

The Impact of Organizational Culture and Structure on the Routinization of Agile Software Development Methodologies

Full Paper

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Abstract

Agile software development methodologies represent a departure from the heavy document-driven procedures of plan-driven approaches. As organizations continue to adopt agile methodologies, understanding the factors that influence the routinization of agile is a growing concern. In recent years, researchers have focused their attention to the issues of post-adoptive agile use in order to extend our knowledge on agile assimilation. However, little research has been conducted to expose the assimilation gaps that occur as organizations seek to increase the extent and intensity of their agile use. Following prior literature, our objective is to articulate a model that explains the impact of organizational culture and structure on the routinization of agile methods. Our theoretical model provides helpful insights that extend our of knowledge of agile assimilation in organizations.

Keywords

agile software development, organizational culture, routinization, agile assimilation, post-adoptive use

Introduction

The **agile software development** (ASD) practice can be defined as a software development team's ability to respond to changing user requirements through a process of continual readiness (Conboy 2009; Lee and Xia 2010). ASD employs short, iterative development cycles to enable organizations to better accommodate changes, and improve the flexibility of the software development process. These improvements in turn yield positive business value such as faster times to market, higher software quality, and higher customer satisfaction when compared to waterfall methods (Cao et al. 2009; Overhage and Schlauderer 2012). Furthermore, ASD adoption rates both within large organizations and across the software development (SD) industry have seen significant growth since the signing of the *Manifesto for Agile Software Development* in 2001 (Beck et al. 2001; Murphy et al. 2013). For instance, one survey reports that companies that plan to implement ASD for future development projects increased from 59 percent in 2011 to 83 percent in 2012 (Version One 2013). Ironically, some organizations are electing to discontinue their use of ASD methods shortly after experiencing the benefits of ASD use (Sutherland 2014; Version One 2015). Thus, the assumption that successful ASD use will lead to further ASD use has not held. This begs the question: why are some organizations not using ASD methods after achieving ASD project success? --- as such use could lead to a better organizational routine for building software.

The extant literature underscores the reasons why ASD methods are initially adopted (i.e. comparative advantage, etc.) (Rogers 2003; Tessem 2003; Bahli and Zeid 2005; Senapathi and Srinivasan 2012), however, there is a dearth of research concerning the routinization of ASD in organizations despite calls for a greater understanding of ASD adoption beyond the initial stages (Abrahamsson et al. 2009). The literature lacks an understanding of the factors that separate those adopters that choose to use ASD methods on a routine basis from those adopters that forego their use of ASD after experiencing the promised benefits of ASD methods (e.g. faster time to market, higher customer satisfaction, etc.). Therefore, we draw upon diffusion of innovation theory (DOI) to understand the gap between the

perceived success of an initial ASD use and ASD routinization. Such insight is critical as more organizations pour resources into making ASD their principal method of software development. As a theoretical lens, diffusion of innovation theory (DOI) examines the extent that ASD represents an innovation in terms of a fundamental shift in the way that software development has typically been done. In line with prior research, we use DOI and its extensions to provide some insight into the progression in which an innovation proliferates throughout an organization.

Prior research suggests that organizational factors play a pivotal role in the diffusion of an innovation within an organization (Chan and Thong 2009). In particular, agile's emphasis on social interactions and continual readiness towards changing requirements (Beck et al. 2001; Conboy 2009) has been shown to induce significant changes to more hierarchical organizational structures (Nerur 2005). Additionally, the inability to change an organization's culture has been identified as a key impediment to ASD assimilation (Ambler 2014; Version One 2015). Therefore, we employ organizational culture theory to explore the relationship between organizational factors of culture and structure, and their influence on the ASD routinization process.

In summary, this study seeks to contribute to the current body of ASD research by providing an understanding of gap between perceived ASD success (at acceptance) and ASD routinization. This gap motivated the following research question: *how do organizational factors of culture and structure affect the routinization of ASD practices in organizations?* Given the gaps in the literature, our study intends to evolve a theoretical model that explains how organizational factors of organizational culture and organizational structure influence the ASD routinization process, given the success of initial ASD use. Our purpose is to provide clarity concerning the organizational factors that influence the routinization of ASD methods. To accomplish this, we conceptualize a parsimonious model that represents relationships among related constructs, with rich theoretical explanations from the extant literature.

The remainder of the article proceeds as follows. First, the theoretical foundations section provides an overview of past research and relevant literature on the theories used to answer our research question. Second, the hypothesis section will layout the theoretical relationship represented in our model. Third, the discussion section will elaborate on the research strategy and the implications of our study on future research.

Literature Review

In this section, we give an overview of the research on innovation theory and organizational culture theory, which were used as the basis for this work.

Diffusion of Innovation Theory and Extensions

The extant literature extends diffusion of innovation theory (DOI) (Rogers 1962) from individual to organizational-level adoption (Rogers 2003) to study the diffusion of complex innovations in organizations (Kwon and Zmud 1987; Meyer and Goes 1988; Cooper and Zmud 1990; Gallivan 2001). We refer to the research on organizational-level assimilation of innovations as **assimilation theory** (Wang et al. 2012). The research model developed by Kwon and Zmud (1987) and further refined by Cooper and Zmud (1990) defines **six-stages of innovation assimilation** that describe technology implementations in organizations. **Innovation assimilation (IA)** is defined as the extent to which the use of an innovation diffuses across "the organizational projects or work processes and becomes routinized in the activities of those projects and processes" (Purvis, Sambamurthy, and Zmud 2001). Table 1 presents the six-stages of the IA model, defining each stage of the process and delineating the adoptive use stages from the post-adoptive use stages. Each stage describes a differing level, at which an innovation diffuses an adopting unit (Overhage and Schlauderer 2012). Like Roger's (1962) original DOI model, Kwon and Zmud's (1987) six-stage IA model has been adapted to study not only technology innovations, but also ideas and practices. ASD methods can be considered an SD innovation (Chan and Thong 2009) because they represent a significant departure from previous methods for building software, as determined by the collective judgements of experts in the field (Meyers and Goes 1988; Beck et al. 2001). Moreover, the implications of studying ASD as an innovation and not just as a method potentially

yield insights as to the broader impacts of ASD implementations across organizations (Wang et al. 2012; Senapathi and Srinivasan 2012).

Innovation Assimilation Stages	
<i>Adoptive Stages</i>	<ol style="list-style-type: none">1. <i>Initiation</i>: need for change is recognized, a match is identified between an innovation and its application in the organization2. <i>Adoption</i>: a decision is made to adopt an innovation3. <i>Adaptation</i>: an adaptation to suit the contextual needs
<i>Post-adoptive Stages</i>	<ol style="list-style-type: none">4. <i>Acceptance</i>: use of the innovation5. <i>Routinization</i>: an increase in the extent and intensity of use (i.e. usage of the innovation is encouraged as a normal activity)6. <i>Infusion</i>: increased usage in a more comprehensive and integrated manner results in increased effectiveness of systems development (i.e. the innovation penetrating deeply into an organization).

**Table 1. Definitions of the Assimilation Stages
(Cooper and Zmud; Senapathi and Srinivasan 2012)**

ASD assimilation

Because our focus is on the organization-level, we draw upon IA research to study the diffusion of ASD methods in organizations (Kwon and Zmud 1987). We define **ASD assimilation** as the extent to which the use of ASD methods diffuse across the organizational projects or work processes and becomes routinized in the activities of those projects and processes (Cooper and Zmud 1990; Wang et al. 2012). With respect to Kwon and Zmud's (1987) six-stage IA model, the early ASD literature focuses primarily on understanding the adoptive use stages (initiation, adoption, and adaptation) of ASD assimilation (Tessem 2003; Bahli and Zeid 2005; Nerur et al. 2005), while later studies provide insights at the post-adoptive use stages (acceptance, routinization, infusion) (Chan and Thong 2009; Mangalaraj et al. 2009; Vijayarathy and Turk 2012; Overhage and Schlauderer 2012) (see Table 1). The studies that apply assimilation theories at the post-adoptive agile use stages largely aim to understand the antecedents that affect agile use (acceptance). These antecedents differ depending on the theoretical perspective and level of analysis employed by the researchers. Despite their differences, these studies broadly agree that: 1) the antecedents that drive an innovation across the adoptive stages differ from those that influence the post-adoptive stages. Additionally, some antecedents may show differing impacts at different stages. 2) Further research of the downstream phases of ASD assimilation is needed to understand how to sustain agile use long-term. Additionally, past research contains models that explain the impact of deep ASD usage on outcomes (Chan and Thong 2009; Mangalaraj et al. 2009; Senapathi and Srinivasan 2012), but these models do not fully explain how the transition is made from one post-adoptive use phase to another at the organizational-level. These models do not expound on the impact of contextual factors such as hierarchy and bureaucracy on ASD assimilation (Russo, Shams, and Fitzgerald 2013). With respect to Kwon and Zmud's (1987) six-stage IA model, the extant literature is missing an understanding of *how* the transition from the acceptance to routinization stages occurs and *why* some organizations elect to adopt agile methodologies, not only initially, but also on a continual basis (Wang et al. 2012).

Using the research on assimilation gaps, we can complement the IA model by studying the forces that influence the diffusion between assimilation stages. **Assimilation gaps** refer the difference between the patterns of cumulative assimilation events of an innovation across a population of adopters (Fichman and Kemerer 1999). Indeed, one of the limitations of the stage models upon which the assimilation theories are built is the neglect of details between each stage (Sabherwal and Robey 1995). According to the research on assimilation gaps, substantial gaps can present a misleading image of the diffusion process, which leads to inaccurate conclusions about the strength of the diffusion process that is being observed. Consequently, erroneous theoretical and practical inferences may be drawn based on false assumptions (Fichman and Kemerer 1999). For instance, using the IA model by itself, one might assume that an innovation that successfully diffuses through one assimilation stage will automatically advance to the

next. However, regarding the transition from acceptance to routinization, practitioner literature suggests that some organizations elect not to routinize ASD methods after successfully completing the acceptance stage (Sutherland 2014). We define **ASD acceptance** as the introductory adoption and employment of ASD methods as a process innovation for one or more software development projects (Vijayasathy and Turk 2012; Wang et al. 2012). Similarly, we define **ASD routinization** as the usage of ASD methods as a normal activity in the organization, where the innovation is no longer considered out of the ordinary (Wang et al. 2012).

Thus, this study combines the assimilation theories and the research on assimilation gaps to understand the process and the factors that impact the ASD assimilation process in organizations. The objective of this study is to provide an understanding of the organizational factors that influence ASD routinization after initial ASD use. To accomplish this, we leverage the strengths of the IA research -- to examine the concept of use, not in the sense of use versus non-use, but rather the extent to which an innovation is used and its relationship with an organization's practices, structures, and organizational culture (Gallivan 2001) --- to study the transition from successful ASD acceptance to ASD routinization.

Organizational culture and structure

To investigate the relationship between OC and post-adoptive ASD use, we draw on the organizational culture (OC) literature to highlight the composition of OC, the different OC orientations, and the effect of OC on the use of ASD methods. Although organization culture's broad conceptualization makes it arguably connected to every organizational process, OC's complex, interrelated, and somewhat ambiguous set of factors make it impossible to create a comprehensive framework (Cameron and Quinn 2011). Consequently, researchers have had marginal success integrating and organizing elements of OC into widely used frameworks. One exception is Schein's (1985) three-layer model of basic assumptions, espoused values, and artifacts, which conceptualizes observable and unobservable layers of OC. Using Schein's (1985) definition of group culture, we define OC as "a pattern of shared basic assumptions learned by an [organization] as it solves its problems of external adaptation and internal integration, which has worked well enough to be considered valid and, therefore, to new members as the correct way to perceive, think, and feel in relation to those problems". His three-layer model suggests that aspects of OC can be tapped by focusing on manifesting elements that are theoretically and practically tied to the unobservable layers. Thus, the vast majority of OC studies focus on values as constituents of OC (Leidner and Kayworth 2006).

Following prior SD research (Iivari and Huisman 2007), we draw upon the Competing Values Model (CVM) to conceptualize OC as the manifestation of competing value systems. These culture types form from four quadrants, differentiated by the continuums of two dimensions, internal to external focus and change to stability as shown in Figure 1 (Iivari and Huisman 2007). Each of the four quadrants in the CVM represents a distinct OC, which we will draw upon to differentiate opposing OCs according to their core of values. We use Iivari and Huisman's (2007) categorizations of OC as shown below.

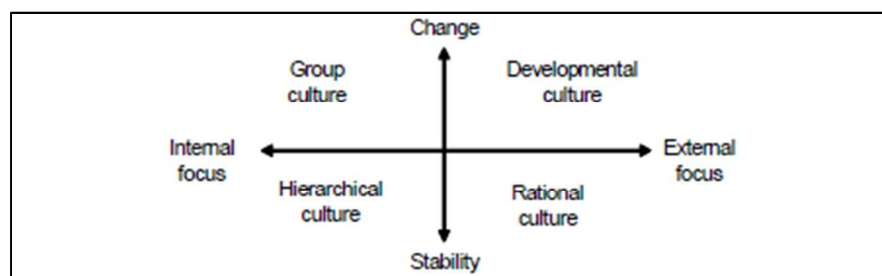


Figure 1. Competing Values (Iivari and Huisman 2007)

- *Group culture* (change and internal focus) is primarily concerned with human relations and flexibility. Belonging, trust, and participation are its core values.
- *Developmental culture* (change and external focus) is future-oriented, considering what might be.
- *Hierarchical culture* (stability and internal focus) is oriented toward security, order, and routinization. It emphasizes control, stability and efficiency through the following of regulations.

- *Rational culture* (stability and external focus) is achievement-oriented, focusing on productivity, efficiency, and goal achievement.

In our research, we focus specifically on the interaction of ASD methods and hierarchical and developmental OCs for the following reasons: First, our primary proposition is that ASD values compete and conflict with those of a hierarchical OC. Thus, a hierarchical OC should have a negative influence on ASD routinization. Given that the hierarchical and developmental OCs are polar opposites in the CVM framework, these OC types pose competing and conflicting demands on organizations (Iivari and Huisman 2007). Second, from a competing values standpoint, the emphasis of the developmental OC closely aligns with the tenets of the ASD philosophy as espoused in the Agile Manifesto. Thus, we chose a more parsimonious approach to test our hypothesis by focusing on the hierarchical and development cultures to discriminate between OCs based on their most salient differences as shown in Table 2 based on the competing values model. These differences manifest themselves in an organization’s structure, which we will discuss in the next section.

Organizational Culture	Hierarchical OC	Developmental OC
Competing Value	Bureaucracy	Adhocracy
Organizational Focus	Internal	External
Stability vs. Change	Stability	Change

Table 2. A Comparison of Hierarchical and Developmental OC Orientations

Organizational structure (OS) can be defined as “the logically consistent clustering of an organization’s elements as it searches for harmony in its internal processes and consonance with its environment” (Mintzberg 1980). According the project management body of knowledge (Rose 2013), organizational structures range from functional to projectized, and can affect the availability of resources and influence how projects are conducted (Rose 2013). With respect to prior research, we postulate that an organization will produce an organizational structure that is reflective of its OC orientation (Sackmann 1992). Second, we postulate that the relationships between OS and ASD routinization will parallel the relationship between OC and ASD, as OS is a manifestation of OC. Thus, we match the OC orientations with their corresponding OSs as follows: hierarchical OC to functional OS and developmental OC to projectized OS. Rose (2013) defines these structures as shown below:

- **Functional OS** is a hierarchical organization where each employee has one clear superior, and staff are grouped by areas of specialization and managed by a person with expertise in that area.
- **Projectized OS** is any organizational structure in which the project manager has full authority to assign priorities, apply resources, and direct the work of persons assigned to the project.

The Impact of Organizational Culture and Organizational Structure on ASD

Prior research has shown interest in the relationship between cultural values and SD process improvement. For example, Dubé and colleagues studied the compatibility between organizational values and values subgroups (Dubé 1998, Dubé and Robey 1999) with results suggesting that high compatibility between the organizational values and a given process innovation, the more successful the implementation is likely to be. Regarding ASD methods, most researchers have focused on the relationship between OC and ASD use (Robinson and Sharp 2005, Tolfo and Wazlawick 2008, and Strode et al. 2009), which is usually studied in the early adoptive stages or simply use versus non-use, with few exceptions (Iivari and Iivari 2011). However, despite calls for future empirical investigation on the influence of OC on the later stages of ASD assimilation, (Vijayasathy and Turk 2012; Wang et al. 2012) there remains only a dearth of examination on this relationship. Additionally, IA research suggests that OC plays a key role in the continual use of an innovation, however, no studies were found that explore the relationship between OC and ASD routinization specifically. Therefore, we study the influence of organizational factors (culture and structure) on the routinization of ASD methods with the intention of theory building. Our model, as depicted in Figure 2, describes a major gap between the perceived ASD success of an initial ASD use and ASD routinization, that being the role of organizational factors, culture and structure. Although we recognize that the relationship between OC and OS on ASD use is not one way, the model is useful in highlighting the way in which organizational factors play a pivotal role in the ASD routinization process.

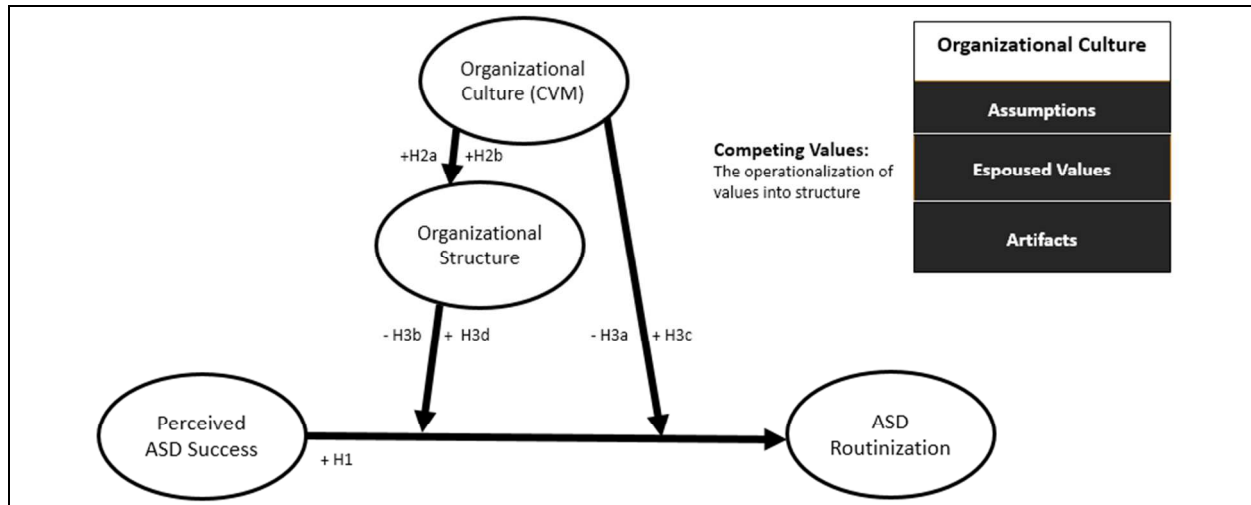


Figure 2. Theoretical Model

In the next section, we describe the constructs in our model --- organizational culture, organizational structure, initial agile usage, perceptions of project success, and ASD routinization, and then test our hypotheses as shown in Table 3 concerning the relationships therein.

Research Model and Propositions

Proposition 1: A firm's perceived ASD success will influence ASD routinization.	H1: Perceived ASD success will positively influence ASD routinization.
Proposition 2: A firm's OC, represented by its core values, will influence its OS (form).	H2a: A hierarchical OC will positively influence a functional OS. H2b: A developmental OC will positively influence a projectized OS.
Proposition 3: Organizational factors, culture and structure, will influence ASD routinization beyond the perceived ASD success.	H3a: A hierarchical OC will negatively moderate the influence of perceived ASD success on ASD routinization. H3b: A functional OS will negatively moderate the influence of perceived ASD success on ASD routinization. H3c: A developmental OC will positively moderate the influence of perceived ASD success on ASD routinization. H3d: A projectized OS will positively moderate the influence of perceived ASD success on ASD routinization.

Table 3. Propositions and Hypothesis

Perceived ASD success and ASD Routinization

Perceived ASD success is the extent to which an ASD project meets technical goals, remains within the budget, is delivered in time, and is accepted by the end user (Jiang, Klein, and Pick 2003; Procaccino and Verner 2006). Both the increase in ASD adoption rates and the findings of empirical research suggest that the use of ASD methods yield a number of comparative advantages over traditional methods such as higher team productivity (Layman et al. 2004), higher customer satisfaction (Ceschi et al. 2005), more efficient requirements gathering (Hansen and Lyytinen 2014), and a greater ability to handle changing user requirements (Vidgen and Wang 2009), with few studies reporting contrary results (Dalcher et al. 2005). Furthermore, the use of ASD methods has been associated with a higher rate of project success and in turn, a lower rate of project failure (Chaos 2010). From an organizational perspective, a firm may employ ASD methods to achieve the benefits listed above for a singular project. However, given a firm's propensity to seek efficiencies and economies of scale, a new SD methodology is more likely to be employed in hopes of achieving long-term benefits. Moreover, the impacts of using a particular SD methodology will influence developers' attitudes toward the future use of the methodology (Khalifa and

Verner 2000). Therefore, a firm that experiences comparative advantages with ASD over alternative SD methodologies is more likely to experience positive attitudes toward future ASD use, and turn, routinized ASD in order to harness the benefits (H1).

Proposition 1: A firm’s perceived ASD success will influence ASD routinization

On the other hand, both research and practice show that perceived ASD success may not lead to ASD routinization in all cases, as some firms have not routinized ASD methods even after experiencing benefits of agile use (Sutherland 2014). One factor believed to influence post-adoptive ASD use is OC (Version One 2015). Prior research points out that the compatibility of a methodology with a firm’s OC (Dubé and Robey 1999) may influence the success of an implementation and the future use of the methodology. During the implementation phase, an innovation may conflict with sources of structure and social norms within an organization, which may lead to the discontinuance of a particular innovation. Thus, we investigate the influence of organizational factors of culture and structure on the relationship between perceived ASD success and ASD routinization.

Organizational Culture, Organizational Structure, and ASD Routinization

Prior research has emphasized the importance of cultural compatibility in relationship to a given IS effort (Dubé 1998). That withstanding, the compatibility and relative fit of a top-down, hierarchical OC to a bottom-up methodology like agile, has been scrutinized (Boehm and Turner 2005; Nerur and Balijepally 2007). Using the CVM, we propose that a hierarchical OC (Quinn 1988) predicated on bureaucracy, should produce OSs to support the culture (H2a). On the other hand, we propose that developmental OCs (Quinn 1988) are predicated on that these bottom-up cultures should produce OCs to support the culture.

Proposition 2: A firm’s OS, represented by its core values, will influence its OS (form).

Table 4 summarizes some of the manifest differences between hierarchical and development OCs, based on the prior research of Russo et al. (2013), Iivari and Huisman (2007), and Gallivan (2001).

Organizational Culture	Hierarchical OC	Developmental OC
Organizational Strategy	Specified and predictable	Flexible and adaptive
Project Scope	Fixed	Adaptive
Team Management Structure	Functional	Projectized
Decision Making Structure	Top-down	Bottom-up
Team Work Structure	Siloed	Collaborative
Control Mode	Formal	Informal

Table 4. OS Differences of Hierarchical and Developmental OC Orientations

The manifest differences between hierarchical and developmental OCs result in observable and polar opposite OC orientations. Given our primary proposition that ASD values (Beck et al. 2001) compete and conflict with those of a hierarchical OCs, we show how hierarchical OCs influence several sources of OS as shown in Table 4. Moreover, we highlight the conflict between these OSs and three core agile values --- self-organization, iterative development, and process flexibility (Dissanayake et al. 2013) --- as follows.

First, ASD methods promote self-organizing teams, which encourage a team’s autonomy to solve problems within constraints specified by management based on the evolution of behaviors within a team (Anderson 1999). Hierarchical OCs tend to restrict team autonomy through rigid formal controls, the arrangement of skill-based versus team-based working structures, the subjection to both project managers and functional managers, and the top-down decision-making structures that disrupt a team’s ability to development unique solutions to complex issues. Second, regarding iterative development, ASD methods challenge the assumption that software requirements can be fully defined up front using a traditional, sequential approach. By taking an incremental approach, ASD teams relax the assumptions of traditional forms of design that rely on upfront planning, and instead, focus on understanding requirements as the artifact is being built in order to deal with change. Hierarchical OCs value predictability, where project requirements are understood in advance, fixed, and executed with minimal adaptations in order to produce predictable outcomes. Third, both self-organization and iterative development support process flexibility, both in the ability to respond to changes in the environment and the ability to quickly interchange their roles (Dissanayake et al. 2013). This approach is in stark contrast

to traditional, waterfall methodologies, where projects are driven by a project manager and expected to follow a pre-established plan without much deviation. Moreover, hierarchical OCs value plan-driven strategies, which have a negative attitude toward changing requirements and self-organization (Kenefick 2011).

In summary, these three core agile values compete with the values of a hierarchical OC, while showing more compatibility with the values of a developmental OC. Regarding ASD routinization, an ASD team's success may inspire positive attitudes toward future use. However, the unwillingness of an organization to modify its existing structures and working norms to accommodate ASD will affect the sustainability of agile use and negatively affect ASD routinization. For instance, developers in hierarchical OSs may receive promotions based on the demonstration of superior knowledge and individual performance. Such developers may be reluctant to share their knowledge to maintain a competitive edge, so that they can be promoted within the hierarchy. In contrast, agile techniques such as paired programming, which requires transparency and teamwork, may be more readily embraced and routinized when developers are incentivized based on team performance. Therefore, we hypothesize that when organizational values are in competition with agile values, organizational factors of culture and structure will negatively moderate the influence of perceived ASD success on ASD routinization (H3a, H3b). On the other hand, when organizational values align with ASD values, organizational factors, culture and structure, will positively moderate the influence of perceived ASD success on ASD routinization (H3c, H3d). Thus,

Proposition 3: Organizational factors, culture and structure, will influence ASD routinization beyond the perceived ASD success.

Conclusion

The goal of this study was to better understand the critical factors that affect the routinization of ASD methods in organizations. Particularly, we sought to understand the gap between the perceived success of ASD acceptance and ASD routinization to answer our research question: *how do organizational factors (culture and structure) affect the routinization of ASD practices in organizations?* Our purpose was to provide clarity concerning the organizational factors that influence the routinization of ASD methods. We accomplished this by evolving a theoretical model from the extant literature. Our study adds to the literature on ASD assimilation by providing insights concerning a key ASD assimilation gap. As the literature calls for, this study provides a novel understanding of ASD assimilation beyond the acceptance stage.

Limitations and Future Research

A clear limitation of the study is that the model has not been empirically validated. Future research is needed to test the relationships proposed in the model. Second, although culture has commonly been conceptualized as consisting of multiple levels, OC is still difficult to define, conceptualize, and operationalize with certainty. Our work follows prior research, which draws upon the CVM model while accepting that there are other ways to study culture (Deal and Kennedy 2000), although they contain more lengthy measures. Third, we have focus on two of the four quadrants of the CVM. Future work should theorize and test all four quadrants. Fourth, in our study, we aim to develop a parsimonious model to explicate the impact of key organizational factors on ASD use. Consequently, our model does not elaborate on the recursive relationships that may exist between constructs (Gallivan 2001). We conceptualize factors that influence ASD use, but we do not have room to discuss how ASD use influences these factors in reciprocally. Future research is needed to further investigate these mutual impacts.

The practical contributions of this research are listed as follows. First, our model sets forth a set of propositions that can aid organizations in understanding ASD routinization issues. Particularly, the impact of an organization's culture on specific factors can be gained from this research. Whereas past research highlights the role of OC in the ASD process, little research has sought to explain how OC might affect the routinization process. Once operationalized, our model may break new ground in the area of ASD assimilation research. Furthermore, understanding ASD routinization holds significant impact for understanding agile transformation, or the organizational change from less agile to more agile, as the ASD assimilation process is key in an organization's pursuit of firm agility.

Despite the limitations, the researchers were able to fulfill the objective of the study, answer the research question, and provide rich insights concerning ASD routinization. We hope that this work helps readers and researchers in understanding this phenomenon, and points the direction for future research.

References

- Abrahamsson, P., Conboy, K., and Wang, X. 2009. "“Lots done, more to do”: the current state of agile systems development research," *European Journal of Information Systems* (18), pp 281-284.
- Ambler, Scott. "Agile Adoption Survey Results." Survey. Accessed online. 11 June 2014.
- Anderson, Philip. 1999. "Seven levers for guiding the evolving enterprise," *The Biology of Business*, ed. John Henry Clippinger III, pg. 120.
- Bahli, B. and Zeid, E.A. 2005. "The role of knowledge creation in adopting extreme programming model: an empirical study," In *Information and Communications Technology. Enabling Technologies for the New Knowledge Society: ITI 3rd International Conference on*, pp. 75-87.
- Beck, K., Beedle, M., van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., Grenning, J., Highsmith, J., Hunt, A., and Jeffries, R. 2001. "The agile manifesto".
- Boehm, B., and Turner, R. 2005. "Management challenges to implementing agile processes in traditional development organizations," *Software, IEEE* (22:5), pp 30-39.
- Cameron, K. S., and Quinn, R. E. 2011. "Diagnosing and changing organizational culture: Based on the competing values framework".
- Chan, F. K., and Thong, J. Y. 2009. "Acceptance of agile methods: A critical review and conceptual framework," *Decision Support Systems* (46:4), pp 803-814.
- Chaos, tech. report 2010. Standish Group Int'l.
- Conboy, K. 2009. "Agility from first principles: reconstructing the concept of agility in information systems development," *Information Systems Research* (20:3), pp 329-354.
- Cooper, R. B., and Zmud, R. W. 1990. "Information technology implementation research: a technological diffusion approach," *Management Science* (36:2), pp 123-139.
- Dalcher, D., Benediktsson, O., and Thorbergsson, H. 2005. "Development life cycle management: a multiproject experiment," in *Engineering of Computer-Based Systems, ECBS'05. 12th IEEE International Conference and Workshops on the, IEEE*, pp. 289-296.
- Deal, T. E., and Kennedy, A. A. 2000. "Corporate cultures: The rites and rituals of corporate life," *Da Capo Press*.
- Dubé, L. 1998. "Teams in packaged software development: The software corp. Experience," *Information Technology & People* (11:1), pp 36-61.
- Dubé, L., and Robey, D. 1999. "Software stories: three cultural perspectives on the organizational practices of software development," *Accounting, Management and Information Technologies* (9:4), pp. 223-259.
- Fichman, R. G., and Kemerer, C. F. 1999. "The illusory diffusion of innovation: An examination of assimilation gaps," *Information Systems Research* (10:3), pp 255-275.
- Gallivan, M. J. 2001. "Organizational adoption and assimilation of complex technological innovations: development and application of a new framework," *ACM Sigmis Database* (32:3), pp. 51-85.
- Hansen, S. and Lyytinen, K. 2014. "Requirements Computation: Analyzing Requirements Cognition in Multiple Development Paradigms," in *AMCIS*.
- Iivari, J., and Huisman, M. 2007. "The relationship between organizational culture and the deployment of systems development methods," *MIS Quarterly*, pp. 35-58.
- Iivari, J., and Iivari, N. 2011. "The relationship between organizational culture and the deployment of agile methods," *Information and Software Technology* (53:5), pp. 509-520.
- Jiang, J. J., Klein, G., and Pick, R. A. 2003. "The impact of IS department organizational environments upon project team performances," *Information and Management* (40:3), pp. 213-220.
- Kenefick, S. Agile Development Methodologies (ID: G00211991). Retrieved from Gartner database, (2011, May 23
- Khalifa, M. and Verner, J. 2000. "Drivers for Software Development Usage," *IEEE Transactions on Engineering Management* (47:3), pp. 360-369.
- Kwon, T. H., and Zmud, R. W. 1987. "Unifying the fragmented models of information systems implementation," *Critical issues in information systems research*, pp. 227-251.

- Layman, L., Williams, L., and Cunningham, L. 2004. "Exploring extreme programming in context: an industrial case study," *Agile Development Conference, 2004, IEEE*, pp. 32-41.
- Lee, G., and Xia, W. 2010. "Toward Agile: An Integrated Analysis of Quantitative and Qualitative Field Data," *MIS Quarterly* (34:1), pp. 87-114.
- Mangalaraj, G., Mahapatra, R., and Nerur, S. 2009. "Acceptance of software process innovations—the case of extreme programming," *European Journal of Information Systems* (18:4), pp. 344-354.
- Martin, J. 1992. *Cultures in Organizations: Three Perspectives*, Oxford, New York.
- Meyer, A. D. and Goes, J. B. 1988. "Organizational assimilation of innovations: A multilevel contextual analysis," *Academy of management journal* (31:4), pp. 897-923.
- Mintzberg, H. 1980. "Structure in 5's: A Synthesis of the Research on Organization Design," *Management science* (26:3), pp. 322-341.
- Murphy, B., Bird, C., Nagappan, N., Zimmermann, T., Williams, L., and Begel, A. 2013. "Have Agile techniques been the silver bullet for software development at Microsoft?", in: *2013 ACM/IEEE international symposium on empirical software engineering and measurement*, p. 75–84.
- Nerur, S., Mahapatra, R., and Mangalaraj, G. 2005. "Challenges of migrating to agile methods," *Communications of the ACM* (48:5), pp. 72-78.
- Overhage, S., and Schlauderer, S. Year. 2012. "Investigating the long-term acceptance of agile methods: An empirical study of developer perceptions in scrum projects," *45th Hawaii International Conference on System Science (hicc)*, IEEE 2012, pp. 5452-5461.
- Rose, K.H., 2013. A Guide to the Project Management Body of Knowledge (PMBOK® Guide)—Fifth Edition. *Project Management Journal*, (44:3), pp.e1-e1.
- Procaccino, J. D., and Verner, J. M. 2006. "Software project managers and project success: An exploratory study," *Journal of Systems and Software* (79:11), pp. 1541-1551.
- Purvis, R. L., Sambamurthy, V., and Zmud, R. W. 2001. "The assimilation of knowledge platforms in organizations: An empirical investigation," *Organization science* (12:2), pp. 117-135.
- Quinn, R. E. 1988. *Beyond rational management: Mastering the paradoxes and competing demands of high performance*, Jossey-Bass, San Francisco.
- Robinson, H., and Sharp, H. 2005. "Organisational culture and XP: three case studies," *Agile Conference, Proceedings*, pp. 49-58.
- Rogers, E. M. 1962. *Diffusion of innovations*. Simon and Schuster.
- Rogers, E. M. 2003. *Diffusion of Innovations*, 5th ed., New York: Free Press.
- Russo, N., Shams, S., and Fitzgerald, G. 2013. "A Tale Of Two Agile Implementations: A Cross-Case Exploratory Analysis," in the *UK Academy for Information Systems Conference*.
- Sabherwal, R. and Robey, D., 1995. "Reconciling variance and process strategies for studying information system development," *Information Systems Research*, (6:4), pp. 303-327.
- Sackmann, S.A. 1992. "Culture and subcultures: An analysis of organizational knowledge," *Administrative science quarterly*, pp. 140-161.
- Schein, E. H. 1985. "How culture forms, develops, and changes," *Gaining Control of the Corporate Culture*, R. H. Kilmann, M. J. Saxton, R. Serpa, and Associates (eds.), Jossey-Bass, San Francisco, pp. 17-43.
- Senapathi, M., and Srinivasan, A. 2012. "Understanding post-adoptive agile usage: An exploratory cross-case analysis," *Journal of Systems and Software* (85:6), pp. 1255-1268.
- Strode, D. E., Huff, S. L., and Tretiakov, A. 2009. "The impact of organizational culture on agile method use," *42nd Hawaii International Conference on System Sciences*, IEEE2009, pp. 1-9.
- Sutherland, J. 2014. *Scrum: The Art of Doing Twice the Work in Half the Time*. Crown Business.
- Tessem, B. 2003. "Experiences in learning XP practices: A qualitative study," in *Extreme Programming and Agile Processes in Software Engineering*, Springer Berlin Heidelberg, pp. 131-137.
- Tolfo, C., and Wazlawick, R. S. 2008. "The influence of organizational culture on the adoption of extreme programming," *Journal of Systems and Software* (81:11), pp 1955-1967.
- Version One. "7th Annual State of Agile Survey." Survey. Accessed online. 15 June 2013.
- Version One. "9th Annual State of Agile Survey." Survey. Accessed online. 15 June 2015.
- Vidgen, R., and Wang, X. 2009. "Coevolving systems and the organization of agile software development," *Information Systems Research* (20:3), pp 355-376.
- Vijayarathy, L., and Turk, D. 2012. "Drivers of agile software development use: Dialectic interplay between benefits and hindrances," *Information and Software Technology* (54:2), pp 137-148.
- Wang, X., Conboy, K., and Pikkarainen, M. 2012. "Assimilation of agile practices in use," *Information Systems Journal* (22:6), pp 435-455.