react to ISD-related change with speed and flexibility while constantly contributing to the delivery of value via IS. This article investigates how IS departments maintain their continual readiness for ISD agility. **Drawing** on a dynamic capability perspective, we suggest that routines underlie ISD agility. The analysis of three high-performing IS departments identifies six aspects of routines conducive to ISD agility: continuous discovery and validation of customer needs, continuous evolution of IT-enabled products and services, resource optimization, continuous integration and deployment, continuous management of risk, and continuous learning. In light of microfoundations, individual competence and mindset, constructive dialogue, and structural arrangements are essential components of routines and ISD agility. Theoretical and practical insights are discussed.

Keywords: ISD agility · Dynamic capabilities · Routines · Microfoundations

1 Introduction

In a rapidly changing digital business world, information systems development (ISD) must be agile to address challenges caused by customer needs, emergent technologies, and disruptive markets. ISD methods, agile methods mainly, are in the spotlight concerning ISD agility as they are comprised of recommended means to engage stakeholders, increase delivery speed, respond to change, and add business value (Conboy 2009). Despite the promised benefits of agile methods, the majority of firms has not reaped the full benefits. In the State of Agile Survey with almost 1,500 practitioners across the world, 84% of respondents stated that their organization was at or below a "still maturing level of agility". After decades of agile movements, people still hold a fragmented understanding of ISD agility let alone achieving agility. For example,

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some equate agility with the velocity of delivery and overlook the development of capabilities to cope with ISD-related changes and generate value via IS. More recently, scaling agility exacerbates the challenges in the development of agility. The existing agile methods mostly provide recommendations at the project level and do not always achieve organization-wide impacts. The project-level methods disregard the interdependencies of projects, systems, and stakeholders and endanger delivering the value of IS (Jiang et al. 2018). A couple of nascent agile frameworks, such as the Scaled Agile Framework (SAFe) and Large-Scale Scrum (LeSS), tackle the scaling issues and touch upon management principles at the organizational level. However, the prescribed practices are not systematically validated, and the claimed benefits are experienced-based. It remains elusive what makes ISD agile and how ISD agility is attained.

Therefore, this study aims to clarify the underlying meaning of ISD agility and unveil mechanisms to develop ISD agility. Since ISD agility comes within the purview of the IS department (or any equivalent unit responsible for ISD), we suggest shifting the central focus away from selecting and adopting agile methods and looking into the development of organizational capabilities. Organizations can concentrate on resource configurations (e.g., people, processes, products, and technology) and formulate a holistic approach to achieve ISD agility. Drawing on a dynamic capabilities perspective, which concerns the capability development toward changing environmental dynamics, we apply the theoretical underpinnings of dynamic capabilities – routines and their microfoundations – to understand the development of ISD agility. Organizational routines build organizational capabilities as a result of "complicated, detailed, analytic processes that rely extensively on existing knowledge and linear execution to produce predictable outcomes". Consistency in complex problem-solving through routines shapes organizational capabilities. Such routines persist as they prove to be effective, but some of them have to evolve for change. The evolution of routines represents dynamism of capabilities. Recent research further delves into the sources of dynamism and study people, their interactions, and the context where individuals and routines are situated – so-called "microfoundations" (Barney and Felin 2013). We contend that the theory of routines advances our understanding of ISD agility by elucidating ISD routines for change. Microfoundations explain how routines evolve and in turn enhance ISD agility. In essence, routines and microfoundations expand the focus of ISD agility from an ISD method to the nature and origin of the dynamism of ISD agility and the context where ISD agility breeds. We illustrate the development of ISD agility based on data from three IS departments with high ISD agility. We do not move the level of analysis to the firm level because it requires capabilities more than ISD agility, that is, IT-dependent organizational agility – "the ability to respond operationally and strategically to changes in the external environment through IT". Besides ISD agility, IT-dependent organizational agility requires IT-dependent information agility as well as IT-dependent strategic agility. It contains far more elements and offers more robust outcomes for firms than ISD agility alone.

2 The Concept of ISD Agility

Considerable research has contributed to an understanding of ISD agility. Nevertheless, there is still no consistent definition (Abrahamsson et al. 2009; Conboy 2009; Gregory et al. 2016). An exhaustive review of the debate around ISD agility is beyond the scope of this article. Instead, we select seminal works that inform our understanding of ISD agility. Following MacKenzie et al. (2011), we analyze the conceptual domain (e.g., feeling, behavior) to which the construct refers (i.e., property), the entity of the property (e.g., individual, team), and the necessary and sufficient attributes to represent the conceptual theme of ISD agility. ISD agility has been referred to as a capability of an ISD method, a team, and a firm. Different entities in various definitions stem from researchers' propositions about whether ISD methods, teams, or firms account for ISD agility. As discussed in the introduction, we shift the entity from ISD methods to the IS department. Consistent with previous definitions, ISD agility is conceptualized as a capability in response to change. The common attributes of responses consist of flexibility (i.e., adapt without change or with minimum efforts) and speed (e.g., "quickly," "swiftly," "rapidly"). We side with Conboy that, besides reactive response, agility connotes proactive nature and should encompass continual improvement that adds value. To sum up, we define ISD agility as *IS department (or any equivalent unit responsible for ISD)'s capability to reacting to ISD-related change with speed and flexibility while constantly contributing to the delivery of value* via *IS.*

3 Achieving ISD Agility

Dynamic capability and ISD agility share a commonality as both are organizational capabilities that enable organizations to adapt to change in a complex business environment. The objective of dynamic capabilities is grander – not only adding value to customers but also sustaining competitive advantages. The goal of ISD agility, although it should contribute to business outcomes ultimately, is closely related to IS-enabled business. ISD agility can be considered as a subset of the broad area of dynamic capabilities. A dynamic capability perspective offers an insight into how organizational capabilities evolve and, therefore, should inform the development of ISD agility. Notably, we concentrate on two essential areas in dynamic capabilities: routines, which entail reliable and systematic performance while being adaptable to change, and microfoundations, which investigates how micro-level elements interact and emerge forming the collective phenomenon (i.e., routines and ISD agility). In the following section we introduce key theoretical ideas underpinning dynamic capabilities: routines, routine dynamics, and microfoundations.

3.1 Routines, Capabilities, and ISD Agility

It should first be noted that routines underlie capability (Winter 2000). Routines as "repetitive, recognizable patterns of interdependent actions, carried out by multiple actors" ensure organizations reliably provide services and products. Routines can be either rigid or fluid, and have benefits of stability and flexibility. An integration of

routines supporting stability and flexibility is vital to ISD agility because a portfolio of routines allows response to change while maintaining productivity and quality. For instance, a time box defines a period for a team to achieve specified goals. If a 2-week sprint routine is adopted, a team needs to get agreed-upon deliverables done by then. Such a rigid routine assures steady delivery. Meanwhile, a team can implement another agile practice to generate flexibility. Instead of assigning tasks to a developer, in daily standup meetings team members share impediments they are facing and support each other. Task allocation can be fluid, in which available and capable team members work on tasks in need of resources to move the project forward.

3.2 Routine Dynamics and ISD Agility

Uncertainty demands changes of routines. Although cognitive and behavioral regularities rooted in routines imply inertia, routines can be livelier than they appear. Routines evolve and adapt when firms implement meta-routines (Adler et al. 1999). Put differently, firms need to leverage routines to change other routines that are no longer suitable for new environmental conditions. Zollo and Winter (2002) propose to enhance dynamic capabilities by engaging in experiential learning, articulating new knowledge for changes, and codifying knowledge. Deliberate learning is a type of meta-routines and can generate new routines and modify existing routines. A transformation of Ericsson, a Swedish telecommunications company, from a plan-driven to an agile method organization illustrates how deliberate trial-and-error processes help members in the ISD unit to learn and undertake changes in ISD routines. Besides a trial-and-error learning approach, various meta-routines embedded in agile methods support deliberate learning (Annosi et al. in press; Bjørnson and Dingsøyr 2008). For example, collaborative spaces, including physical and virtual ones, allow team members to learn from each other and share knowledge. Moreover, sprint and project retrospective meetings are designated to improve routines.

3.3 On Microfoundations of Routines and ISD Agility

Microfoundations explain the collective phenomenon by systematically looking at its origins and nature (Barney and Felin 2013). Multiple microfoundational elements form and explain routines and capabilities. Individuals serve as microfoundation because they operate routines and can make a change to routines. Routines mature over time as individuals learn and develop habits, supporting the reliable operations of organizations. Since individuals are not situated in a vacuum, other microfoundational constituents, such as interpersonal interactions and the context where individuals are embedded, can enable or hinder individual behaviors. We explain their role in ISD agility as follows.

(1) Individuals and their interactions
In the early literature of dynamic capability, the role of managers is emphasized. Their competence, such as dynamic managerial capabilities (Adner and Helfat 2003), influences the strategic choices and actions when facing change. Extending this line of work,

the literature on microfoundations of dynamic capabilities suggests that individuals, regardless of ranks, should all be considered (Abell et al. 2008). A dilemma lies in the diversity. Even though diverse expertise enables agility (Lee and Xia 2010) and improves routines, differences among individuals pose a risk. Some people have a propensity of overlooking opportunities and threats, resisting to change their behaviors, and holding negative emotion amid adaptation. The predicament calls for the investigation of ways to better manage diverse individual members. First, firms can nurture the talent by shaping their cognitive capability and attitudes, such as openness to change and learning (Balijepally et al. 2015) and tolerance for ambiguity. People possessing such attributes are more likely to improve routines and react swiftly when routines cannot operate. Although ISD personnel's competence for organizational capability is widely studied, limited empirical research has been done on what competence for ISD agility should be based on. Second, the recent research looks at the interactions among individuals, specifically, how diverse expertises collaborate to generate dynamic capabilities. The theoretical mechanisms of constructive dialogue reinforce the idea of communication and collaboration in agile methods. Cooperation, collective learning, and cohesion signal that people are "being agile" beyond "doing agile".

(2) Structure
Structure concerns "specialization of tasks, hierarchical arrangements, as well as formalization of objectives and procedures" (Bresman and Zellmer-Bruhn 2013, p. 1120). When adapting to change, organizations need to be organic, characterized by fluid roles and responsibilities, decentralized authority, and fewer rules and procedures. The flat organizational structure allows units to be responsive and nimble to change. However, the coordination cost can be heightened, leading to fragmentation. More recently, the matrix organizational structure encourages cross-unit collaboration. On the extreme is the so-called Spotify model where, to meet 70 million subscribers' needs, Spotify leverages tightly bonded small core units called squads. Squads with different development foci, when combined, bring new ideas and spark innovation. Squad members belong to other larger formal and informal teams, such as Chapters, Tribes, and Guilds, to build a shared understanding of tasks and teams.

4 Research Method

Our research question is to answer what fundamental elements prescribed the ISD agility In particular, to explore how routines and microfoundations constitute ISD agility, we adopted a qualitative research method using a positivist multiple-case study design. The multiple-case study approach is suitable for the less explored phenomenon that requires contextualized understanding. Multiple cases enable comparisons among sites and help demonstrate the influence of variability in context. We selected firms that have received wide recognition for their ISD agility. We sought firms which considered ISD a core competence where the continual evolution of IS applications and IS-enabled services are necessary to sustain competitive advantages. Per our working definition of ISD agility, we focus on the IS department (or any equivalent unit responsible for ISD).

We included IS departments from both the in-house and vendor setting to maximize variation in our sample and enhance the external validity. The cases involve one worldwide leading IS security software company (hereafter SoftCo), one regional bank (hereafter BankCo) famed for its digitization services and recognized by several awards in the Asia/Pacific region, and one leading system integration company in Asia (hereafter SysCo). All three firms, more than 30 years old, received IT innovation awards in 2017. We use multiple data collection methods, including semi-structured interviews and secondary data, to triangulate our findings. The sources and nature of data is described in Table 1. The content of the interviews were coded by applying triangulation approach including one of the authors and two other experts from the fields. The overview of cases is summarized in Table 2.

Table 1. Sources and nature of data

Sources of data	Description
Interviews	• Participants: managers who oversee ISD and understand the detailed operation of ISD as they possess comprehensive knowledge of the IS department; Senior engineers who possess good knowledge of routines as well as the interaction among colleagues • When and how: a total of eight semi-structured interviews lasting 90 min on average were conducted between May 2017 and October 2018 (three interviews in BankCo, three interviews in SoftCo, and two interviews in SysCo). Interviewees were asked to described ISD-related challenges their department/team face and how they cope with them with speed and flexibility • Trustworthiness: the interviews were recorded and transcribed. To strengthen content-validity from empirical induction, we discussed and clarified our research with our informants with condensed transcripts and summary writings within 2 weeks after each interview session
Secondary data	• Company documents and media coverage to understand their IT strategy, achievements, vision, and industry context • Publicly available interviews between 2017 and 2018 • Employee presentations in well-known practitioner-oriented conferences in 2018 (e.g., Agile Summit, Agile Tour). We include those presentations based on the speaker's position in the firm (e.g., seniority, team lead). The detailedness of the presentation or slides is another good indicator of the speakers' knowledge on ISD operations

Analysis of data began during data collection. We applied a thematic analysis approach starting with the deductive coding approach (Fereday and Muir-Cochrane 2006). The results of the analysis are presented in the next section.

Table 2. Overview of cases and collected data

	SoftCo	BankCo	SysCo
Business context	IT security software	Commercial banking	System integration and solution provider
Core values	Change, Customer, Collaboration, Innovations, Trustworthiness	Governance, Talent management, and IT innovation	Excellent personnel, Customer satisfaction, and Sustainable operation
The need for agility	Constant evolving cyber threats and risks, rapidly changing hardware and software that IT security software works upon and with, and ever-shifting customer demand	The unprecedented pace of technological disruptions along with big data, P2P lending, mobile payment, and deep learning, demands innovation in IS to meet customers' needs, desires, and expectations; the adaptation of IS for evolving cyber risks and the regulatory requirements	Intensified competition and changing market demand
Informants	VP of product development (interview), senior product manager (interview), VP of MIS (interview), VP of R&D (secondary data), project manager of R&D (secondary data), senior engineer and team lead (interview + secondary data), principal engineer (secondary data)	VP of MIS (interview - twice), Chief Digital Officer (interview), Chief Information Officer (secondary data)	CEO (interview – twice)
Outcomes of agility	Short release, high customer retention, highly responsive to customer needs, innovative services and products	Reduced operation cost, reduced operation risks, highly automated process, deeper customer insights, innovative services and products	On-time delivery, high client satisfaction, efficient use of resources, adaptation to risks and uncertainties

5 Findings

We group codes under routines into six clusters and illustrate how individuals, interactions, structure support ISD-related routines as follows.

1. Continuous discovery and validation of customer needs (Table 3): To enhance customer experience and rapidly respond to customer needs, all companies proactively detect needs of customers either through data analytics (BankCo and SoftCo) or

frequent interaction with customers (SysCo and BankCo). For example, BankCo creates the data science team to understand customers' preferences and behaviors. The specialized taskforce contributes to the development of chatbots that offers financial advice. SoftCo sets up the business intelligence system to capture customer profiles and usage behaviors. Alternatively, the discovery of customer needs can be done by interacting with customers. Senior managers in SysCo build their understanding of customer insights by site visits. The long-term relationships with customers support constructive dialogue. After sensing the environment, gathering feedback to validate customer needs is essential. BankCo and SoftCo engage customers via routines, such as applications of persona and user story mapping during the opportunity identification and solution development. In the development process, experiments through workshops and usability lab studies are conducted to validate the ideas (SoftCo). All three companies emphasized the importance of soft skills to engage customers. BankCo and SysCo explicitly state that they crave and nurture the specialized generalists, so-called T-shaped or π-shaped professionals. That is, the professionals possess expertise in one (i.e., the one leg of T) or a couple (i.e., the two legs of π) of domain area(s) and, more importantly, they should be able to span the boundaries within and between disciplines by holding communication skills and a broad understanding of multiple disciplines. Said differently, boundary spanners know how to work in the diverse and complex environment, integrate knowledge held by different people, engender trust and respect, and dedicate themselves to knowledge search and dissemination. The characteristics are conducive to constructive dialogue, which accordingly can lead to better coordination, learning, and cohesion required in the adaptation.

Table 3. Routines under continuous discovery and validation of customer needs

SoftCo	BankCo	SysCo
(1) Sensing customer needs: data analytics routine to discover customer insights (2) Validating customer needs via routines, such as user story mapping, paper prototyping, customer validation workshops, and usability test, *Supported by Individuals (collaboration mindset) and Interaction (constructive dialogue based on engaged relationships)	(1) Sensing customer needs: data analytics routine to discover customer insights *Supported by Structure - the data science team (2) Validating customer needs via routines, such as persona, prototyping, and on-site customers *Supported by Individuals (T-shaped professionals) and Interaction (constructive dialogue based on engaged relationships)	(1) Sensing customer needs: market research via site visits *Supported by Individuals (T-shaped professionals) Interaction (constructive dialogue based on engaged relationships)

2. Continuous evolution of IT-enabled products and services (Table 4): For firms that need to transform their IT-enabled products and services the routines related to design thinking, such as problem analysis (BankCo), product drawing games, design sprints, the creation of minimum viable products (SoftCo), are used to transform their

products. The idea of exploring problems and use design to solve them is the spirit of the routines. It also acknowledges that there is no perfect design. Instead, a design viable for business and feasible based on firms' resources should be pursued. Routines allow teams to experiment ideas across problems, solutions, customer segment, marketing, finance, etc. In other words, the notion of "fail fast and learn fast" is manifested in these routines. Both SoftCo and BankCo configures cross-functional teams to generate creative solutions. The teams are diverse, purpose-driven, and empowered so that they are not bounded by the silo-view of the problems and solutions as well as the authority. Furthermore, the effectiveness of these routines depends upon a few conditions. Team members are open to divergent ideas. When disagreement emerges, they dare to speak up and engage in the conversation. They put the collective benefits ahead of their own. The constructive dialogue is built upon cohesive relationships in these teams. The conflict remains in the meetings and rarely escalate to relationship issues. Besides collaborative mindset and solidarity in teams, the structure commonly prescribed by design-thinking routines, such as idea generation, ideas matching, idea presentation using visual-aid, idea discussion, and consensus building, facilitate the collaboration processes. SoftCo has launched several successful products within a short period originating from these routines. BankCo rolled out a new mobile banking app that differentiates itself from others, and 90% of customers adopted the new app.

Table 4. Routines under continuous evolution of IT-enabled products and services

SoftCo	BankCo	SysCo
(1) Problem identification and solution formulation using design thinking. e.g., customer journey maps, design spirits, brainstorming, product drawing games, and impact mapping *Supported by Structure – empowered, cross-functional team *Supported by Individuals (collaboration mindset) and Interaction (constructive dialogue based on team cohesion)	Problem identification and solution formulation using design thinking. e.g., problem identification process using business analysis techniques, brainstorming, prototyping *Supported by Structure – empowered, cross-functional team *Supported by Individuals (collaboration mindset) and Interaction (constructive dialogue based on team cohesion)	Not observed

The findings suggest six ISD-related routines conducive to ISD agility. Microfoundations, including individuals, interactions, and structure support ISD-related routines. Figure 1 illustrates a framework for ISD agility.

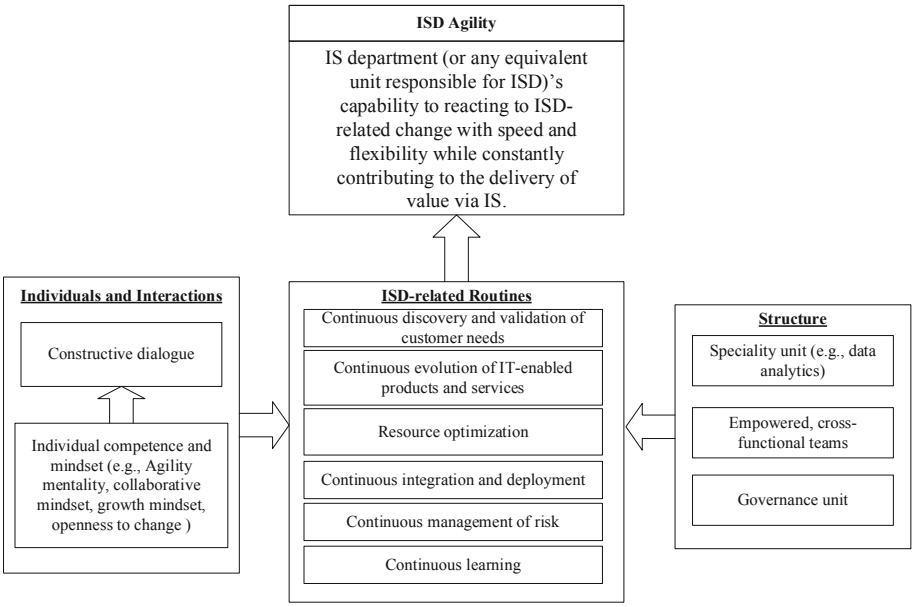

Fig. 1. A framework of the development of ISD agility

6 Discussion and Conclusion

Our study aims to understand how IS departments maintain its continual readiness for ISD agility. Our analysis of IS departments in three top performing firms reveals that, consistent with the literature of dynamic capabilities, routines underpin ISD agility. Extending research in ISD routines, we discover that routines for ISD agility can be established in six different aspects. We argue that the strategic orientation of the firm should determine which aspects of routines will receive more investment. In the adaptation context, firms can increase ISD agility by making the best use of what they have (i.e., exploitation). Routines under "resource optimization," "continuous integration and deployment," and "continuous management of risks" all conduce to discover what can be improved to adapt to changes. On the other hand, firms can be oriented to explore new opportunities through search, discovery, experimentation, and innovations (i.e., exploration). Routines related to "continuous discovery and validation of customer needs" and "continuous evolution of IT-enabled products and services" prepare IS departments to attain the exploration purpose. As shown in Table 5, BankCo and SoftCo devote efforts to exploration-related routines whereas SysCo mainly invests in exploitation-related routines. The business environment where a firm is situated can account for different strategic choices. BankCO and SoftCo are in hyper-competitive environments and thus their ISD agility should cover exploration. SysCo is a system integration vendor who needs to fulfill contractual obligations. Enhancing ISD agility by exploiting their human resources and ISD processes is the priority. BankCo and SoftCo both develop exploitation-related routines as these routines are the operational

backbone (Ross et al., 2017). To what extent IS departments should invest in exploration or exploitation is beyond the scope of this research. The ambidexterity literature on whether the simultaneous pursuit of exploration and exploitation is desirable (Cao and Ramesh 2008) can shed lights on this challenge.

Table 5. The Relationship between Strategic Orientations and Routines

	Exploration	Exploitation
Continuous discovery and validation of customer needs	BankCo (high), SoftCo (medium), and SysCo (low)	
Continuous evolution of IT-enabled products and services	SoftCo	
Resource allocation optimization		BankCo, SoftCo, and SysCo
Continuous integration and deployment		SoftCo
Continuous management of risk		BankCo, SoftCo, and SysCo
Continuous learning	BankCo, SoftCo, and SysCo	BankCo, SoftCo, and SysCo

We also find that individual competence and mindset, constructive dialogue, and structural arrangements compose microfoundation of routines and ISD agility. Individuals should possess agility mindset and competence to operate routines. Since, over time, the routine may no longer serve the purpose, it is important to empower individuals to modify or decommission routines for the sake of ISD agility. The structural arrangements, such as the inclusion of the data analytics group for sensing, a governance unit for monitoring, a cross-functional team for knowledge creation and integration, further complement what individuals can accomplish. Finally, ISD agility lies in constructive dialogue as it indicates that stakeholders interact and make sure ISD is evolving.

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