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Management Strategies for Adopting Agile Methods of Software Development in Distributed Teams

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This is to certify that the doctoral study by

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Abstract

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MBA, John F. Kennedy University, 2004

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Doctoral Study Submitted in Partial Fulfillment

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Abstract

Between 2003 and 2015, more than 61% of U.S. software development teams failed to satisfy project requirements, budgets, or timelines. Failed projects cost the software industry an estimated 60 billion dollars. Lost opportunities and misused resources are often the result of software development leaders failing to implement appropriate methods for managing software projects. The purpose of this qualitative multiple case study was to explore strategies software development managers use in adopting Agile methodology in the context of distributed teams. The tenets of Agile approach are individual interaction over tools, working software over documentation, and collaboration over a contract. The conceptual framework for the study was adapting Agile development methodologies. The targeted population was software development managers of U.S.-based companies located in Northern California who had successfully adopted Agile methods for distributed teams. Data were collected through face-to-face interviews with 5 managers and a review of project-tracking documentation and tools. Data analysis included inductive coding of transcribed interviews and evaluation of secondary data to identify themes through methodological triangulation. Findings indicated that coaching and training of teams, incremental implementation of Agile processes, and proactive management of communication effectiveness are effective strategies for adopting Agile methodology in the context of distributed teams. Improving the efficacy of Agile adoption may translate to increased financial stability for software engineers across the world as well as accelerate the successful development of information systems, thereby enriching human lives.

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Dedication

I dedicate this doctoral study to my loving family, which is the core of my existence, my values, and my wisdom. I foremost dedicate this degree to my parents, Alex and Galina, for their ever-present encouragement to pursue my educational goals and for being my life role models. You instilled in me the curiosity and love of knowledge that will always be associated with you. I also dedicate this degree to my wife, Elena, for joining me in this extraordinarily difficult journey, for supporting my doctoral ambitions, and for placing on hold the fun and excitement of out-of-school life. I thank you for that wholeheartedly. To my mother-in-law, Lidia, for the enormous support and understanding, often at the most difficult times. I would not have been able to complete this undertaking without your relentless help. I finally dedicate my work to my children, Gregory and Sasha, for respecting and appreciating my aspirations and for believing in the value of education and self-development. This degree is for you.

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Section 1: Foundation of the Study

Successful completion of software development projects translates to increased business value and contributes to the overall progress of the software industry (Arbib, 2014), while failed projects cost the software industry an estimated $60 billion (Mansor, Arshad, Yahya, & Razali, 2016). Researchers in the field of software development methodologies have suggested advantages of Agile processes in managing software projects for local and distributed teams (Alahyari, Svensson, & Gorschek, 2017; Könnölä et al., 2016). Ahimbisibwe, Cavana, and Daellenbach (2015) noted that execution of an appropriate strategy for Agile methodology implementation is the most critical factor in successful product development.

Background of the Problem

The number of failed software development projects exceeds the number of successfully completed projects (The Standish Group, 2015). Timely introduction and implementation of Agile methodologies have a positive effect on the outcomes of software development (Solinski & Petersen, 2014; The Standish Group, 2015). Projects managed using Agile methods are 5 times more effective in delivering new functionality and tend to reduce the project timelines by 24% to 64% (Olszewska, Heidenberg, Weijola, Mikkonen, & Porres, 2016). Campanelli and Parreiras (2015) stated that ineffective implementation of Agile methodology in software development organizations is a unique and critical business problem. The challenges of Agile adaptation are especially noticeable in the environment of multiple teams working from different locations (Shrivastava & Rathod, 2015). The cause of these challenges is the

incompatibility of Agile principles of frequent and unobstructed collaboration with the reality of language barriers, time zone differences, and cultural diversities of dispersed teams (Dikert, Paasivaara, & Lassenius, 2016; Shrivastava & Rathod, 2015). The challenges of knowledge sharing and resistance to accept new methods of leadership are also prevalent and might lead to failure of Agile adaptation and project success (Dingsøyr & Šmite, 2014; Nkukwana & Terblanche, 2017; Wohlin, Šmite, & Moe, 2015). Rasnacis and Berzisa (2017) indicated a lack of research on management strategies in tailoring agile methods for development organizations that consist of multiple geographically distributed teams. Considering the number and complexity of these challenges, additional research might be helpful in identifying strategies for adopting the Agile methodology to successfully complete projects in the context of distributed teams.

Problem Statement

Between 2003 and 2015, more than 61% of U.S. software development teams failed to satisfy project requirements, meet budget targets, or finish development within the timelines allocated for the project (The Standish Group, 2015). Software development teams that do not adopt Agile methodology for project execution are 400% less productive, take longer to complete the project, and are more likely to fail than teams that implement Agile methods (Olszewska et al., 2016). The general business problem was that failure to adopt Agile methodology in project execution has a negative impact on the productivity, time-to-market availability, and cost effectiveness of software development projects. The specific business problem was that some software development managers

lack strategies for adopting Agile methodology to successfully complete projects in the context of distributed teams.

Purpose Statement

The purpose of this multiple-case qualitative study was to explore the strategies that software development managers use in adopting Agile methodology to successfully complete projects in the context of distributed teams. The targeted population consisted of five managers of software development teams employed by five U.S.-based companies located in Northern California who had successfully adopted Agile methodology to enable distributed teams to complete software development projects. Implications for positive social change include the potential to achieve greater sustainability of software development, which could lead to stronger financial gains and increased employment, thereby facilitating economic stability and independence of team members' families and local communities.

Nature of the Study

I chose a qualitative approach. In applying qualitative methods, scholars explore the roots of the phenomenon in social and business environments using words and conversations from those environments (McCusker & Gunaydin, 2015). Conducting a qualitative study enabled me to search for answers to questions of *what*, *why*, and *how* while examining the recent experiences of study participants. Researchers who seek to explain phenomena by investigating associations among measurable parameters use quantitative methods (Ritchie & Ormston, 2014). Researchers who employ a quantitative

method do not immerse themselves in the setting and context and do not have the flexibility to collect unstructured and nuanced data (McCusker & Gunaydin, 2015).

Molina-Azorin (2016) defined mixed-methods research as a fusion of qualitative and quantitative approaches applied in a single study. Molina-Azorin suggested that mixed-methods research might require extensive resources while presenting an opportunity to enrich the understanding of the business context in which a phenomenon was studied. My goal was to conduct an in-depth exploration of managers' experiences with adoption of Agile methodology for software development. Collection of quantitative data was not necessary for this study. Therefore, a mixed-methods approach was not appropriate.

A case study design was suitable for this study. Scholars apply case study designs to understand the complex dynamics of organizations and organization management and to investigate a practical matter within a limited period when the issue is relevant and observable (Yin, 2014). When conducting a study according to a phenomenological design, the researcher explores a phenomenon while closely observing or participating in rich human experiences during the event (Sanders, 1982). The phenomenological design was not appropriate for the exploration of business strategies relative to implementation of a particular methodology. The ethnographic design is used for studying the cultural tendencies and behaviors of a group over an extended period of time (Leslie, Paradis, Gropper, Reeves, & Kitto, 2014). Ethnographic research was not suitable for the study of time-limited software development projects. Researchers who conduct narrative research explore participants' stories of phenomena (De Loo, Cooper, & Manochin, 2015). A

narrative design was inconsistent with the study of development teams' project management strategies.

Research Question

What strategies do software development managers use in adopting Agile methodology to successfully complete projects in the context of distributed teams?

Interview Questions

1. How did your team manage development projects prior to adopting Agile methodology of software development?
2. What motivated you to adopt Agile methodology of software development?
3. What strategies did you find worked best to adopt agile methodology of software development?
4. How did you address obstacles encountered by your distributed teams when they were adopting Agile methodology of software development?
5. How, if at all, did distributed team members' adoption of Agile methodology affect the project outcome?
6. How, if at all, did the distributed nature of the team affect adoption of Agile methodology?
7. How did you monitor the progress of distributed team members' adoption of Agile methodology?
8. What additional information can you provide about your experience with distributed teams' adoption of Agile methods of software development?

Conceptual Framework

DeSanctis and Poole (1994) developed the adaptive structuration theory (AST) in 1994. Cao, Mohan, Xu, and Ramesh (2009) expanded DeSanctis and Poole's original theory into the adapting agile development methodologies (AADM) conceptual framework in 2009. The AADM framework is a lens through which researchers can view the effects of agile structuration and appropriation on the outcomes of the Agile methodology adoption process. Appropriation is the process of actors embracing and interacting with new structures that result from the interplay between intrinsic advanced information technology structures and emerging structures that result from these interactions (Cao et al., 2009). Structuration is the process of introducing rules, resources, and other structures into action (Cao et al., 2009). In AADM, appropriation is an implementation of a structure within a specific context. The sources of structures are agile methods, project characteristics, organizational context, and the systems used by internal teams, such as collaboration techniques, skills, and perceptions of the agile concept.

Appropriations include the adoption of new approaches and technologies, faithfulness to newly adopted technologies, usage of instrumentation, and attitudes toward new technologies. Improved alignment between process implementation and organizational context might lead to a more successful project (Cao et al., 2009). Likewise, a strategy of faithful appropriation could improve project outcomes. DeSanctis and Poole's (1994) AST and Cao's et al. (2009) AADM were appropriate theoretical lenses for this study, the objective of which was to identify the strategies software

development managers use in adoption of agile methodologies, including appropriation and structuration, for successfully completing projects in the context of distributed teams.

Operational Definitions

Agile software methodology: The Agile methodology of software development is a flexible, highly responsive, incremental approach to achieving high-level project requirements by focusing on 12 principles identified in the Agile manifesto (Beck et al., 2001; Yu & Petter, 2014).

Continuous integration: Continuous integration is a collection of daily workflow activities designed to ensure the quality of software through frequent quality validation processes that include version control, building, testing, and deploying of applications during development (Meyer, 2014).

Distributed software development: Distributed software development is the concept of a development environment in which geographically dispersed team members collaborate (Shrivastava & Rathod, 2015).

Scrum project: A scrum project is a type of Agile project in which self-managed teams focus on communication rather than documentation to satisfy the objective of rapid, iterative, task-focused implementation of subprojects (Dulock & Long, 2015).

Software test automation: Software test automation is a popular labor-saving technique used in the process of developing quality software through the incorporation of software tools capable of continuously setting up and executing test scenarios and reliably reporting on the quality of software under development (Amaricai & Constantinescu, 2014).

Virtual software team: A virtual software team is a decentralized entity whose members work across time and distance with other parts of the organization by contributing resources to achieve shared organizational goals (Hoch & Kozlowski, 2014).

Assumptions, Limitations, and Delimitations

Assumptions

Assumptions are unverified or unconfirmed considerations the researcher accepts relative to the study being undertaken (Marshall & Rossman, 2014). Researchers make assumptions to establish the rationale for their inquiry (Marshall & Rossman, 2014). It is important to analyze the assumptions to improve the merit and reliability of a study; implicit and unstated assumptions might affect the research validity (Kirkwood & Price, 2015). A general assumption for this study was that multiple-case design was appropriate for studying the strategies managers use in adopting Agile methods of software development in the context of distributed teams. Research methods and designs represent particular worldviews and therefore are vulnerable to biased selection or application (Kirkwood & Price, 2015). An additional assumption was that the selected study participants would provide honest retrospective answers, free of management influence and overconfidence. The final assumption was that, as the researcher, I would be able to minimize any preconceptions that might have developed during my career in software development management.

Limitations

Limitations are notable deficiencies in the research that might affect the validity or credibility of the study (Brutus, Aguinis, & Wassmer, 2013). The selection of

participants for a study was a limitation because selections are targeted samples of a population (Prowse & Camfield, 2013). The choice of participants from a particular location might skew the results of a study by representing the selective dynamics of software project management unique to that area. The context of the study, such as the culture and geography in which the study is undertaken, as well as the execution process, might affect results of the study and undermine repeatability (Prowse & Camfield, 2013).

For this study, the selection of several managers who work in Silicon Valley, the area of California dominated by high-technology companies, is acknowledged as a limitation. In general, leaders of Silicon Valley companies embrace technology and readily adopt new approaches to technology development (Kim, Chung, Beckman, & Agogino, 2016). The choice of the participants from a particular location may skew the results of the study by representing selective dynamics of software project management unique to that area. Prowse and Camfield (2013) observed that research context, such as culture and geography, as well as execution process, could affect the study results and undermine the repeatability. In this study, a distributed nature of software development processes incorporated dispersed teams from various countries with distinct cultures and geographies. A potential limitation of this study was that I explored the adoption of Agile methods by virtual teams from selected locales, thereby representing only cultures with the potentially atypical aptitude for autonomous organization and change management.

Delimitations

Delimitations are the confines within which researchers conduct their studies (Yin, 2014). By identifying the delimitations, the researcher explicitly formulates the

scope of the valid research context (Marshall & Rossman, 2014). Companies whose managers have adopted Agile methodology in Beck et al.'s (2001) original manifestation were the delimitations of the present study. Subsequently introduced complimentary methods, such as lean principals, were beyond the scope of this study. Also, only small- or medium-size projects executed by software firms with offices in Northern California and involving no more than three distributed teams were additional delimitations of the study.

Significance of the Study

Successful projects increase the value of the organization through the delivery of objectives that support organizational strategy (Serra & Kunc, 2015; Too & Weaver, 2014). Using Agile methodology in software development enhances the likelihood of projects being completed on time and on budget (Olszewska et al., 2016). The findings from this study may benefit leaders of companies by revealing strategies that some managers have used to adopt Agile methods and successfully complete software development projects in the context of distributed teams.

Contribution to Business Practice

Lost business opportunities and misused project resources are often the result of software development leaders failing to adopt Agile methodology (Olszewska et al., 2016). Bass (2016) concluded that the challenges of adopting Agile methods come from the overwhelming complexity of software development. These challenges increase in the context of distributed software development ([DSD] G. Lee, Espinosa, & DeLone, 2013) due to the dispersed nature of teams and the apparent lack of strategies to adopt Agile

methods (Verner, Brereton, Kitchenham, Turner, & Niazi, 2014), but few researchers have explored Agile methodology adoption strategies in DSD environments (Olszewska et al., 2016). This study contributed to business practices through a detailed review of the strategies software development managers of DSD teams have used successfully in adopting Agile methodology in the execution of software development projects.

Implications for Social Change

Computing is an integral part of modern society (Arbib, 2014); software systems are ubiquitous, regulating the most critical aspects of daily lives. The social and economic impact of the software industry is evident in areas of safety, security, and environmental sustainability (Penzenstadler, Raturi, Richardson, & Tomlinson, 2014). Rashid and Khan (2014) identified the adoption of Agile methodology of software development as a positive social change because this method has the propensity to reduce the impact of wasteful engineering on humanity, the environment, and the economy. The implication for social change from this study was advancing the development of systems that can enrich human lives (see Penzenstadler et al., 2014) and reduce the effects of computing waste on the economy and the environment (see T. V. N. Rao, Rani, Swetha, & Satyam, 2015). Another implication for social change was improved financial stability and independence for software engineers of distributed teams in less developed countries because of improved success rates of DSD projects and subsequent growth of investment in DSD.

Review of the Professional and Academic Literature

The purpose of this multiple-case qualitative study was to explore strategies that software development managers use for adopting Agile methodology to successfully complete projects in the context of distributed teams. A review of relevant literature served to establish a scholarly foundation of recent findings, trends, and directions in the adoption of Agile methods for software development teams. This review of literature is organized to reflect the multifaceted nature of software development methods, including a comprehensive exploration of the main aspects of Agile transformation.

The review begins with an introduction to the conceptual frameworks used as the foundation for this study. The frameworks are the representation of the approach to study adaptation of new methods and structures in organizational environment. In this review, I present the utilization of adaptive structuration theory (AST) and the adaptive agile development methodologies (AADM) framework in the latest research on Agile principles. I also explore supporting and contradicting theories and frameworks reflecting scientific coverage of the topic. I include reviews of Agile methods and distributed development, followed by the theme of challenges experienced by remote software development teams when transitioning to Agile development. The review of literature concludes with a discussion of the challenges of adopting Agile methods and the processes and strategies used to assist with the transformation to following Agile methods of software development.

Resources used to conduct this review of literature included scientific publication databases and Google Scholar. The list of databases included EBSCOhost, ACM Digital

Library, Computers and Applied Sciences Complete, Emerald Insight, IEEE Xplore Digital Library, and ScienceDirect. Key words and key phrases entered individually and in various logical combinations included *Agile methodology*, *software development*, *distributed team*, *dispersed team*, *remote team*, *Agile transformation*, *Agile adoption*, and *Agile transition*.

This review of scholarly literature covers 119 items. Of that total, 107 (90%) were refereed articles published since 2014. Out of those, 0 (0%) were dissertations, and 12 (10%) were nonrefereed articles, books, corporate publications, and other sources. Overall, this study included 265 references. As I conducted this extensive literature review, I noted broad coverage of Agile transformation in publications on software development, but limited coverage of working Agile adoption strategies that managers might use to improve the outcome of software development projects in dispersed software teams. This gap in the knowledge base justified the need for this study.

Adaptive Structuration Theory

DeSanctis and Poole (1994) developed AST as a method of analyzing the impact of IT on organizational development. Adaptation of new technologies involves the interplay of social or organizational structures (structuration) with tools, attitudes, and internal processes (appropriations) inside and outside of the affected groups (DeSanctis & Poole, 1994). Structuration is the process of transforming structures into activities; structures are artifacts that embody new technologies, existing social interactions, organizational environments, group dynamics, and various processes (DeSanctis & Poole, 1994). Appropriation is the application of structures in a particular context; the act of

appropriation affects organizational, developmental, and social interactions, subsequently making an impact on the project outcomes (DeSanctis & Poole, 1994). Many researchers have used AST theory to advance the understanding of technology integration in the workplace (Rains & Bonito, 2017; Schmitz, Teng, & Webb, 2016; Wang, Xiang, & Fesenmaier, 2016; Widyarini & Simatupang, 2015). Angeles, Bongon, Esguerra, Rodriguez, and Kagaoan (2015) applied AST framework to their study of the effects of technologies on social dynamics and people's interactions. Angeles et al. found the theory was applicable for the exploration of changes within the group and in individual collaborations during and after integration of new technologies. Ajjan, Kumar, and Subramanian (2016) explained that technology adaptation, in the context of AST, depends on factors that include technology, organization culture, attitude toward technology, and social patterns. Ajjan et al. explored AST effectiveness in their examination of management strategies for managing an IT portfolio of assets and investments, while Bresciani and Comi (2017) used AST in their investigation of technology appropriation to promote collaboration within culturally diverse groups.

Cao et al. (2009) expanded DeSanctis and Poole's (1994) theory by providing a lens for interpreting the effects of Agile structuration and appropriation on the adaptation and outcomes of Agile methodology. At the core of Cao et al.'s AADM conceptual framework is the interplay between the characteristics of appropriation practices and the outcomes of software development practices related to development, developers, customers, and management-organizational operations (Altameem, 2015; Jovanović, Mas, Mesquida, & Lalić, 2017). To validate their framework, Cao et al. expanded AST

terms for coding of interviews on the Agile adaptation process to include new labels for signifying Agile methods, organizational factors, appropriation practices and processes, process outcomes, and project outcomes. Finally, Cao et al. synthesized the codes into themes of sources related to structure, appropriation practices, and characteristics of appropriation.

The resulting framework offers an approach for identifying alignments between Agile methodology adaptation and organizational contextualization leading to a successful project implementation (Lechler & Yang, 2017; Pries-Heje & Baskerville, 2017; Xu & Yao 2015). Pries-Heje and Baskerville (2017) affirmed the effectiveness of Cao et al.'s (2009) framework based on the foundational Agile principle of continuing iterative improvement (Beck et al., 2001), but noted the short duration of Cao et al.'s study leading to creation of AADM. To address the temporal limitations of AADM, Pries-Heje and Baskerville added a longitudinal aspect to AADM, presenting structuration elements through ongoing improvement of development processes. Based on these additions to AADM, Pries-Heje and Baskerville found that managers and developers transform Agile methods to specific environments by applying recommended Agile rules with adjustments to best fit in a team context. Pries-Heje and Baskerville argued that gradual and consistent enhancements will continue to have a positive impact on Agile adaptation efforts. Enhancing the longitudinal view of AADM, R. A. Rao and De' (2015) observed that structurations developed at the task level of a project can evolve into a team-level structuration artifact; examples of these artifacts include processes and the social culture of the development team.

Researchers have remarked on the benefits of AADM as an extension of AST, explaining there are advantages to transitioning from an approach focused on project planning to one based on Agile methodology (Cram & Newell, 2016; Gandomani & Nafchi, 2015). Application of AADM allows new development environments to emerge because adaptation in Agile methodology is highly customized (Cram & Newell, 2016). Gandomani and Nafchi (2015), in their study of four cases involving Agile method interpretation (extreme programming) similar to the framework advocated by Cao et al. (2009), asserted Cao et al.'s framework limited applicability of AADM framework to other interpretations.

Researchers in the field of Agile development have created several alternative conceptual frameworks to promote Agile methodology adaptation. Fontana, Meyer, Reinehr, and Malucelli (2015) illustrated the Agile adoption and maturation process using the progressive outcomes framework with the premise that positive process outcomes and the Agile adaptation progress are the result of improvements in personal and social structures rather than an appropriation of prescribed practices. Fontana et al. based their assertion on the Agile principle of valuing people and collaboration over procedures and means.

Gandomani, Zulzalil, Ghani, Sultan, and Sharif (2014) developed a transitioning framework to enhance the alignment of Agile principles with strategies for adopting Agile methodology. Using the grounded theory approach, Gandomani et al. investigated the artifacts that influence Agile implementation. To conduct the investigation, Gandomani et al. divided the Agile transition process into the four components of

transformation preconditions, facilitators, challenges and issues, and transition framework. This transition framework resembles the AADM approach in that both approaches split the concept of adaptation into its structural characteristics (structuration) and core activities (appropriations) (Gandomani et al., 2014).

Balakrishnan (2016) suggested that Agile adaptation success requires organizational acceptance and a good fit with a specific implementation of Agile. In terms of AADM, Balakrishnan considered the process of personal and organizational outcomes and ways to improve appropriation of organizational attitude toward transformation to acceptance of the Agile method. Balakrishnan proposed an agility implementation framework at the company level to introduce Agile development methods. At the core of the framework is a detailed organizational analysis of how Agile values and principles (Beck et al., 2001) juxtapose with organizational values and culture. Balakrishnan called this alternative conceptual framework the Agile software solution framework (ASSF).

As Qumer and Henderson-Sellers (2008) explained, the objective of applying the ASSF is to quantify the level of agility of the software development team. ASSF is a guide that managers can use to identify areas of inadequate implementation of Agile and actions that might benefit from organizational and procedural improvements in the development environment (Qumer & Henderson-Sellers, 2008). The core of ASSF is a 4-dimensional analytical tool (4-DAT) method for measuring team agility along four independent method dimensions: scope, agility features, agility values, and process. Each of the four dimensions includes a number of quantitative and qualitative categorization

criteria. Qumer and Henderson-Sellers constructed agility feature dimensions from five quantitative parameters; in contrast, the six agility value dimension characteristics are mainly qualitative. Notably, four out of six qualitative values can be traced to the Agile manifesto (Beck et al., 2001).

Researchers have considered the phased principle of most project implementations to identify areas of potential improvement. Activities conducted at each project stage make a different contribution to the degree of project agility. Qumer and Henderson-Sellers (2008) claimed the framework could be applied to any project method and demonstrated the use of ASSF on projects being developed using various methods such as eExtreme, Scrum, Feature-Driven Development, Adaptive Software Development, Dynamic Software Development Method, and Crystal. Qumer and Henderson-Sellers found, from the perspective of Agile practice implementation, that Scrum is the most Agile method, but is only third after considering the impact of project phases on Scrum agility. Finally, Qumer and Henderson-Sellers offered a relative assessment of the pure implementation of these methods. Development managers might benefit from conducting the assessment at the beginning of project structuration to select the most appropriate process for a specific project and specific team composition.

Gandomani and Nafchi (2014) incorporated the 4-DAT approach in their development of the more comprehensive computational technique of 44 Agile-for-agility assessments of a software development project. Gandomani and Nafchi eliminated the agility-level dimension used in ASSF, arguing that teams should not be limited to implementation of any particular Agile method. While exploring the benefits of

knowledge management (KM) strategies for the adoption of Agile methods in software development, Amritesh and Misra (2014) integrated the 4-DAT technique of ASSF to increase the propensity of improved transformational outcomes. Similar to Gandomani and Nafchi, Amritesh and Misra did not limit their research to a particular Agile adaptation method, but rather explored a generic application of KM in an Agile environment. Narrowing the scope ASSF to a project on a smaller scale, S. Lee and Yong (2013) developed an Agile framework for small projects (AFSP), thereby extending ASSF to include the critical success factors that allowed for development of a 5-step Agile improvement model for small teams. In their AFSP, S. Lee and Yong described the method for creating a customized AFSP process and selecting appropriate instruments from the Agile practice pool. S. Lee and Yong also used the 4-DAT method to evaluate team agility, mainly for the purpose of validating the AFSP.

Conceptual Frameworks for Agile Adaptation in the Distributed Team Context

While Agile transformation frameworks are generally applicable to any size and structure of team, team distribution trends compound the complexity of the transformation process. The focus of this section is distributed software development (DSD). The impact of agile development on DSD is part of the distributed Agile development (DAD) literature reviewed below.

Jarvenpaa and Ives (1994) described their vision of increasing the value of virtual teams through scenarios involving the use of information technology (IT) and the Internet, and the benefits and challenges of using IT in a virtual corporation. Jarvenpaa and Ives questioned others' opinions of the irreplaceability of face-to-face meetings and

predicted successful well-defined and carefully arranged virtual teams sharing software development tasks. Since before the 21st century, there has been increased acceptance of distributed organizational structures, and researchers have offered alternative concepts to the rigidity of traditional networking organizations. For example, DeSanctis, Staudenmayer, and Wong (1999) proposed the option of interdependent teams including several virtual groups. These teams would require a sophisticated grid of interrelated components to support the design of tailored procedures and would rely extensively on the use of maturing collaborative tools.

Advances in communication technologies in the 1990s and 2000s alleviated some of the technical challenges of software development in a distributed team environment (Carlo, Gaskin, Lyytinen, & Rose, 2014; Jarvenpaa & Ives, 1994). At that time, approximately 50% of software development projects failed because of the lack of effective collaboration strategies and deficiencies of knowledge-sharing processes among distributed teams (Jabangwe, Šmite, & Hessbo, 2016; Moe, Šmite, Šablis, Börjesson, & Andréasson, 2014). Researchers in the field of software development changed their focus from the facilitation of remote team management toward identification of a particularly challenging aspect of professional-level interactions in global environments (Babar & Lescher, 2014; Bergadano, Bosio, & Spagnolo, 2014). Richardson, Casey, McCaffery, Burton, and Beecham (2012) offered insights into how virtual organizations might be established by defining global teams as functional components of a global organization. In this context, Richardson et al. identified four DSD-specific risks related to dimensions of distance between team members in terms of time, location, language, and culture. As

explained by Silva et al. (2015), Richardson et al. designed a global teaming scheme, grounded in the capability maturity model for software development. Holtkamp, Lau, and Pawlowski (2015) changed the focus on the notion of distributed teams by highlighting the necessary competencies of distributed team participants to manage the challenges of linguistic, temporal, cultural, and geographical dissonances. Holtkamp et al. incorporated Richardson's et al. framework to support the finding that technical expertise is only one of many components of a distributed team contextual fit otherwise composed of cultural backgrounds, environment of the organization, and cultural influence on management processes.

The discord between management process, managers' skills, and the distributed environment is not the only obstacle in the path to success for distributed projects. Lehtinen, Mäntylä, Vanhanen, Itkonen, and Lassenius (2014) conducted a root cause analysis targeting the failure of almost 200 distributed projects in several software development companies. Lehtinen et al. focused on the categories of failures and the areas of greatest potential benefit from Agile process improvements. The reasons for failures belonged to three groups of almost even distribution: (a) bridge causes, (b) people-task-methods causes, and (c) project improvements causes. Based on extensive data analysis, Lehtinen et al. concluded the development teams perceived a combination of people, task, and methods were the most effective targets for process improvements needed to reduce project failures. Lehtinen et al. suggested the great impact on project outcome improvements would come from a management focus on people and work processes. Jabangwe et al. (2016) addressed concerns about the quality of distributed

software development, acknowledging the increasing frequency of companies to achieve quality results from these efforts. They reported failure category types similar to those noted by Lehtinen et al., particularly project quality associated with practices involving people, products, and processes. Jabangwe et al. suggested fine-tuning the practices within development teams might improve the quality of produced software.

Increased popularity of distributed software development (Estler, Nordio, Furia, Meyer, & Schneider, 2014) has prompted studies with the goal of analyzing the effectiveness of geographically distributed development. Mishra and Mahanty (2016) studied the cost and value of relationships among local and remote teams working together on global software development projects and found that large offshore teams had higher training overhead costs and lesser project productivity overall. The researchers underscored it might be possible to achieve overall project cost savings if the tasks assigned to remote teams require only minimal training. Although cost saving is a motivating factor contributing to the use of distributed software development (Belsis, Koutoumanos, & Sgouropoulou, 2014), the high rate of failure among distributed projects (Jabangwe et al., 2016; Moe et al., 2014) was the reason most frequently cited for the need to improve the performance of distributed development. Introduction of Agile methodology is a way to improve project outcomes (Serrador & Pinto, 2015).

Sidky, Arthur, and Bohner (2007) attempted to define structuration of the efforts organizations undertake when adopting Agile methodology for software development. At the heart of the Agile adoption framework (AAF) is a system of estimation of Agile adaptiveness for a specific environment and a four-step technique for identifying the

specific Agile processes appropriate for the organization. Sidky et al. suggested the Sidky Agile Measurement Index (SAMI) of team preparedness for Agile transformation is representative of Agile indicators such as the level of constraints on existing processes, the feasibility of a particular project for alignment with Agile principals, organizational willingness to transform, and the efforts required to associate Agile processes in the combined scope of project and organization. Managers of projects in transition can use these indicators to organize a four-step Agile transformation process that consists of discontinuing the current practice, setting up project-level practices, introducing organizational practices, and reconciling project and organizational practices (Sidky et al., 2007).

The SAMI framework (Sidky et al., 2007) is unique in that it combines project- and team-level adjustments for Agile adaptation while providing a quantitative measure of transformation preparedness and success (Jalali, Wohlin, & Angelis, 2014). Fontana, Fontana, da Rosa Garbuio, Reinehr, and Malucelli (2014) recognized the value of utilizing SAMI to identify the achievement of project or team Agile maturity on the scale of five levels: cooperative, evolving, operational, transformative, and all-embracing. Gren, Torkar, and Feldt (2015) applied AAF as a conceptual framework and practical approach to measuring Agile maturation of software development. In focus groups conducted before launching their study, Gren et al. found positive results from employing SAMI to define the level of maturity of projects. The statistical component of Gren et al.'s research was not supportive of the AAF model definitively categorizing agility

levels in the researched organization. Moreover, Gren et al. noted inadequacy in the distinctness of management roles in the AAF.

Despite more than 10 years having passed since Sidky's et al. (2007) study, Agile adaptation is not fully understood. Nkukwana and Terblanche (2017) echoed concerns about the lack of structured approach to Agile adaptation and deficiencies in software development managers' understanding of transformation strategy. Specifically, Nkukwana and Terblanche pointed to transformation of the role of manager in the traditional software development setting being one of direction, compared to the role in the Agile environment being one of facilitation. Project managers' failure to adjust to their new role has delayed or derailed the Agile transition process. Citing Sidky's et al. work, Nkukwana and Terblanche suggested strengthening managers' positions through better understanding of managers' expectations for their projects.

Most researchers have recommended using proven Agile transformation frameworks to guide management throughout the stages of Agile adoption. For example, Stavru (2104) suggested a cautious approach to using the frameworks and Agile adaptation strategies identified in industry surveys, questioning the trustworthiness of data from results of eight of nine surveys published in 2011–2012. Of greatest concern to Stavru was the quality of studies, particularly the thoroughness with which research methods and study results were reported. The short duration of the studies limited validity of the results, according to Stavru. Furthermore, there was a possibility of measurement bias of surveys in terms of reliability and trustworthiness (Stavru, 2104).

Agile Software Development in the Context of Distributed Teams

Beck et al.'s (2001) publication of the original Agile manifesto marked a turning point for the software development industry (Brhel, Meth, Maedche, & Werder, 2015; Jovanović et al., 2017). Beck et al. proposed a set of four values of software development practice as prerequisites to successful software projects. Also included in the original Agile manifesto were 12 principles of Agile methodology that became signature attributes of the Agile software development approach (Mandal & Pal, 2014; Olszewska et al., 2016). The goal of introducing Agile methodology was to address the dynamic nature of the business environment and uncertainty in the planning of products and services development (Brhel et al., 2015; Chuang, Luor, & Lu, 2014). The emphasis of the manifesto is on collaboration, pragmatism, and responsiveness to change (Beck at al., 2001). Since the formulation of the manifesto in 2001, Agile methodology has become highly popular in the software industry (Alahyari et al., 2017; Campanelli & Parreiras, 2015; Könnölä et al., 2016). Several methodology implementations such as Scrum, Kanban, Extreme, and Feature Driven dominate software development practices (Lei, Ganjeizadeh, Jayachandran, & Ozcan, 2017; Lindsjørn, Sjøberg, Dingsøyr, Bergersen, & Dybå, 2016). Consequently, the number of studies on the various methods has grown steadily throughout the years since the manifesto was published (Baseer, Reddy, & Bindu, 2015; Brhel et al., 2015; Dingsøyr & Lassenius, 2016).

Accompanying the increased scholarly attention to Agile methodology and renewed popularity of distributed software development (R. A. Khan, Wang, Arif, Khan, & Idris, 2016; Langer, Slaughter, & Mukhopadhyay, 2014), researchers have noted the

contradiction between the Agile principle of team members' co-location and the practical popularity of Agile software development among distributed teams (Bass, 2016). Rizvi, Bagheri, and Gasevic (2015) explored the root causes and motivations of several companies that adopted Agile methods in a DSD environment and found a shortage of local talent and the high cost of local expertise were the main drivers of distributed team configurations. Greater cost savings associated with more effective use of resources on Agile projects surpassed the burden of coordinating and aligning remote teams (Rizvi et al., 2015). Researchers concluded business leaders perceived Agile methods were more effective than traditional Waterfall methods of software product development, resulting in a complete replacement of all phases of traditional Waterfall methods with Agile methods (Rizvi et al., 2015). Zanoni, Perin, Fontana, and Viscusi (2014) added that the goals of business leaders who embark on Agile adaptation are to create working products at every iteration of development and to quickly react to changing customer or market demands. Flora, Chande, and Wang (2014) found that in some lines of business, Agile methodology yields generally lower costs and shorter time-to-market benefits through distributed teams. In their survey of more than 130 business leaders, Flora et al. found 86% of the participants asserted Agile methodology is the most natural and intuitive approach for mobile devices application development, mainly for enabling product development to meet shifting market demands, speedy release of products, and the ability to distribute development efforts between remote teams and local programmers.

In contrast to Flora et al.'s (2014) findings, Estler et al. (2014) urged caution in wholeheartedly embracing Agile methodology, asserting there was no significant

correlation between the choice of Agile or traditional project methodology and project success rates, particularly in distributed software development projects. Estler et al. acknowledged the findings of their study were unexpected and concluded that their findings might not show the irrelevance of methodology for project results, but rather a dependency of process selection in determining the outcome of a project. Serrador and Pinto (2015) discovered a statistically significant positive correlation between projects with various degrees of Agile development and successful project implementation. Instead of focusing solely on the IT industry, Serrador and Pinto collected data from almost 1,400 projects across various fields, revealing a statistically conclusive advantage of Agile methodology over traditional methods in the approach to successful project implementation. Although Serrador and Pinto did not determine all causalities of the relationship, the findings suggest Agile implementation is more likely to lead to project success than is traditional implementation. More recently, Ahimbisibwe, Daellenbach, and Cavana (2017) noted the difficulty of comparing traditional planned project methods with Agile methodology, citing variability in definitions and measures of critical success factors. They suggested methodology selection should be a function of project environment, resources, goals, organizational structure, and other parameters of the context of the projects. Ahimbisibwe et al. warned managers against biases and personal preferences when choosing project methodology, urging them to reflect on the project type and environment for the best development approach.

Challenges of Adapting Agile Methodology

The trend of fusing DSD and Agile methodology represents an attempt to deliver cost-effective software in rapidly changing business environments (Kaur & Sharma, 2014). Several researchers explored the applicability of Agile methodology in the distributed development context (Hoda, Salleh, Grundy, & Tee, 2017; Shrivastava & Rathod, 2014), while others focused on the contradiction between Agile principles and the concepts of distributed software development (Alzoubi, Gill, & Al-Ani, 2015; Estler et al., 2014). Ghafoor, Shah, and Rashid (2017) asserted the greatest challenges of Agile implementation in DSD are ineffective communication, sociocultural differences, and temporal distance. In their study on the benefits and challenges of Agile methodology application in the DSD environment, Kaur and Sharma (2014) found the benefits of implementing DAD might surpass the difficulties if development managers address the challenges of collaboration, such as different languages and extended time zones. Bergadano, Whittaker, and Falk (2014) emphasized that, on a higher level, the challenges of collaboration, direction, and managing organization activities in a distributed Agile environment are a function of cultural, geographical, temporal, and linguistic characteristics of dispersed development settings.

Shrivastava and Rathod (2015) reached conclusions similar to those reported by Bergadano et al. (2014). They sought to identify risks to the performance of distributed Agile teams among 13 organizations and 28 projects, and discovered 45 distributed Agile development risk factors in five risks categories: (a) group awareness, (b) project management, (c) technology set-up, (d) software development lifecycle, and (e) external

stakeholder (Shrivastava & Rathod, 2015). Shrivastava and Rathod mapped DAD risk factors to Agile principals, challenges of distributed environment, and mitigation factors, and concluded the incompatible properties of Agile methodology and distributed environments are strong contributors to the number of risk factors in every risk category.

Hoda and Murugesan (2016) described the various challenges managers of DAD teams face according to levels, such as project, team, task, and individual. Each level of challenge requires a specific approach and mitigation (Hoda & Murugesan, 2016). Hoda and Murugesan found the keys to effective and successful project management are good communication, knowledge sharing, and appropriation of suitable technologies. The discussion of critical collaboration challenges, the demands for knowledge sharing, and complexities imposed by remote nature of distributed teams are the subjects of the next sections.

Collaboration challenges of DAD. Alzoubi et al. (2016) explored the alignment between the Agile principle of the frequent close cooperation (Beck et al., 2001) and the remote nature of distributed development. Alzoubi et al. found and categorized factors that complicate communication in the context of geographically DAD: physical distance, team configuration, project characteristics, and customer interaction. Rizvi et al. (2015) categorized communication complexities applicable to remote teams as communication challenges that included (a) time zone differences; (b) deficient asynchronous interaction; (c) language barriers; (d) imperfect collaborative infrastructure; and (e) insufficient cooperation on priorities, requirements, and reviews. Alzoubi et al. reviewed literature to analyze the communication factors complicating collaborations in DAD teams and

recommended potential solutions. They found several mitigating characteristics that included limiting distribution to no more than two teams, encouraging face-to-face communication via video tools and site visits, facilitating frequent product demonstrations, supporting trust and honesty in the team, promoting organizational support of rapid and frequent communication, and systematic refactoring of development code.

Effective interaction and consistent communication within a development organization translates to higher performance by development teams, as compared to individual contributions (Mansor et al., 2016). Korkala and Maurer (2014) proposed improving communication by identifying waste in the communication process. Paasivaara and Lassenius (2014b) found that projects could be successful even with communication waste when balancing measures such as regular and frequent collaborations take place. Practices such as daily meetings might also improve the quality of collaboration on large Agile distributed teams (Paasivaara & Lassenius, 2014b). Alzoubi et al. (2016) suggested utilizing enterprise architecture as a partial solution to DAD collaboration challenges, based on their hypothesis of the role of enterprise architecture as a unifying collaboration platform that removes communications barriers. From the technology perspective, Yagüe, Garbajosa, Díaz, and González (2016) observed modern web-based tools such as messaging, screen sharing, common document repositories, code control tools, and video conferencing improve communication and collaboration among remotely located teams.

Geographic, temporal, and cultural constraints. Bergadano et al. (2014) described the three types of distances in DSD as geographical, temporal, and sociocultural. These distances are the product of distributed allocation of development teams; they represent challenges as well as advantages to Agile development (Bergadano et al., 2014). *Geographical* or *spatial difference* is the physical displacement of teams or team members (Nguyen-Duc, Cruzes, & Conradi, 2015). When spatial dispersion is a problem, teams have difficulty adhering to the Agile principle of face-to-face collaboration and customers working with developers on a daily basis (Beck et al., 2001; Bergadano et al., 2014). Without an effective process structure, the quality of globally developed software might suffer (Naeem, Qadri, Saleem, Bashir, & Ghafoor, 2014). Even though geographical distances might be necessary within the team, managers can implement well-aligned communication structures to reduce the impact on team performance and product quality (Bano, Zowghi, & Sarkissian, 2016).

Bano et al. (2016) applied Conway's law, a description of the similarity between the product design and the development organization, to model structuration of the communication process. They found improved communication structures have a direct impact on team effectiveness (Bano et al., 2016). Bano et al. formulated the values of mutual respect, flexible working hours, regular conference calls, and skillful use of collaborative tools as fundamental to effective communication in DSD. Belsis, Koutoumanos, and Sgouropoulou (2014) recommended prioritizing the utilization of tools that aid in synchronous communication (e.g., video conferencing, direct calls, chat) with less reliance on asynchronous communication (e.g., e-mail, electronic boards, online

forums). Using near-real-time instant messaging tools might also mitigate spatial challenges of DSD (Haig-Smith & Tanner, 2016).

Temporal dispersion is the difference between work time or time zones and, similarly to spatial distance, the hurdles of temporal distance are typical and wide-ranging (Alzoubi et al., 2016); Nguyen-Duc et al., 2015). Espinosa, Nan, and Carmel (2015) posited that the temporal gap has a greater impact on team performance than does the geographical gap. By studying the effects of temporal distance through a simpler concept of interactivity and measuring interactivity levels, Espinosa et al. found that using well-chosen communication technology reduced the effects of time zone differences on remote teams' performance. They noted the benefit of temporal teams' dislocation in situations when development, testing, and other activities take place in a wider temporal span (Espinosa et al., 2015). There is general agreement among scholars that coordination of cost and higher project complexity are consequences of temporal distance (Haig-Smith & Tanner, 2016; S. N. Khan, 2014; Verner et al., 2014). To mitigate these challenges, Verner et al. (2014) suggested predefined overlapping work schedules and periodic co-location of teams or team members at key moments of product development.

Human factors influencing the agile adoption process. Departing from familiar traditional methodologies and embracing an Agile process is challenging for some individuals (Gandomani & Nafchi, 2016). Gandomani and Nafchi (2016) studied human-related barriers to Agile adaptation and found inaccurate perceptions of the new methodology might be the reason for incomplete or failed transformations. These human-

related factors included resistance to change, unrealistic expectations, and cultural issues. Lenberg, Tengberg, and Feldt (2016) supported these finding, noting that readiness for change in software engineering firms is a function of members' awareness of the need for change and perceptions of inclusion in organizational change. Jovanović et al.'s (2017) grounded theory study focused on the evolution of organizational functions and roles during Agile transformation. Before engaging in Agile adoption, Jovanović et al. recommended managers should assess the level of embeddedness in traditional practices in the organization. Jovanović et al. (2017) found understanding of the Agile methodology, executive management support, team size, product owners' participation, and team members' skillsets are criteria that define transition outcome. Ensuring Agile adaptation participants are adequately trained might increase the likelihood of successful transformation from traditional project implementation (Gandomani, Zulzalil, Ghani, Sultan, & Parizi, 2015). Gandomani et al. (2015) found that training is an essential component of Agile methodology integration. Researchers provided several solutions to mitigate the lack of training, including self-training and trust in trained contributors.

Knowledge sharing in DAD. Equal to collaboration difficulties of DAD, there are challenges to achieving effective knowledge sharing in the distributed Agile environment (Zahedi, Shahin, & Babar, 2016), often resulting from increased misinterpretation of tasks and failure of distributed development teams to understand project requirements (Nguyen-Duc et al., 2015). Nguyen et al. (2015) suggested managers who want to reduce the level of confusion should endeavor to equalize the size of the team across all locations. Inayat, Salim, Marczak, Daneva, and Shamshirband

(2015) recommended both equalizing the team and promoting individual knowledge to facilitate Agile implementation. The distributed nature of Agile teams is conducive to limited documentation—an Agile principle—being replaced by in-person discussions (Inayat et al., 2015).

While technical knowledge among distributed teams is usually adequate to the task, business knowledge and an understanding of business processes might be lacking (Sundararajan, Bhasi, & Vijayaraghavan, 2014). Failure to understand business processes places software development quality and sustainability at risk (Sundararajan et al., 2014), but Agile methodology, especially Scrum methods, can be a good fit for distributed projects as long as there are regularly scheduled information exchanges, such as weekly team retrospectives and general project progress discussions (Paasivaara & Lassenius, 2014a). To streamline the practice of knowledge sharing among Agile distributed teams, Bass (2016) proposed dividing project-related information into syntactic, semantic, and pragmatic objects.

Syntactic objects represent the technical domain, semantic objects are a part of the business area, and pragmatic objects are components of project management, resources, and scheduling. In large-scale distributed projects, a strategy of knowledge sharing should be part of the Agile process (Bass, 2016). While emphasizing the importance of establishing knowledge sharing practices for scaling Agile development, Santos, Goldman, and de Souza (2015) developed a model for integrating knowledge sharing in the organizational environment and motivation activities. They reported successful knowledge-sharing practices among Agile team members enables company

competitiveness (Santos et al., 2015). Knowledge of project requirements is a critical element of the Agile team dynamic (Strode, 2016); team members depend on each other to work together and have a singular understanding of the objectives. Two additional knowledge dependency paradigms are domain expertise and task allocation (Strode, 2016).

Agile Adaptation Strategies

Although teams working in traditional, non-Agile environments might consider adopting the Agile methodology, 84% projects fail to achieve completion when the team adopts Agile methods (El Hameed, El Latif, & Kholief, 2016). Gregory, Barroca, Sharp, Deshpande, and Taylor (2016) analyzed management challenges practitioners face when they adopt Agile and revealed five themes that describe most of the difficulties in the transformation to Agile. These themes include (a) incongruence of the claims and limitations of Agile methods, (b) lack of organizational fit or support, (c) cultural incompatibility, (d) team unpreparedness, and (e) sustainability of processes and commitments.

Gregory et al. (2016) noted the need for additional research of Agile transformation challenges within the context of organizational and business environments. Noting the low success rate of adaptation of Agile methodologies, scholars in the field of software development management began studying the strategies of transformation from non- or pseudo-Agile development methods (Ahimbisibwe et al., 2015; Gandomani & Nafchi, 2016). The following discussion about strategies used in the

transformation to Agile begins with a characterization of the meaning of successful software development projects found in recent scholarly articles.

Project success outcomes. Researchers acknowledge generalizing the definition of successful project outcomes is complex (Bermejo et al., 2014; Lehtinen et al., 2014). Drury-Grogan (2014) noted similarities between the objectives of success from Agile software development projects and traditional golden triangle projects, such as schedule, quality, and resources. Commonly, the definition of software project success includes the criteria of features, budget, and customer satisfaction (Mishra & Mahanty, 2016). Bermejo et al. (2014) defined project success as the combination of (a) project functionality matching the requirements (scope), (b) delivering a particular scope ahead of the agreed completion date (time), (c) completing the work within the confines of allocated resources (cost), and (d) providing a reasonable level of reliability and usability (quality).

Dikert et al. (2016) found 29 success factors in 11 categories applicable to large Agile transformations. The most prominent success categories were support of the leadership, customization of Agile implementation to fit project needs, and access to knowledge and training**.** For the purpose of comparing and quantifying project success, Mishra and Mahanty (2016) proposed a model that includes policy decisions, knowledge transfer, software development, and team productivity sectors. They adjusted the model to represent the specifics of DSD such as lower costs of software development resources combined with the higher cost of knowledge transfer between distributed teams (Mishra & Mahanty, 2016).

Bermejo et al. (2014) underscored that developing a product to satisfy the customer is an important aspect of project success. Karvonen, Behutiye, Oivo, and Kuvaja (2017) expanded the scope of customers by including all project stakeholders and the marketplace for the product. They suggested software developers' satisfaction with developing the product might be a critical factor in success of a project (Karvonen et al., 2017). The importance of developers' contributions to project success resonated with Lindsjørn et al. (2016), who noted that perceived personal and team successes directly correlated with product quality, eventually leading to a successful project outcome.

According to Drury-Grogan (2014), the most critical choices made by Agile team members that affect project outcomes relate to work division, iterative improvements, quality, and members' satisfaction. However, Gren, Torkar, and Feldt (2017) offered a different perspective by constructing a definition of project success outcome grounded in managers leading a well-performing project. In studying performance aspects of team management, Gren at al. found projects that perform well often have agile, mature, and socially advanced teams. With a nod to the importance of flexibility and the self-organizational nature of successful Agile projects, Salleh, Al-Kautsar, Hoda, and Asmawi (2014) designated the team participants as the primary contributors to project success. Adding the variant of purpose to the description of a software project, Heeager and Rose (2014) argued that maintenance-focused Agile projects have different success criteria than development-focused projects. Regardless of the difference in focus, Heeager and Rose favored Agile process structures similar to those recommended by Lehtinen et al. (2014) for purely development projects.

Using the concepts of project success outcomes, researchers studied the factors affecting the outcomes of distributed projects during adaptation of Agile methodology. Shrivastava and Rathod (2015) defined the risk factors as circumstances that threaten successful results. In a subsequent study that focused on the DSD, Shrivastava and Rathod (2017) noted a lack of clients' commitment and insufficient customer collaboration as key factors in projects failures. Similarly, Papatheocharous and Andreou (2014) reported the primary reasons for Agile transformation project failure are inadequate collaboration between the product owner and development teams and insufficient understanding and knowledge of Agile methodology concepts.

Some of the causes of insufficient collaboration are language gaps between remote teams (Shrivastava & Rathod, 2017) and cultural differences between international team members (Gandomani & Nafchi, 2016; Nguyen-Duc et al., 2015). Haig-Smith and Tanner (2016) suggested Agile team members must overcome cultural differences for the team to become a high-performing one. Similarly, Ghobadi (2015) pointed to challenges of harmonizing activities across teams whose members have different social and cultural backgrounds, while Yu and Petter (2014) warned about potential conflicts resulting from cultural disparities. Jørgensen (2014) found similar risks to successful project outcomes in implementation of small distributed projects.

Belsis et al. (2014) concluded that detailed requirements analysis is critical to the success of distributed Agile projects. Consistency and clarity of requirements can be challenges for distributed Agile team members, and an automated framework for requirements validation can be helpful (Belsis et al., 2014). Mishra and Mahanty (2016)

suggested that remote or outsourcing teams should not participate in requirements analysis and definition, but rather concentrate on testing and coding tasks. Other factors for improving Agile distributed project outcomes are technology integration and team-tailored processes (Rasnacis & Berzisa, 2017). Venters et al. (2014) asserted successful software delivery is unlikely to occur without the application of experienced decision making when complex technological solutions are being created. Structuration and adaptation of new technologies into new employee structures, attitudes, and perceptions are essential for successful transformation to theAgile project management methodology and to achieve a positive project outcome (Lenberg et al., 2016; Papatheocharous & Andreou, 2014). Papatheocharous and Andreou (2014) asserted that half of the 250 participants in their study identified the established company culture, resistance to moving away from Waterfall methodology, and lack of training were hurdles to project success in Agile transition.

Adoption strategies. Gandomani and Nafchi (2014) suggested approaching Agile transformation by measuring the level of software team agility to assess the need and efforts for transforming development practices. Using almost 50 agility criteria, Gandomani and Nafchi formulated an expression of agility as a sum of the products of criteria incorporation level and criteria weight. They later combined this study with their work on Agile adaptation facilitators (Gandomani et al., 2014) to develop an Agile transformation framework that was intended to simplify agile methodology conversion for small and medium-sized companies (Gandomani & Nafchi, 2015). Olszewska et al.'s (2016) complementary study revealed the impact and cost of Agile transformation; the

level of improvements offered by Agile methods would absorb the cost of Agile transformation for projects and teams. Specifically, after Agile transformation, six out of eight measured performance parameters were significantly improved, while only one measure deteriorated. Olszewska et al. also offered a concise metric for comparing pre- and posttransformational performance.

Based on a study of 45 practitioners experienced with the adoption of Agile practices, Solinski and Petersen (2014) identified four strategies of transformation from traditional rigid development to Agile development. They found that strategy selection depends on the extent of complexity and scope of traditional practices, as well as the size and structure of the organization. A common *big bang* strategy translates to complete and concurrent replacement of all rigid development processes with Agile processes. This strategy is associated mostly with teams of mainly rigid development or plan-driven organization (Solinski & Petersen, 2014). Among teams in which some Agile practices were already in place, Solinski and Petersen found the gradual removal of rigid development practices and replacement with Agile practices was more popular. The strategy of adding various Agile practices while building a new team and team structure was found more frequently in smaller organizations than in larger organizations. Finally, a hybrid strategy of Agile adoption included incrementally introducing Agile processes into development while maintaining the overall traditional plan-driven development scheme. Solinski and Petersen found the main benefits of pure Agile conversions were product quality and value offered to the product owner.

Rizvi et al. (2015) noted that Agile adoption strategy frequently included pilot projects, the objectives of which were to familiarize the organization with the Agile approach in DSD. Organizations in which prototype projects took place reported a high likelihood of successful adoption of Agile for regular operations (Rizvi et al., 2015). Furthermore, holding seed strategy (project conception) and maintenance (during project implementation) meetings with remote teams improved the process of Agile methodology adoption.

El Hameed et al. (2016) developed a framework to utilize Agile structures to improve the process of Agile transformation. They identified links and the relationship between Agile structures and presented the framework in the form of mind maps. Abdalhamid and Mishra (2017) extended El Hameed et al.'s study and the use of developed mind maps by identifying five critical dimensions and factors of the Agile transformation process: organization, people, technical, project, and process. These dimensions include almost 30 success criteria. Among the most important measure of success that overlaps process and the technical domain is the presence of efficient and tailored Agile practices (Abdalhamid & Mishra, 2017), but Abdalhamid and Mishra failed to prioritize the importance of transformation success factors. Before engaging in the transformation process, Ahimbisibwe et al. (2015) recommended managers carefully review available methodology options for fitness of a match between the objectives of the project objectives and the methodology. Ahimbisibwe et al. presented a list of 37 success criteria based on scholarly publications and the value of each criterion in Agile and

traditional approaches. The qualitative valuations of criteria serve as the basis for managers to compare when choosing between Agile and traditional approaches.

For managers who select an Agile approach, Rasnacis and Berzisa (2017) suggested a method for integration of Agile methods into project execution. Rasnacis and Berzisa constructed a transformation scheme that consists of several phases such as preparation, employee analysis, Agile method selection, adoption, and implementation. Preparation and employee analysis are the stages of greatest importance when addressing the influence of human factors on the success of Agile transformation (Rasnacis & Berzisa, 2017).

Continuous improvement approach for DAD. Similar to establishing a process of knowledge sharing, a practice of continuous improvements is a fundamental principle of the Agile approach (Beck et al., 2001; Hinojo, 2014). Paasivaara and Lassenius (2014a) found creating an efficient Agile process and effective team coordination requires optimization of the full development cycle. Such optimization translates to continuous improvement at every step in the development process, resulting in continuous release planning, continuous integration, continuous testing, and continuous delivery (Paasivaara & Lassenius, 2014a). In their study of agility processes modeling, Mandal and Pal (2014) added regular collaboration with the client and self-organization to the Agile paradigm of continuous improvement.

Papadopoulos (2015) further refined the concept of team self-organization to include self-improvement activities such as frequent retrospective meetings in which the team discusses enhancements to present practices. Fontana et al. (2015) noted that

continuous improvement practices represent the highest level of methodology optimization because the practices reflect unceasing changes in organizational and business environments, team dynamics, and customer requirements. Dingsøyr and Lassenius (2016) revealed a recent trend in managerial strategies for continuous improvements in Agile processes, noting an increase in the frequency of delivering required updates and functionality. They observed the transformation in the emphasis of Agile software development from project performance improvements to offerings of ongoing value to an organization. Denning (2016) found that continuous incremental improvement of development processes and frequent product deliveries could lead to increased team productivity and customer satisfaction, and suggested continuous feature delivery has a positive effect on the quality of developed software and the overall success rates of projects.

Transition and Summary

Section 1 of the study included definitions of the problem and purpose statements, along with the description of the nature of the study. In this section, I provided justifications for choosing a qualitative approach with multiple case study design. I also presented a collection of the interview questions designed to address the research question. The first section also included identification and specifics of the conceptual framework selected for the in-depth exploration of Agile methodology adoption for distributed teams. This section also contained operational definitions as well as perceived and experienced assumptions, limitations, and delimitations of the study. I presented the description of the research significance and potential social impact in the Significance of

the Study subsection. The final component of Section 1 contained an extensive review of related current scholarly literature on the topic of Agile and distributed software development. During my review of literature, I found a number of attempts to align theoretical frameworks to practical strategies of Agile implementation. I also noted that the temporal, cultural, and collaborative challenges of distributed Agile development dominate the professional and academic literature in the global domain of software development management.

In Section 2, I present further reasoning for selecting the research method and study design. I elaborate on my role and responsibilities as a single researcher during this study. Section 2 includes descriptions of data collection techniques, instruments, and analysis procedures. The section conclusion contains steps and actions to ensure the reliability and validity of the study. Section 3 includes discussions of the findings, suggestions for professional application, and implications for social change. Also in this section, I propose recommendations for additional research and practical development of management strategies. I conclude Section 3 with my experiences and observations during the doctoral study and present the final data analysis.

Section 2: The Project

In Section 2, I present my role as the researcher, describe the purpose of the research, and explain the approach and criteria for selecting prospective study participants. Also, I include a brief examination of research methods, study design methodologies, and my rationale for selecting a qualitative method with multiple case design for this study. I also explain consideration for ethical parameters and principles applicable to this study. In addition, the section contains a description of population sampling followed by a review of the methods for collecting, organizing, and analyzing the data. I conclude with a discussion of my approach to ensure the reliability and validity of the research and steps for minimizing potential biases and assuring credibility and confirmability of the study.

Role of the Researcher

A researcher conducting a qualitative study has the responsibility to perform rigorous research, assure clarity of presented cases, apply a strategy for developing outcomes, and manage available resources (Yin, 2014). The role of the researcher is to pursue the goal of intimate understanding of the research topic, to keep an open mind, and to enrich social science with a high-quality, repeatable, and ethical exploration of a subject contributing to business practice (Kaczynski, Salmona, & Smith, 2014). During the study, the researcher becomes the primary data collection instrument (Peredaryenko & Krauss, 2013). Beneficial attributes of the interviewer as a data collector in qualitative research include adaptability and ability to follow up to confirm and clarify participants' statements (Granot, Brashear, & Motta, 2012). Researchers should identify and expand

on the relevant information during interviews (Tomkinson, 2015). Researchers also should be cognizant of their influence on the interviewee and minimize the effect of personal opinions during conversations with participants (Granot et al., 2012). As the sole researcher on this study, I conducted and recorded all of the interviews. I avoided influencing participants during data collection by following the interview protocol, maintaining neutrality in follow-up questions, and suppressing manifestations of my personal opinions.

In a qualitative study, the researcher often employs interpersonal skills to connect with the participants to better understand the subject and context (Collins & Cooper, 2014). This personal involvement creates an opportunity for injecting personal subjectivity (Gentles, Jack, Nicholas, & McKibbon, 2014; McDermid, Peters, Jackson, & Daly, 2014). Although a researcher with a professional connection to the study topic might encounter positionality challenges with study participants (Green, 2015), there are advantages to being an insider researcher. For example, the insider researcher has knowledge of the field of study, context understanding, the ability to formulate appropriate questions, appreciation of participants' input, and access to resources. Insider researchers must scrutinize their principal viewpoints for any sign of conflict or partiality (Nyman, Berg, Downe, & Bondas, 2016). For more than 10 years, I managed Agile and non-Agile distributed development teams; as such, I considered myself an insider researcher for the scope of this study. I also have degrees in computer science and business management, with a direct relationship to the topic of this study. I understood the benefits and vulnerabilities of my involvement in the study in the role of primary

researcher. I often reflected on my core professional perceptions to identify any partiality or influence I might have introduced during the study. I also avoided selecting study participants with whom I may have had a professional affiliation and took other precautions for conducting an objective and impartial study.

The Belmont Report is a blueprint of ethical guidelines for conducting a study that involves human subjects (Cugini, 2015). The focus of the Belmont Report is the welfare and protection of research participants (Bromley, Mikesell, Jones, & Khodyakov, 2015). The three principles highlighted in the report are respect, beneficence, and justice in the selection of participants (Cugini, 2015; Vitak, Shilton, & Ashktorab, 2016). While conducting the research, I adhered to the highest ethical standards defined by Belmont protocol. I behaved ethically by demonstrating respect and appreciation for participants' involvement and by placing their needs above the needs of the research. I also adopted the utmost levels of care when selecting the participants to make sure their inclusion in the study had no adverse impact on their career and life. I informed the participants about their right to withdraw from the study at any time. In accordance with Walden University ethical guidelines, I completed the National Institutes of Health training course (Certification 2027339) designed to promote knowledge of ethical human participation in scientific studies. The Walden institutional review board (IRB) reviewed this study for adherence to ethical standards (IRB Approval Number 01-22-18-0609391).

Research decisions and study components might reflect the personal lens and biases of the researcher (Gentles et al., 2014). Researchers may be inclined to look for expected data or information (Morse, 2015). As a result, a researcher is likely to

introduce personal choices and opinions (Fusch & Ness, 2015; Morse, 2015). Understanding and continuing to be vigilant about personal subjectivity are necessary steps in maximizing the validity and objectivity of the study (Cope, 2014; Peredaryenko & Krauss, 2013). To minimize the researcher's decision-making and reasoning bias, Cope (2014) recommended maintaining a reflexivity diary. Peredaryenko and Krauss (2013) suggested using an audit trail log for recording the process of making decisions and conclusions. Sealey-Ruiz and Greene (2015) advocated for thick descriptions, member checking, data triangulation, and continuing refinement of the hypothesis. I recognized and accepted personal propensity for bias during the research, and I was wary and attentive to manifestations of prejudice and partiality during the study. I maintained a reflexivity diary and audit trail log to mitigate personal opinions developed during my professional work experience. I triangulated the interview data with referential documentation and provided extensive descriptions of analysis development and decision-making.

Participants

Limburgh et al. (2013) and May and Perry (2014) noted the advantages of selecting participants with direct subject expertise when conducting a qualitative study. The sample selection pool consists of populations defined by eligibility and availability constraints (Harriss & Atkinson, 2015). Namageyo-Funa et al. (2014) advised that the identification of suitable criteria and eligible participants should take place before the start of data collection. With prudent sampling, each participant might provide unique and rich information (Wu, Huang, & Lee, 2014). For this study, the participants were

development managers of companies in Northern California who led distributed software teams through successful adoption of the Agile methodology. The eligible middle- or senior-level managers were those who managed distributed teams during the Agile adoption process with a minimum of three directly reporting developers. The participants had not less than 4 years of experience in managing software development teams.

Recruitment of study participants is a critical component of qualitative research (James, Taylor, & Francis, 2014). Valdez et al. (2014) and Lane, Armin, and Gordon (2015) found that Facebook is an appropriate venue for sourcing qualitative research participants, but suggested the researcher pay attention to preserving the privacy and confidentiality of the participants. Bender, Cyr, Arbuckle, and Ferris (2017) and Carter-Harris, Ellis, Warrick, and Rawl (2016) reported Facebook was a cost-efficient recruitment tool. My recruiting strategy for this study included the use of Agile software development groups on social networks such as LinkedIn and Facebook, as well as my direct contacts for the recommendation and introduction to potential participants. I used LinkedIn and Facebook direct messaging to approach potential candidates with a brief description of the study that included the narrative of possible study benefits to the industry and participants. I e-mailed selected personal contacts and asked for references and introductions to qualified participants and followed up in a timely manner on received recommendations with the same direct messaging used for Facebook and LinkedIn contacts.

To establish and maintain working relationships, a researcher should keep his or her authenticity, show exceptional respect, and demonstrate effective communication and

listening skills (Collins & Cooper, 2014; Granot & Greene, 2015). Trust is another essential element for establishing a working relationship with participants (Hirschberg, Kahrass, & Strech, 2014). Tomkinson (2015) noted that the request for informed consent has a positive impact on the researcher-participant relationship. In addition to asking for informed consent, I attempted to arrange introductory face-to-face meetings with participants. The in-person introduction provided me with an opportunity to build a closer working relationship.

The strategy of validating preselected participants for their alignment with research questions might include checks of participants' references, a web search of work history, and a pre-interview phone conversation (Hoeffler, 2015; Palinkas et al., 2015). Incomplete validation of participants or their characteristics might affect study validity or add to study limitations (Golan, Sinai-Gavrilov, & Baron-Cohen, 2015). The participants were required to be managers of software development teams at the time the participants led their organization through a successful adoption of Agile methodology in the context of distributed teams. The participants should have been managing distributed teams prior to and during the Agile adoption process. I evaluated the participants' eligibility by reviewing available public information about their work experiences. If I was not able to collect sufficient information from the initial review, I sent a brief e-mail questionnaire focused on clarifying eligibility criteria. If necessary, I followed up with a pre-interview phone call to verify any remaining eligibility details.

Research Method and Design

A study design should reflect the study purpose (Bell, 2014; Choy, 2014). The purpose of this study was to explore working managerial strategies in a specific organizational context. The most applicable method for this research was qualitative. A qualitative approach is suitable for deep analysis of a phenomenon (Yin, 2014). A multiple-case study design allowed me to add breadth to the study by exploring several organizations in which managers employed successful strategies to adopt the Agile methodology.

Research Method

When employing a qualitative method, scholars explore the roots of phenomena in social and business environments described in words and conversations (McCusker & Gunaydin, 2015). The qualitative method follows inductive reasoning with theory development based on the topic being explored (S. N. Khan, 2014). When the topic has not been extensively studied, a researcher might learn more about a phenomenon through qualitative study (Tavakol & Sandars, 2014). The strengths of qualitative design are in understanding social dynamics through uniform investigation and developing broader understanding via unstructured examination (Choy, 2014). A qualitative method was the most suitable for this study because I investigated the topic by studying the experiences and perspectives of the participants.

Researchers use the quantitative method to study associations between measurable characteristics of events or entities (Ritchie & Ormston, 2014). Reliable numeric data are a foundation of a quantitative research (Tavakol & Sandars, 2014). By

applying statistical analysis, a researcher determines whether there is quantifiable evidence that supports a predefined theory (White & Millar, 2014) and makes conclusions based on objective measurement and the strength of numeric indicators (Hamer & Collinson, 2014). Quantitative research is often narrow in its scope of examination (Vohra, 2014). In this study, I did not intend to investigate correlation and causality and plan for an extended examination of the topic. Therefore, a quantitative approach was not appropriate for my research.

In the mixed-methods approach, the researcher combines the benefits of qualitative and quantitative methods (Choy, 2014). By employing a mixed-methods approach, a researcher might use findings produced from a quantitative part of the study to feed the qualitative portion of the research or vice versa (Morse, 2016). Molina-Azorin (2016) suggested that mixed-methods research in the field of business might enrich the understanding of business dynamics by triangulating the results of qualitative and quantitative approaches. However, a mixed-methods approach can be time- and resource consuming (McCusker & Gunaydin, 2015). A mixed-methods approach would not have been appropriate for this research.

Research Design

For this research, I employed a multiple case study design. Vohra (2014) described a multiple case design as effective for in-depth topic exploration and for conducting a valid study by showing the repeatability of findings. Researchers use multiple case study design to ensure replicability and to confirm the findings through exploration of multiple cases (Storm, van Gestel, van de Goor, & van Oers, 2015; Yin,

2014). By comparing several cases in a multiple case study, a researcher might reveal a deeper comprehension of the effects and associations between studied groups (Raeburn, Schmied, Hungerford, & Cleary, 2015; Storm et al., 2015). When conducting a multiple case study, a researcher concludes exploration of individual cases with comparative analysis (De Massis & Kotlar, 2014). Stake (2013) suggested a cautious approach to the selection of each case. The cases must epitomize the theoretical foundation to culminate in predicting or contrasting derived concepts (De Massis & Kotlar, 2014). Yin (2014) warned that a researcher must prepare to formulate and defend the claims of similarity or contrast between selected cases. When selecting the cases, I applied narrow inclusion and broad exclusion criteria for study participants to ensure homogeneous sampling and adherence to conceptual propositions.

In addition to case studies, researchers also use phenomenological, ethnographic, and narrative designs when conducting a qualitative study (Yin, 2014). Researchers conduct a phenomenological study to understand the core of individuals' experiences and participation dynamics during an event (Sanders, 1982; van Bendegem, van den Heuvel, Kramer, & Goossens, 2014). Wagstaff and Williams (2014) considered the phenomenological design a tool for exploring the view of a phenomenon with an idiographic bias toward a participant's perspective. The phenomenological design was not appropriate for the present study because this approach requires a comprehensive examination of participants' lived experiences, which was not needed for answering the research question.

Ethnography is a design that researchers use when studying social trends and behaviors over a prolonged period of time (Hägg-Martinell, Hult, Henriksson, & Kiessling, 2017; Leslie et al., 2014). In an ethnographic study, the researcher often immerses himself or herself and engages in the context for an extended period of time to observe extemporaneous representative moments in an otherwise ordinary setting (Marion, Eddleston, Friar, & Deeds, 2015). Ethnographic design was not suitable for this research because neither a community nor societal development was the topic of this research.

In conducting narrative research, a researcher examines the omnibus of a story presented by tellers (De Loo et al., 2015). While conducting a narrative study, the researcher focuses on the language, conversation structure, and the edifice and story of the plot (Ormston, Spencer, Barnard, & Snape, 2014). An important aspect of narrative research is the chronological progression of activities evolving over a period of time and an identification of elements influencing the events (Corner, Singh, & Pavlovich, 2017). Narrative design is inconsistent with the study of business development because the focus of the present study was in strategy development and project planning rather than an exploration of managers' perceptions of events.

Researchers must reach data saturation when performing qualitative study (Fusch & Ness, 2015). A researcher reaches the point of data saturation when no important new information surfaces during interviews (Roy, Zvonkovic, Goldberg, Sharp, & LaRossa, 2015; Tavakol & Sandars, 2014). An additional indication of data saturation is the absence of unfamiliar concepts during the review of interview discussions (Houghton,

Casey, Shaw, & Murphy, 2013). To ensure I achieved data saturation, I continued data collection until no new relevant and noteworthy data emerged during conversations with study participants.

Population and Sampling

The population of this study was the managers from five U.S.-based companies located in Northern California who led distributed teams through the efforts of Agile methodology adoption. I used the purposeful sampling method to recruit the participants. Purposeful sampling is appropriate when there is a need for decidedly relevant material (Palinkas et al., 2015; Yin, 2014). A researcher using purposeful sampling might acquire highly influential and expert sources for the qualitative study (Gentles, Charles, Ploeg, & McKibbon, 2015). The researcher strengthens the study rigor by using purposeful selection because of the presence of more knowledgeable and authoritative sources (Valerio et al., 2016). The use of purposeful sampling for this study allowed me to gain the intimate expert level of details necessary for enhancing my understanding of the topic.

The number of participants reflects the objectives and scope of a study (Roy et al., 2015). A smaller number of participants allows for more in-depth exploration (Cleary, Horsfall, & Hayter, 2014). A smaller number of participants is desirable when the researcher seeks to gather specific information and wants to focus on the depth of case exploration (Cleary et al., 2014). Robinson (2014) stated that for idiographic research, the population sample size could be small to allow for a thorough examination of interviews and other collected data. To conduct an extensive in-depth exploration of adoption of the

Agile methodology, I gathered information from five managers of five organizations. This sampling size was appropriate for the study because I focused on the depth of understanding and exploration of the topic requiring extensive interviews and analysis of the data derived from those interviews.

Study validity is contingent on sampling, relevance of data, and data saturation (Elo et al., 2014). Elo et al. (2014) posited that achieving data saturation is an indication of an appropriate sample size. A sufficient and selective number of participants should lead to data saturation (Cleary et al., 2014). Roy et al. (2015) suggested assembling a more homogeneous population sample to save time and simplify the path to data saturation. Researchers might recognize the signs of data saturation when little or no new information surfaces from the interviews (Fusch & Ness, 2015; Roy et al., 2015). My approach to reaching data saturation was through persistent application of selection criteria to arrive at the homogeneity of the population sample. In addition, I reviewed documentation from possible projects, such as sprint retrospectives and sprint planning notes, to enrich data and achieve data saturation. I might also have interviewed additional participants if I encountered difficulties in reaching data saturation.

An interview setting should be private and free of interruption, while offering a comfortable environment and accessible location (McDermid et al., 2014). The location of the meeting might have an impact on recruitment efforts, with participants preferring a safe, businesslike, and nearby location (Namageyo-Funa et al., 2014). If possible, a participant should be able to choose the location of the interview (Lasten, 2016). Considering the participants were managers working from their offices in the particular

geographic area, I set up the interview appointment in their offices or in the meeting rooms frequently available in software organizations. Another option was to set up a meeting in a local library or rent a conference room in offsite centers abundantly present in the Bay Area.

Ethical Research

The rationale for obtaining informed consent from study participants is to assure the participants understand the risks, benefits, and responsibilities they assume by taking part in the study (Hallinan, Forrest, Uhlenbrauck, Young, & McKinney, 2016). Securing informed consent is a process during which participants are provided necessary information about the research with which to make a well-informed decision of whether to participate in the study (Bromwich, 2014). An uncomplicated informed consent process with a clearly and positively written consent form might be helpful with recruitment and retention of study members (Hallinan et al., 2016). Hallinan et al. (2016) recommended the researcher provide sufficient time for potential participants to review and understand the consent. I dedicated time to educate and discuss the study specifics with potential participants as well as encouraged them to understand and actively participate in the informed consent process. I shared with potential participants a comprehensive description of the study process and a clear identification of their role in the research. I included these individuals in my research only once they provided their informed consent.

The process of procuring informed consent included providing information about participants' ability to withdraw from the study. Participants have rights to withdraw

from the study at any time (U.S. Department of Health & Human Services, 1979). The request for withdrawal does not require a reason, and the researcher must grant the request unconditionally and without penalty (van Wijk, 2014). As a part of the withdrawal procedure, the researcher should remove any participant's related data from the study (Skinner et al., 2015). I reiterated participants' withdrawal rights before initiating the interview process with each individual.

Offers of incentives for participation in a study might have unexpected effects (U.S. Department of Health & Human Services, 1979). Participants often welcome the incentive of receiving the final study results (Namageyo-Funa et al., 2014; Skinner et al., 2015). While recruiting the participants, I did not offer incentives for participation in the study. However, I offered to share the copy of this study or a summary of results, if requested. I also made sure that the participants did not incur any financial hardship, such as transportation expenses. In the case of reasonable transportation costs, I offered to reimburse the participant before the start of the interview process.

I applied several measures to assure the ethical treatment of participants. I acted ethically by showing deference and gratitude for the participants' contribution to the study. I always prioritized the needs of the participants over my needs as a researcher. I also respected without questioning the participants' wish to quit the study, should they have indicated the desire to terminate their participation. Per Walden University requirements, I obtained Walden University IRB approval for conducting the study before beginning recruitment or data collection. The purpose of IRB approval is to assure

the researcher is aware of and follows ethical guidelines developed to protect study participants (Walden University, n.d.).

Kantanen and Manninen (2016) posited there are three pillars of participant ethical protection: (a) respect of privacy; (b) avoidance of mental, social, or financial harm; and (c) protection of information and data collected during the research. Protection of collected records and private information necessitates continuing consideration and attentiveness to data security (Saunders, Kitzinger, & Kitzinger, 2015; Saylor, 2015). Kinouani et al. (2016) and Audrey, Brown, Campbell, Boyd, and Macleod (2016) anonymized interview transcripts and data linkages to protect participants' privacy. Audrey et al. asked the informants to use nicknames during collaborations and interviews, and obfuscated any identifying data; furthermore, Audrey et al. stored all digital data in encrypted form. Barnhill and Barnhill (2014) recommended avoiding the use of personal or organizational identities and keeping the study materials locked in secure locations when not in use. They also suggested the use of password-protected storage and offline data archival. I was diligent in ensuring the privacy protection of study participants. In case a third party participated in interview transcription, I redacted any personal identification or organization name from the original audio recording. Throughout the study, I have refered to participants' organizations in a general and nonidentifiable manner. I encoded data with a unique key assigned to each participant. I was the only person in possession of the keys. The keys and collected data were stored on separate storage media. I encrypted the collected data and stored them on privately accessible Google Drive folders for the duration of the study. After completion of the

study, I archived the data to an encrypted thumb drive that I have kept stored in a personal safety deposit box, thus restricting any network access to the data repository. I will destroy the data and the keys 5 years after study completion.

Data Collection Instrument

The researcher is a principal data collection instrument (Peredaryenko & Krauss, 2013) in many studies and, as such, is inseparable from the study and can affect the study outcome (Fusch & Ness, 2015). The researcher should be cognizant of injecting personal opinions in the data collection process (Gentles et al., 2014). The researcher should also resist yielding to confirmation biases for data selection (Morse, 2015). As the only researcher involved in this study, I collected data by conducting semistructured interviews and gathering and reviewing related documentation. I was the only data collection instrument for this study.

Interview, observations, and documents are some of the primary sources of data in qualitative case studies (S. N. Khan, 2014). The main data collection method for this study was semistructured interviews. The semistructured style of interview is an adaptable method for collecting information from participants (Sherman et al., 2014). The versatility of semistructured interviews results in flexibility in answering open-ended questions in a free-form process under a researcher's guidance (Doody & Noonan, 2013; McIntosh & Morse, 2015). While conducting semistructured interviews, the researcher needs to maintain a collective understanding of the context and patterns shared by the participants (Mojtahed, Nunes, Martins, & Peng, 2014; Reuben & Bobat, 2014). I conducted open-ended semistructured interviews with subject experts to collect their

experiences and perceptions of Agile methodology adaptation projects. I used the interview protocol (see Appendix A) to ensure uniformity of the interview process I followed with all the individuals who accepted my invitation to participate in the study and signed the informed consent form. During semistructured interviews, I was able to clarify my understanding of participants' answers, validate assumptions, and explore the depths of the topic through probing questions and participants' open-ended answers.

Collecting data from several sources enhances the quality of case study research (Phillips, Kenny, Esterman, & Smith, 2014). Yin (2014) described documentation as a contributing source of qualitative study data. The use of documentation expands the researcher's understanding of the subject (Carter, Bryant-Lukosius, DiCenso, Blythe, & Neville, 2014). The researcher may use documentation data to validate and complement data collected from interviews, thus reducing researcher bias and partiality (Anney, 2014). I used project documentation such as sprint retrospectives, project planning history, feature backlogs, project task and bugs review logs, team velocity records, and other archived artifacts as sources of secondary data. In software organizations, these project data are often available in electronic form as part of the Agile management toolset. I used these data to develop a deeper understanding of Agile methodology adaptation by confirming and complementing information collected from participants during the interviews.

The use of supportive sources of evidence enhances study validity through merging information inquests into consistent themes (Yin, 2014). Carter et al. (2014) stated that application of triangulation techniques increases study validity. Method

triangulation is the use of various methods to collect data; data triangulation is a convergence of data from multiple sources (Carter et al., 2014). I used both the interviews and documentation to collect a multisource data set. To assure data validity, I triangulated interview data with supporting information gathered from project documentation. Specifically, I correlated the codes extracted from the processing of interviews and documentation.

Researchers may also improve study validity by having participants review the accuracy of interview interpretation and assumptions (Harvey, 2014; Marshall & Rossman, 2014). Andraski, Chandler, Powell, Humes, and Wakefield (2014) recommended member checking and peer debriefing to enhance study validity. I enhanced the study validity through member checking. I performed member checking by reviewing the understanding and interpretation of the interviews with the key participants.

Data Collection Technique

Data collection for this study included semistructured, open-ended interviews as well as collection of archival project implementation documentation, such as sprint retrospective notes, project planning history, feature backlogs, tasks and bugs review logs, team velocity records, and other artifacts. In software organizations, such project-specific data are often available in electronic form as part of the Agile management toolset. Researchers use semistructured interviews to stimulate open-ended answers (Sovacool, Linnér, & Klein, 2017). Adams (2015) suggested semistructured interviews are appropriate when exploring newer topics or when a researcher needs to guide the

examination by asking probing and follow-up questions. The use of semistructured interviews enables adequate relevancy and in-depth investigation of the topic by providing participants with flexibility of expression (McIntosh & Morse, 2015).

To assist in keeping the interview structure consistent and uniform, researchers develop an interview protocol (Doody & Noonan, 2013; van Schendel et al., 2014). In the context of semistructured interviews, a protocol refers to a list of procedural steps describing interview process logistics and questions (Yin, 2011). I constructed the interview protocol that includes a personal introduction, confirmation of the individual's consent to participate, request for audio recording, and an ordered list of interview questions. I recorded the interview using an audio recorder for subsequent transcribing and auditing purposes. I guided the participant according to the items defined in the protocol. The conclusion of the interview protocol incorporated follow-up questions intended to encourage free-form unprompted input from the participants. The interview protocol is included in Appendix A.

There are distinct benefits to using semistructured interviews for qualitative studies. Researchers have an opportunity to ask clarifying questions and validate perceptions while conducting interviews (McDermid et al., 2014). Participants have the ability to refine their understanding of interview questions through direct interaction with the researcher (Doody & Noonan, 2013). Also, a semistructured design of the interview format is convenient for recording and reviewing the transcripts for clarity and interpretation fit (Houghton et al., 2013). Prior (2016) noted the advantage of the

semistructured interview in providing flexibility to investigate a variety of subject themes while maintaining uniform interview structure to support study validity.

Along with advantages, researchers have noted shortcomings of the semistructured interview data collection method. Adams (2105) pointed out several drawbacks of semistructured interviews, such as (a) the requirement for extended time to prepare, conduct, transcribe, and analyze interviews; (b) a generally smaller sample size; and (c) the need for the interviewer to possess advanced knowledge of the field. Other drawbacks of using interviews for data collection are the effort required to connect with potential participants as well as the participants' potential reluctance to agree to audio recording (Doody & Noonan, 2013). Prior (2016) noted the need for a researcher to possess enhanced interviewing skills and interpersonal aptitude to execute a semistructured interview effectively.

I chose to use documents as a secondary source of data to complement interview data collection. According to Owen (2014), the use of documentation enables the researcher to validate and expand data acquired through a primary collection method. Another advantage of documentation as a data source is in the opening of different perspectives and channels of information to extend the understanding of phenomena and provide additional themes during analysis (Yin, 2014). Internal company documentation might also contain data that are not readily available or data unfamiliar or overlooked by participants (Bryde, Broquetas, & Volm, 2013; Owen, 2014). Among the disadvantages of documentation as a source of data are the possibility of outdated documentation (Owen, 2014) or incorrect or misrepresented information (Bryde et al., 2013).

Member checking is a mechanism for confirming understanding, interpretation, and correctness of collected data (Simpson & Quigley, 2016). A researcher may use member checking to achieve trustworthiness and validity (Lenz & Lancaster, 2017). To increase study confirmability, Birt, Scott, Cavers, Campbell, and Walter (2016) recommended researchers should use member checking to engage participants in the construction of knowledge. Morse (2015), however, questioned the necessity of member checking, arguing that researchers using other research types usually do not provide participants with an opportunity to change collected data or the results of the analysis. Morse also warned about placing the participant or researcher in an uncomfortable situation when there is disagreement with the researcher's analysis. I edask the interviewees to review the interview transcripts for the correctness of transcription and interpretation.

Data Organization Techniques

To conduct a rigorous and effective study, a researcher should design methods for efficient storage, categorization, and retrieval of collected information (Green & Thorogood, 2013; Yin, 2014). Reflexivity records are necessary components of quality and rigor (McDermid et al., 2014). Researchers use reflexivity to enhance the trustworthiness and transparency of their study (Cope, 2014; Gentles et al., 2014). Logging personal observation and interpretation of data during transcription and analysis enhances data validity and reliability (Luckey, 2016). Thorne (2016) recommended keeping an audit trail of the data collection progression for reconstruction and recollection of research stages and for improving the study credibility. I maintained a

personal journal for cataloging research steps, recording personal reflections in the form of a reflexivity journal, and noting observations made during interviews and data analysis. I kept the reflexivity journal in the root folder of the study folder hierarchy and referenced other research documentation from the journal through embedded URL links.

Grouping data into categories simplifies searching for and navigation to specific data (Vance, 2017). Bergman, Whittaker, and Falk (2014) concluded that users who manually set up folders for data management are more efficient at locating stored data. Bedi, Bedi, Singh, and Nanda (2015) also suggested storing audio and video content together with corresponding textual documentation. Cloud storage folders and software tagging of documents are methods of effective grouping by the collection source, document types, and data relevancy (Underwood, 2016). I deposited data in Google Drive cloud storage. I created folders for individual interviews and cataloged all research data in digital form on cloud storage. I tagged or indexed various types of files with theme tags for quicker search and retrieval. I securely stored all raw data during the study and will continue to store the raw data security for 5 years after the study has been completed.

A researcher should destroy private and confidential study data to avoid an unwanted exposure of sensitive and private data (Lustgarten, 2015; Underwood, 2016). Childs, McLeod, Lomas, and Cook (2014) found retention of research data is an essential element of data security, and the length of retention may vary with the type of research and nature of the information collected. Upon completion of my study, I will encrypt and move collected raw data to a network-disconnected hard drive and will safeguard the

drive in a locked fireproof safe. I will retain study data for a 5 years after the study completion. After 5 years, I will destroy the encryption key and reformat the hard drive, thus completely erasing the study data.

Data Analysis

Collection of study data from multiple sources is necessary for conducting a reliable and valid case study research (Yin, 2014). Carter et al. (2014) posited that use of triangulation as a technique enhances data analysis. Carter listed four methods of triangulation: (a) data source, (b) method, (c) investigator, and (d) theory. When applying method triangulation, a researcher employs various methods of data collection, such as interviews, recordings, documents, inspection, and others (Carter et al., 2014). Fusch and Ness (2015) favored method triangulation for demonstrating vigor and fullness of the research. Cope (2014) and Houghton et al. (2013) suggested more objective coding is achieved by employing different data sources. I used methodological triangulation of primary and secondary data sources to allow themes to converge and support the findings. I triangulated interview data with collected documentation.

Following an initial review of the data, Yin (2014) recommended a researcher should apply one of four methods of qualitative data analysis: (a) application of proposition, (b) inductive theory construction of connected data elements and themes, (c) creation of illustrative case through a descriptive framework, or (d) examination of various contradictory theories. According to Yin, the inductive approach may be beneficial to a researcher with experience in the particular field of study. Cho and Lee (2014) suggested both inductive and deductive methods are applicable for data analysis in

qualitative studies. Wiens, Kyngäs, and Pölkki (2014) demonstrated how inductive content processing, implemented through the iterative grouping of subcategories to a final grouping, is a sound data analysis method for a case study.

Inductive processing starts with the researcher becoming familiar with the data during collection as well as replaying the interviews, rereading the transcripts, and reviewing personal notes (Govender, Mabuza, Ogunbanjo, & Mash, 2014). Yin (2014) identified five phases of the data analysis process: compiling, disassembling, reassembling, interpreting, and concluding. After collecting and becoming familiar with data, a researcher might separate parts of the collected data into logical components or apply code tags to parts of collected data (Cox & McLeod, 2014). In the third step of data analysis, the disassembled data elements become the building blocks of a more structured pattern that leads to emerging themes (Cox & McLeod, 2014). During the fourth step of interpreting the data, a researcher may select to repeat a disassemble-reassemble cycle to extract additional themes and ideas (Yin, 2014). The conclusions of the analytical process are the results of the final and fifth step of data analysis (Cox & McLeod, 2014).

At the start of the data analysis process, I familiarized myself with the collected data by reviewing the interviews and documents in the original format. Because I used a third-party service to transcribe the interviews, I validated the transcription by comparing the audio recordings with the text. While verifying each transcript, I also reviewed my interview notes taken during the interview and familiarized myself with the collected data. I used QSR International NVivo, Version 11, to assist me with the second (disassembling) and third (reassembling) steps of the analytical process. At this stage, I

triangulated the data by coding with documentation provided by the study participants and other relevant sources. I used the results of reassembling and triangulation to interpret the data and construct the prevailing themes. I also confirmed my interpretations with selected participants as a part of member checking procedure. Finally, I concluded the analysis by summarizing the interpretations of performed data analysis.

By utilizing the functionality of NVivo software, a researcher may effectively adjust and improve many aspects of coding and analysis (Yin, 2014). Green and Thorogood (2013) suggested the use of software for coding produces less biased and more consistent results, as compared to manual coding. Green and Thorogood found that NVivo stimulates the researcher's objective views of data by using internal techniques for generating a data-driven relationship between story line and keywords. The use of NVivo may assist with effective word analysis, accurate keys generation, and unbiased identification of trends (Sotiriadou, Brouwers, & Le, 2014). To reassure impartiality, I used software-driven coding techniques available through NVivo. As I progressed with learning NVivo, I used XMind 8 software to represent concepts and themes relationships via mind-mapping diagrams.

During data analysis, a researcher concentrates on deriving the themes that emerge from careful coding and triangulation of different sources (Yin, 2014). For this study, I used Cao et al.'s (2009) adapting Agile development methodologies conceptual framework, which is an extension of DeSanctis and Poole's (1994) adaptive structuration theory. The central concepts of the theory are structuration and appropriations. Structuration is the process of introducing rules, resources, and other structures into

action, while appropriation is the implementation of a structure in a particular organizational context. The selection of key themes for my study reflected the introduction of Agile procedures in software development (structuration) and customization of the development process and social dynamics for specific team environments (appropriation).

Yin (2015) asserted researchers should be familiar with the latest findings in the field of their study. The Google Scholar alert feature is a useful tool for notifying researchers about new work related to particular topic or theory (Bryan & Church, 2017; McEvoy et al., 2014). I set up my Google Scholar account with alerts based on search strings that included the terms *agile*, *distributed*, *software development*, *ACT framework*, and so on. I regularly reviewed the newest studies and, in addition to automated alerts, researched Google Scholar and Walden Library for updated publications. I incorporated new findings in my research by comparing and updating developed themes with the premises ascertained from the recently published literature.

Reliability and Validity

Commonly, researchers determine qualitative and quantitative study trustworthiness through evaluation of research reliability and validity (Elo et al., 2014). In qualitative studies, researchers interpret the principals of reliability and validity through dependability, credibility, transferability, and confirmability criteria (Morse, 2015). Such criteria are not measurable; therefore, researchers use various methods, such as members checking, transcript review, and others, to enhance the norms of research quality (Anney, 2014).

Reliability

When formulating study reliability, researchers apply the concept of dependability (Tong & Dew, 2016). Dependability denotes a consistent use of methodology, data collection, analysis, and transparency of study procedures (Tong & Dew, 2016). The significance of dependability is the indication of study longevity and durability (Anney, 2014). The researcher might enhance study reliability by using member checking (Andraski et al., 2014; Lenz & Lancaster, 2017). Member checking is a method for validating the interpretations that a researcher made during data collection and analysis (Marshall & Rossman, 2015; Simpson & Quigley, 2016). Birt et al. (2016) suggested using member checking to engage participants in validating the researcher's interpretation of the data. Reilly (2013) asked participants to review transcripts, while Harvey (2014) discussed the themes and the results of data analysis with participants. To enhance the reliability of the study, I conducted member checking after the interviews by asking the participants to review the interview transcripts and notes.

Validity

Yin (2015) identified validity as a component of the research design quality. To achieve a high level of research quality, a researcher needs to construct an authentic and comprehensive exposé of the studied phenomena (Bengtsson, 2016). Often, researchers formulate study validity through the terms of credibility, transferability, and confirmability (Lincoln & Guba, 1985; Wilkerson, Iantaffi, Grey, Bockting, & Rosser, 2014). Birt et al. (2016) noted that member checking and triangulation are techniques that enhance study validity. Carter et al. (2014) recognized the combination of method and

source triangulation, together with member checking, as credibility- and validity-enriching tools. I used member checking for a more credible interpretation and categorization of collected data. I also applied both method and data source triangulations by using secondary data and field notes to further enhance the validity of the study.

Credibility is the aspect of study validity denoting the spectrum and quality of data interpretation, conclusions, and explanations derived from collected data (Tong & Dew, 2016). Lincoln and Guba (1985) explained credibility as a trust of the study findings. Researchers attain credibility when readers are willing to accept the results of the study and possibly employ the conclusions in their activities (Tracy, 2010). A critical component of credibility is providing concrete, verifiable details and including member reflection in the study process, which implies participants' feedback in the final or intermediate study results (Tracy, 2010). Tong and Dew (2016) advised encouraging participants to provide thick descriptions in response to interview questions and member checking to support the credibility of analysis and conclusions.

Transferability of research is a qualification of relevancy of the study and findings to surroundings and conditions (Lincoln & Guba, 1985). Per Anney (2014), transferability is a representation of generalizability and external validity of qualitative research. Anney suggested that purposeful selection of participants and thick descriptions enhance transferability of a study. Researchers attain transferability when they purposefully or instinctively associate and apply the study to their circumstances (Tracy, 2010). To facilitate transferability, a researcher should share participants' extended declarations, present comprehensive descriptions, and convey the study in clear, relatable,

and easy-to-understand style (Tracy, 2010). Marshall and Rossman (2014) stipulated that establishing transferability of an older study to a new research context is a responsibility of the researcher conducting the new study. To enhance future transferability, I included thorough narratives of data collection procedures and analysis process, references from analysis conclusions to primary and secondary data sources, and explanation of study limitations.

Confirmability is the potency of the relationship between study conclusion and collected data (Guba & Lincoln, 1982). A study is confirmable if a researcher did not affect the study outcomes by injecting personal views and experiences during the data collection and analysis (Tong & Dew, 2016). Researchers achieve confirmability by engaging several researchers in the analysis process, member checking of interviews, and providing references to data and findings (Fusch & Ness, 2015; Tong & Dew, 2016). Anney (2014) recommended researchers could decrease biases and improve confirmability by keeping a reflexivity journal, applying triangulation techniques, and maintaining meticulous logs. I used member checking to ensure confirmability of my study. In addition, I kept and shared the linkages between the analysis and collected data.

Data saturation is a contributor to study credibility (Houghton et al., 2013). Yin (2015) noted that attainment of data saturation enhances study validity. Fusch and Ness (2015) suggested that lack of data saturation may decrease the quality of the research. Data saturation is evident when no new information emerges during data collection (Houghton et al., 2013). A researcher achieves data saturation when the collection of additional data produces no undiscovered information about the topic (Gibbins, Bhatia,

Forbes, & Reid, 2014). Fusch and Ness (2015) noted that the methods of achieving data saturation might be different for every study. The indications of data saturation are the presence of sufficient information to replicate the study and the impracticality of additional coding (Fusch & Ness, 2015). I continued the interview and document review processes until no new concepts emerged from the primary and secondary data sources.

Transition and Summary

Section 2 comprised the explanation of my role as the researcher, the roles and selection of participants, and the criteria for selecting the study method and design. Equally important sections were the discussion about the population and sampling, followed by the review of the ethical considerations. The conclusion of the section contained a description of data collection techniques, instruments, and analysis procedures, along with the process for ensuring study reliability and validity. In the next section, Section 3, I provide the summary of findings, recommendations for practical application, and the research implications for social change. I also suggest the direction for additional research and further development of management strategies. I close Section 3 with the presentation of the final data analysis and reflections on my experiences during the doctoral study.

Section 3: Application to Professional Practice and Implications for Change

Section 3 includes an introduction to the research and the report of the study results. In addition to the presentation of themes, the section contains recommendations for the application to professional practice. I provide a summary of suggested actions for software development managers. Section 3 also includes recommendations for further studies on adoption of Agile methodology for remote teams. In addition, I include reflections of my experiences during the doctoral journey and a summary of principles and values that may be helpful when applying the strategies of Agile development.

Introduction

The purpose of this multiple case qualitative study was to explore the strategies that software development managers use in adopting Agile methodology to successfully complete projects in the context of distributed teams. Failure to deliver on the commitments of software projects has a negative financial impact on organizations and the software industry (T. V. N. Rao et al., 2015). Additionally, the waste of engineering capital associated with failed projects might stall or impede the advancement of information technologies (Penzenstadler et al., 2014). Considering the overall impact of project failures, managers might benefit from applying proven effective strategies to improve execution of software projects.

For the purpose of this study, I conducted face-to-face semistructured interviews with five managers (M1–M5), all of whom worked in Northern California. All participants were middle- or high-level managers responsible for software development teams and had experience in adopting Agile methodologies in a distributed environment.

I also reviewed three documents (Survey of Training Satisfaction, Standup E-mail Notification Format, and Sprint Points Progression) provided in the form of project management reports and notes to triangulate the interview data and ensure validity and reliability of the study. As the result of data analysis, I found that (a) educating the teams on methodology concepts, (b) establishing iterative continuing improvement processes, and (c) implementing tailored strategies to address collaboration challenges specific to the cultural environment and distributed context may enhance the process of Agile adoption.

Presentation of the Findings

The research question of this qualitative multiple case study was the following: What strategies do software development managers use in adopting Agile methodology to successfully complete projects in the context of distributed teams? To answer the research question, I studied a number of projects in which managers employed Agile methodologies in a distributed team environment. As a part of the study, I collected data by conducting in-depth semistructured interviews and gathering project-related documentation. I conducted the interviews with experienced managers either in person at their offices or via Skype, according to their preference, and recorded the interviews using the iPhone Voice Memo utility. Availability of audio recording is helpful for reconstruction and clarification of interview data (Thorne, 2016). I used a third-party service to have the recordings transcribed, and I preserved the transcriptions in Microsoft Word documents. I used QSR International NVivo Version 11, a software application for Windows, to import the transcripts and other project documentation collected from the

participants. Using NVivo, I proceeded with several iterations of data analysis by coding concepts, aggregating the codes into groups, and finally, generating themes. The themes that emerged from the data analysis are as follows:

- Training and coaching enabled Agile methodology acceptance.
- Continuing iterative enhancements of Agile processes and ceremonies improved the efficacy of Agile adoption.
- Communication challenges are a substantial obstacle for Agile adoption.

Theme 1: Training and Coaching Enabled Agile Methodology Acceptance

The first theme that emerged from the data analysis was that training and coaching enabled Agile methodology acceptance. The participants expressed that teams' education about new methodology was essential for effective transition to Agile. All five interviewed managers (M1–M5) used various learning approaches to familiarize the teams with Agile principles, techniques, and processes and to motivate the teams to accept the new development approach. An important strategy for this education was the facilitation of team training and coaching. Educated teams were more accepting of Agile practices and engaged in the transformation process with more enthusiasm than those teams who received less training and coaching.

Training. Training played an important role in demonstrating benefits and challenges of adopting Agile methodology by development teams (M1–M4). Agile training for distributed teams was important in helping the teams understand new processes, learn how to mitigate risks, recover from failures, and share Agile knowledge with other teams or team members (M1). M4 found a substantial benefit of training when

the teams practiced the assessment of the health of development processes. During the assessment exercise, the teams identified gaps and inefficiencies in the areas of work allocation, collaboration, and tooling. Experienced trainers prepared the teams to expect challenges and failures that are common at the beginning of transitioning to Agile methodology (M2).

M1 noted the importance of all remote teams' participation in Agile training: "When multiple teams work together, it is important to engage all teams in training. Having everyone on board, not just one team going Agile, but teams working on the same one project going Agile that was also helpful." M3 described how training remotely located teams in quick progression benefited the project by creating synergy and reducing misunderstanding between distributed teams. However, M4 explained that formal simultaneous training of multiple teams was not always practical. In those cases, M4's teams had to self-train and attempt to replicate the processes established by the teams that had already completed formal training. M1 pointed out that, despite high cost, top management agreed to bring most members of the remote teams together in one location for the training, which made the event not only an educational experience, but also a team-building experience.

To understand the managers' and teams' perceptions of the value of training, I reviewed the training participants' feedback provided by M1. M1 collected the feedback after the team completed 5-day Agile training. M1 reported, "We [management] wanted to find out if we should repeat that [training] in the future." As shown in Figure 1, 60% of

trainees reported that the training would be helpful in overall Agile project execution, with only 9% rejecting the value of training.

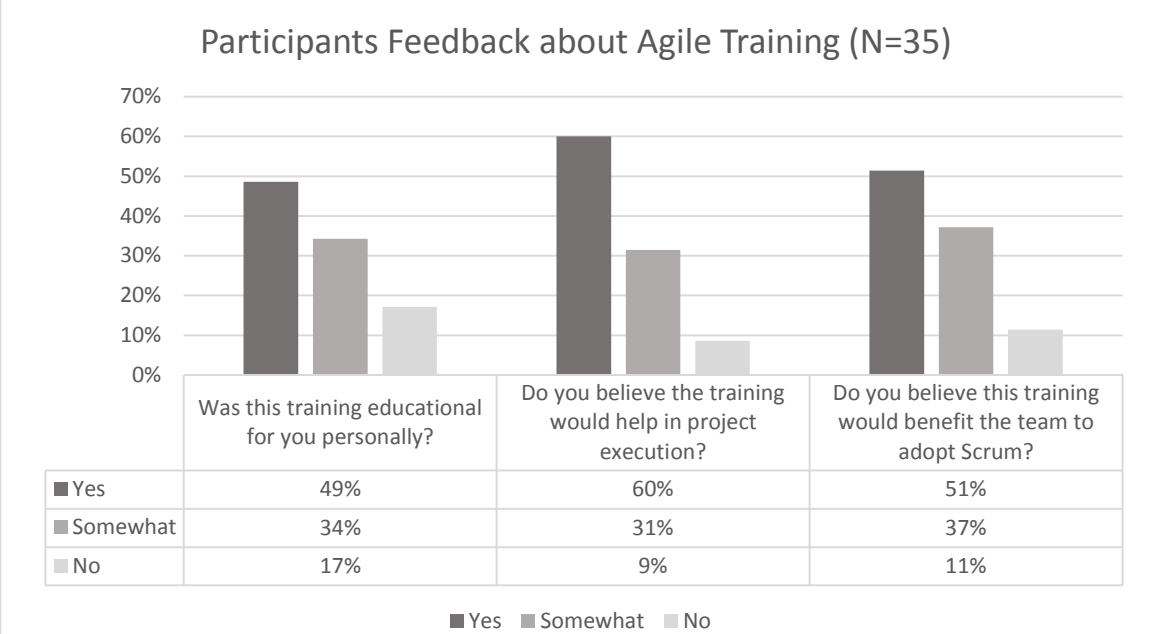

Figure 1. Participants' feedback after completion of Agile training.

As shown in Figure 1, more than half of the trainees (51%) believed the training would be beneficial during the adoption of Agile methodology, while 37% considered the training somewhat useful for Agile adoption. The survey data indicated that teams welcome Agile training and consider it a valuable team experience. M2 and M3 reported that their teams liked the training and believed that training played an important role in the realization of Agile adoption. A numerical breakdown of participants' feedback is included in Appendix B.

A lack of training exacerbated difficulties of bringing new developers on board. M1 described an example of a recently established team joining the project in progress: "They struggled for a while, not knowing why we do certain things and how to do those."

There was no formal Agile training for that team, which made it challenging to integrate the new team to the overall project. Raval and Rathod (2015) found that lack of team training or insufficient team training are factors in the delay of Agile adoption. M1 observed the similar tendency of slowing the transformation to Agile for the untrained team, mainly due to the longer time required by the new or untrained team members to align their Agile processes with the rest of the development organization.

Coaching. Coaching, according to M1, M2, and M3, was a necessary step for successful Agile transition. Coaches assisted the managers and teams in tailoring the Agile processes to align with teams' skills, environment, and project needs (M2). According to Losch, Traut-Mattausch, Mühlberger, and Jonas 2016), coaching extends the concept training with continued observation and feedback performed by the coach to help those being coached to attain their goals. When asked what strategies worked well during adaptation of Agile methodology, M1 stated, "We found that having Agile coaches—which are different from just Agile specialists—helps. Coaches are trained in getting teams trained in the project context, so that was helpful."

M1 explained that coaching consisted of a week of introduction to Agile principles and discussion of various Agile implementation examples including Scrum, Kanban, and Extreme Programming (XP). Coaches returned to teams' workplaces several times to assess how well the teams followed Agile processes and to recommend adjustments to distributed execution practices. M3 explained that coaching included practical exercises focused on assessing the types of Agile implementation for a broader cross-team fit: "We had external Agile coaches hired, I mean who helped us, set

environment, the structure." M2 believed that formal coaching was helpful in adjusting the perceptions of the organization on the benefits of the Agile approach: "[With coaches' help] the company understood the value, and we went to Agile." According to M1, coaches also assisted in the transition from Waterfall to the XP version of Agile, and shortly after from XP to Scrum.

Most coaching sessions involved every team member, but during some sessions coaches focused on educating managers about Agile leadership and prepared the managers to assume the roles of Scrum masters and project leads (M2). The managers learned about the process of work allocation and the best practices of leading recurring Agile ceremonies such as sprint planning, daily meetings, retrospectives, and others (M2). Following the coaching engagement, M2 signed up for additional courses and obtained Agile coaching and Scrum master certifications: "And then that's when I got heavily involved in Agile Scrum, and actually got certified as a certified Scrum master and a certified coach." M1 indicated the value of managers' extended hands-on coaching engagement was instrumental in building confident and knowledgeable leadership for Agile adoption.

M1 and M4 found some shortcomings in their work with coaches. For example, M1 asserted coaches did not sufficiently cover the challenges of leading ceremonies for distributed teams: "When asked for advice in setting up the, you know, a specific practice for our company, they [coaches] often suggested to try various scenarios to see which will work best." Similarly, M4 found that although some coaches were knowledgeable in

general Agile methodology, only a few had practical expertise in aligning Agile practices for multinational or distributed teams.

The training and coaching of teams before full engagement to Agile adoption had a dual effect in facilitating Agile transformation. First, familiarity with Agile translated to teams whose members were more confident and well-acquainted with Agile transition. These teams were prepared for adoption challenges and were able to coordinate integration of Agile components with their development practices. Second, the trained and coached teams were eager to engage in Agile transformation. All five interviewed managers noted that teams endorsed Agile adoption with enthusiasm when the teams understood and most importantly, accepted the need for Agile and the superiority of the Agile method over previous methods. Knowledgeable team members had fewer doubts about Agile and were less resistant to change (M1).

Teams' acceptance of Agile methods. Accepting the need to change development methodology to Agile was an important focus of Agile education and a milestone in Agile transition. Whereas some teams were eager to convert to Agile (M2, M4) and needed only minimal assistance or encouragement, others resisted the move (M1, M2, M3). Managers used various persuasion techniques to reduce individuals' skepticism and help individuals embrace the change. M2 shared several examples of teams' initial doubt and even refusal to adopt the new organizational approach. M2 shared a comment from M2's boss: "You're gonna have a hard time selling this [Agile] to developers." M2 noted that one common misconception among software developers about Agile was that they would lose control over their ability to innovate: "'Oh! That's

going to take away our creativity,' they said. They thought it would be like putting a bucket over a light." M1 explained that developers with more experience in traditional Waterfall methodology were often reluctant to transition to Agile: "So people who worked with our company for an extended period of time, they were less willing [to accept Agile], and even if they were willing, they had challenges understanding the concepts and adapting them." Some researchers observed occasional unwillingness among software developers to alter their established practices (Lenberg et al., 2016). Zanoni et al. (2014) identified this resistance as one of the primary reasons for the failure of Agile projects. Furthermore, M4 noticed that older software developers were less accepting of the principles of Agile and more hesitant to try new processes than were younger software developers.

Encouraging team members to accept Agile methodology was a challenge, and managers employed various strategies to motivate the teams to do so. In one case, a personal leadership promise of a better managed workload and reduced overtime work was sufficient for the team to engage in exploration and initial efforts to adopt Agile: "I could say that every day, you're going to know what your work is and you know your goal for that day. How would you feel about that? What if I can have your day planned out?" (M2). Team members' trust in the leaders and respect for the manager was imperative for such a strategy to achieve team acceptance of Agile. Less effective, though eventually successful, was the strategy of senior management forcing teams to transition project execution to Agile methodology. "[Top] management saw a need [for Agile] because we were facing the same challenges over and over" (M1). M1 also noted that

extensive training and coaching complemented the top management directive to migrate to Agile, thus becoming a critical component of successful Agile adoption.

Another manager described a different path of persuading the team to accept Agile as an effective development methodology. M5 found a close similarity between the process of software creation and processes of movie development in the film industry. Considering the century-long evolution of film development processes and common (software and movie) characteristics of complexity and shifting demands, M5 began adapting some practices of film creation for software teams:

> The film industry, believe it or not, use(s) a lot of the Agile methodologies and have [*sic*] been for decades. So, you know, we had taken those principles and techniques working in the film industry and working on animation movies and adapted those into standard software as a service development. So, my first exposure to Agile was really in a context of not calling it Agile, but doing a lot of the practices that we see that are normal today in Agile, daily Scrum. (M5)

Seeing the effectiveness and benefits of some Agile rituals in an established industry—that of film or movie making)—was instrumental in building confidence in and encouraging acceptance of the Agile approach (M5).

Recently trained and especially younger developers needed less persuasion to accept Agile and demonstrated higher inspiration and acceptance for moving to new methodology, as compared to older developers. M3 shared that, in teams M3 manages, the developers who only recently joined the workforce learned the basics of Agile in college or related courses. This group of developers already considered Agile to be a

natural, de facto approach to software development. M4 described an example from an experience when younger developers and entire teams intuitively selected and implemented the elements of Agile methodology: "Young students in software companies . . . we have this very Agile-like approach where we create the specs up front, but then we routinely change them. We had use cases with the small notepad, notes on the board." The manager associated the team members' initiatives with acceptance of Agile as a superior methodology. Once the teams embraced the advantage of the Agile approach, the remainder of the transition process became more organized and effective (M2, M5).

Correlation to the conceptual framework. According to Cao's et al. (2009) AADM framework, categories of appropriated practices include developer-related empowerment through shared expertise. Thus, the proliferation of knowledge becomes a necessary attribute of teams' success in adopting new appropriations such as Agile methodology. The broad finding of this theme is that education through self-instruction or professional training and coaching is the catalyst for Agile transformation. The correlation of the theme with the conceptual framework is in the positive effect of appropriation practice through enhanced knowledge of Agile methodology. The educated Agile team thus becomes a self-correcting entity and develops internal structures to address the challenges of distributed development complexities. Another linkage of the theme with AADM constructs is in the advantage of co-located training events. Such events facilitate the creation of new social structures. Consequently, the social interactions organically developed during training accelerate the acceptance and adoption

of Agile methodology. A representation of Cao et al.'s AADM framework is provided in Appendix C.

Theme 2: Continuing Iterative Enhancements of Agile Processes and Ceremonies Improved the Efficacy of Agile Adoption

Another theme that emerged was that continuing iterative enhancements of Agile processes and ceremonies improved the efficacy of Agile adoption. All five of the managers interviewed for this study saw practical benefits of incremental improvements and dedicated efforts to establish iterative and repeatable processes. Through analysis of the documentation participating managers provided, I found support of managers' perceptions about the benefits of continuous iterative improvements. Continuing iteration with incremental improvements of development processes is one of the principles laid out in the Agile manifesto (Beck et al., 2001). Ceremonies are a part of Agile iterative processes that all managers established during adoption of the new methodology (M1–M5).

Iterative enhancements of Agile processes. The participants described various processes that they implemented at the start of projects and how those processes evolved as a part of continuing review and adjustment. M3 decided to initiate Agile adoption by setting up a self-designed variant of the Agile process: "We started using our own version of Agile—it wasn't Scrum, per se. It was not in any kind of name or Kanban, but when we started out, certain things we've definitely borrowed from the Agile process." In time, M3's team transitioned to a slightly more formal Kanban version of the Agile process: "The strategy was just cherry-picking the best pieces from every process, and we didn't

get it right, so we constantly get changing [*sic*].” Their teams’ *sprints*, the term used for a typical Agile-driven iterative development cycle, were 2 weeks long, with each sprint culminating in a software release of new features or fixes.

One of the advantages of a short, consistent sprint was the reduction of frequent requests of feature extensions in the midst of the development cycle. M2 explained, “As we do a monthly release, and halfway into writing the code or doing what we have to do, we would get feature creep, and scope creep.” M2 suggested that the reason for scope creep was the extended time between a feature request and delivery. Therefore, the team adopted a 2-weeks sprint to deploy a working system more frequently for the client, thus collecting more frequent and timely feedback.

Other reasons for shorter iterations were to meet customers’ expectations for timely releases and to allocate work assignments evenly. M1 stated that because of the complexity of the system, it would take too long to deliver a set of functionalities to customers. The manager saw the solution in the shorter iterative Agile process:

> The time to deliver was getting to be extremely prolonged, and any changes along the way were really cumbersome to implement. That’s why we considered [a] different approach, Agile namely, to be able to deliver in shorter period of times, right, in sprints, and kind of being able to regroup and see if we need to adjust any of the requirements, if the result of our work is not what has been expected by the business. (M1)

M1 chose a short, 3-week sprint cycle to facilitate a more equally allocated workload: “So as work became available, the developers would pick it up, and then the same sprint

turn(ed) it over to testing team and so on and so forth." Based on team members' availability, developers and quality assurance engineers had the tasks uniformly allocated during sprint progression, thus reducing potential resource constraints.

The incremental process improvements were more prevalent and noticeable in the initial stages of the project, but continued, even at later stages: "Obviously, we are extremely ready for the change. As a matter of fact, we change the whole thing; we are doing change and change again" (M4). An example of an improvement at the late stage of Agile transition was the work hours shift for M1 teams. M1 described persistent difficulties in collaboration between the teams in the US East, US West, and India. Several months into Agile transition, the teams applied multiple adjustments of their work schedules to assure several intersecting hours of real-time communication. The team in India had a late work start time, the US East Coast team had a regular 9 a.m. start, and the members of the US West Coast started early—at 6 a.m. M1 was confident that the work time adjustments improvements were instrumental in the success of Agile adoption.

Agile ceremonies and tools. All study participants indicated the consistent use of Agile ceremonies throughout Agile transition. Agile sprint ceremonies are a sequence of rituals designed for continuous learning and improvement of the process (Noguera, Guerrero-Roldán, & Masó, 2018). The frequently used Agile ceremonies include *daily standup* and *sprint retrospective* (Jovanović et al., 2017). As M2 explained, "You have to have your stand-ups every day, and then your postmortem [retrospective]." The

managers' common belief was that a well-established customized practices of recurring events are the foundation of successful Agile adoption initiatives (M1, M2, M5).

One of the primary Agile rituals for a distributed team was a stand-up meeting in which the teams reviewed the latest sprint progress and challenges (M2, M4). M1 established a stand-up event as a meeting in which all team members participate by calling in via WebEx platform. The team took advantage of the overlapping work hours set-up as a part of the Agile process. According to M1, participation by the entire team in real time helped to identify the overall project status, eliminate or clarify communication issues, and identify areas that may need additional attention.

For some teams, however, a real-time or face-to-face daily stand-up was impractical to organize. M3 described a different approach to a stand-up ceremony. The teams established a process that combined daily internal local team meeting and standardized structured e-mail communication between teams. Specifically, a team in each geographic location met in person to discuss the agenda for that team. At the end of each day, the team sent the status e-mail in a predefined format (see Figure 2) to other teams and the management (M3). As shown in Figure 2, the structure of the e-mail removes ambiguity by a clear delineation of covered topics. All five main subjects (e.g., product releases, personnel, and so on) include an enumeration of related subtopics with concise descriptions.

Current product releases	
	Release 1.2.3 Feature 1 Feature 2
	Release 1.2.4 Feature 3
Product development task status	
	Task 1
	Task 2
Customer support issues	
	Customer A had issue 1
	Customer B had issue 2
Customer presales projects	
	Customer C is working on a proof of concept – status (GREEN, YELLOW, RED) – outstanding issues
Personnel changes and interviews	
	Interviewed Candidate C
	Interviewed Candidate D
	Hired A
	Hired B

Figure 2. Format of standardized stand-up e-mail structure.

M3 explained that, at first, the organization had attempted to conduct the stand-up meeting with all teams participating in a video-enabled platform such as Skype. However, as the teams grew, and with new geographic locations added, it became difficult to find a reasonable, collectively convenient time to convene. In addition, collaboration became less effective with the increased number of participants and topics:

> We started with stand-up meetings, so I stayed up late at night, and we asked for everyone to join from Location Z, we [would] sync up, and then the next day, we [would] try the same thing, but the problem was, for example, that when I woke up in the morning, I had no idea what was done. (M3)

Another recurring ceremony that helped the teams in achieving incremental improvements was the sprint retrospective (M1). Sprint retrospective meetings take place

at the end of each sprint cycle. At these meetings, the teams reviewed the successes and failures of the sprint. During the meeting, the team discussed three topics, which included (a) what went well during the sprint, (b) what did not go well during the sprint, and (c) what will need to improve during next sprint. These discussions, when conducted in an environment of openness and trust, increase team participation and improve subsequent sprints execution (M1).

Regardless of which ceremonies the teams adapted for Agile execution, managers emphasized the importance of consistency in practicing those ceremonies. M2 noted that it was critical to maintain a stringent schedule of ceremonies over time, especially with continuing adjustments to the format and topics coverage. For example, to maintain the efficiency and value of stand-up meetings, the manager strived to preserve brevity and focus. Specifically, each participant of the meeting covered three topics: (a) what he or she did today, (b) what he or she will do tomorrow, and (c) what issues or blockers he or she is facing. These repeatable daily updates benefited all teams in presenting the overall sprint progress and highlighting possible issues as soon as the issues emerged (M2). Similarly, the retrospective meeting at the end of each sprint served as the springboard for the next development iteration by yielding a list of suggested improvements for the next sprint.

Similarly to consistent sprint ceremonies, managers normalized internal procedures for using standard Agile tools within the teams. The types of tools used varied between organizations. M1 utilized Rally by CA Technologies to coordinate, formalize, and schedule Agile Sprints. M1 found Rally was an effective environment for Agile

management: “So it [Rally software] helps everyone to make updates and to keep track of the things in Rally. . . . You can see the team’s utilization, who has the time, who don’t [*sic*] have the time, who can, how things can be shifted if needed.” Other managers (M2, M3, M4, M5) used Jira online platform by Atlassian as their main Agile sprint management tool. M4 said, “We used Jira for most of the engineering work. It drives you a certain way, and there is a dashboard. We have Jira that simplify [*sic*] the process a lot. We can clearly see which issues have been worked on” (M4). M2 praised the flexibility of the Jira tool: “That [Jira] is what I use for a long time, works out really well. Whether you’re going typical sprints, or Kanban” (M2). M2 offered that Jira produces report demonstrating the improved velocity (effectiveness) of the team after introduction and maintaining of consistent retrospective meeting for a number of sprints (see Figure 3).

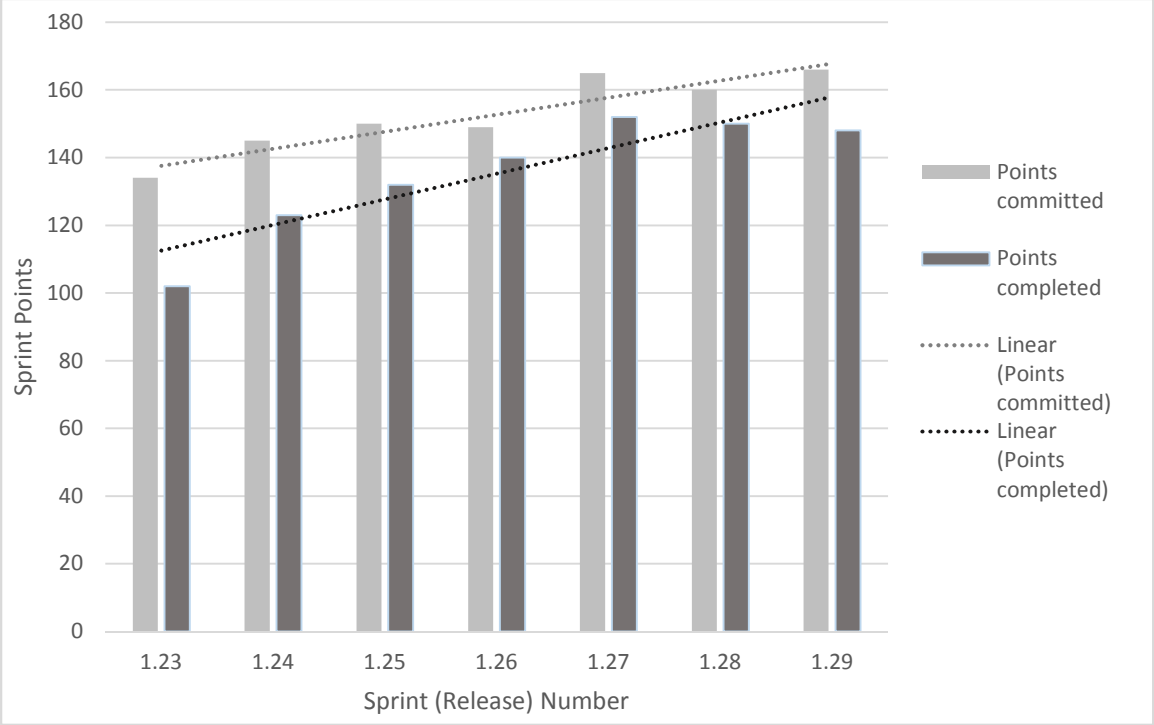

Figure 3. Comparison of committed and complete sprint points for consecutive sprints.

Figure 3 depicts the teams' committed (or estimated) versus completed execution capacity measured in points for seven consecutive sprints. The upward trend line of completed points indicates an increasing amount of work performed in the sprint, which translates to teams' increased productivity. Also, the completed trend line, over time, tended to come closer to the committed trend line, indicating that the team members improved their ability to estimate the amount of work achievable during a sprint.

Correlation to the conceptual framework. According to AADM framework (Cao et al.'s, 2009), the sources of new structures and internal systems are the input to the ructure appropriation process that has an impact on software development outcomes. As defined in the AADM framework, the outcomes of software development processes relate to four structure groups: (a) development process, (b) developer, (c) organization and management, and (d) customer. The findings of the second theme support three out of four groups. The development process-related outcomes are the result of Agile ceremonies and the sprint-driven approach to incremental project improvements (M1–M5). The developer outcomes are the product of continuing refactoring (M4), minimal documentation (M3, M4), and frequent design adjustments (M2, M4), while the organizational outcomes are the effect of task estimations (M1, M2) and balanced formality of Agile team management (M3, M4, M5).

The development processes, continuing iterative improvements, and Agile ceremonies are the sources of structuration defined by AADM concepts. Moreover, the strategies of implementing Agile ceremonies and iterative processes are the teams' internal systems. Figure 4 depicts the AADM relationships that emerged in Theme 2. In

Figure 4, the internal systems are specific to the distributed environment and are part of the appropriation loop, where new or improved Agile structures affect the methods of appropriation in a distributed context. Similarly, new or improved appropriations may cause the creation of new structures. For example, M1 described an instance when, as part of the sprint improvement review, the team identified the need to collaborate remotely on the design. The act of appropriation of this new structure was to introduce a screen-sharing tool as well as to adjust the development process to include design discussions at the start of a sprint. Thus, continuing improvements trigger appropriation and creation of new structures, a process described in Cao et al.'s (2009) AADM framework.

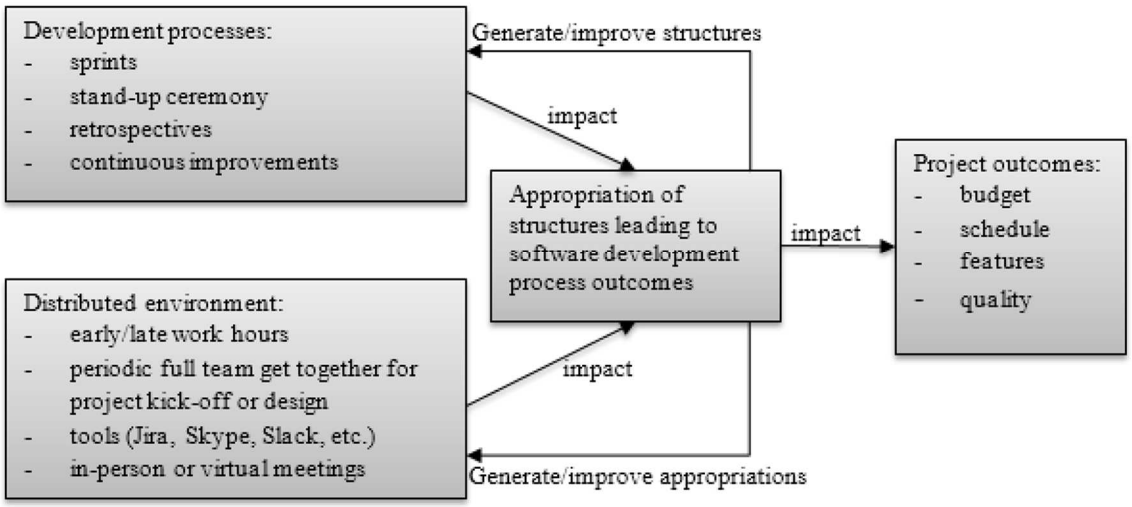

Figure 4. Theme 2 representation of AADM conceptual framework.

Theme 3: Communication Challenges Are a Substantial Obstacle for Agile Adoption

The third theme that emerged was that communication challenges are a substantial obstacle to Agile adoption. All five of the managers who participated in this study acknowledged the importance of establishing effective communication techniques

to create a collaborative environment as part of continuing Agile practices and ceremonies. The managers also recognized the negative impact of distribution on the quality of communication between the members of remote teams. Analysis of managers' interview transcripts revealed that communication is a major overarching challenge of Agile adoption among distributed teams. During the analysis, I found three root causes of communication challenges: (a) time zone difference, (b) cultural differences, and to some extent (c) language barriers. M5 said, "There are always problems in every development project. You know that; I know that. The problems are exacerbated when you've got to deal with time, distance, or culture" (M5). Similarly, M4 noted: "Yeah, the obstacles are pretty obvious. Time zone difference, cultural differences, language differences. That is what geographical distribution gives you" (M4).

Most managers underscored the difficulties in arranging for consistent and reliable communication between teams working in different time zones. M4 remarked, "Time [difference] is the main technical issue. What are we talking about? US-India, US-Russia, US-China. We are on different, opposite ends of the globe. It is very hard to get anybody in a routine manner" (M4). Likewise, M2 considered time zone a difficult problem to manage:

> Because when you have distributed teams, and they're distributed worldwide, the first thing you have is the time zone problem. And that's sort of uphill battle because you gotta have, first, you have to have your sprint planning meeting, then you have to have your stand-ups every day, and then your postmortem. (M2)

Organizing recurring audio calls in almost opposite time zones was difficult, but setting up recurring video chat was almost impossible. M5 understood the value of face-to-face communication as the way to increase the effectiveness of meetings and discussions. M5 said, "Typically, the daily stand-up, if you can see people face to face, is 10 times [more valuable]. You can pick up nuances, speech, demeanor, manner [*sic*] that you cannot pick up remotely over Webex, even if you've got the camera on" (M5). However, the manager did not find a practical way to connect the teams via video or in person. The teams rarely saw each other and demonstrated a weaker bond than locally based teams (M5).

During a critically important software design phase, communication challenges were especially pronounced (M4). M4 reported, "There is nothing that can replace getting in the same conference room and talking [it] out. Imagine, you and I need to design something together, and you [*sic*], like, 12 hours away from me. The effect is very significant" (M4). M4 mitigated the challenge by bringing relevant team members to the same location for design and architecture sessions. However, because design work on Agile methodology projects often recurs during sprints, conducting frequent in-person design sessions was not practical.

Some managers downplayed the challenges of remote communication. M1 described situations in which engineers located on different continents used virtual drawing tools for doodling technical diagrams and shared their desktops, thus enabling a virtual presence. According to M1, technical advances such as desktop sharing, combined with frequently utilized video conferencing, largely eliminated the dispersed teams'

communication challenges. M3 mitigated communication challenges by reducing the need for direct communication. M3 structured the teams such that the majority of task implementation took place in the same locale: "Of course, it's still important to communicate, but collaboration is not as critical whenever you are working locally with the local group on the same thing" (M3). M1 reiterated the collaboration enhancement benefit of bringing the teammates together on a regular basis. This strategy is similar to M4's idea of periodically assembling the team for design and planning sessions.

Similar to the time difference, cultural specificity is an additional challenge in communication among distributed teams. Opinions about the impact of cultural differences on the quality of communication within and between teams varied among managers. While some managers appraised cultural differences as a serious hindrance to Agile adoption (M4, M5), others (M1, M2, M3) did not perceive culture as a considerable problem for Agile adoption. M3 did not include cultural differences among obstacles to Agile adoption. To my question about possibly struggling with cultural issues during Agile transformation, M1 responded, "No, not too many; I know it's a common train of thought that, and I'm sure, there are cultural differences. I just personally didn't find anything challenging or interesting or worth mentioning" (M1). M2 considered some cultural issues as minor. In a specific example related to a culturally influenced lack of commitment to estimating tasks, M2 suggested the need to consistently emphasize the impact of unrealistic estimates:

> I'd rather see you [team] go under [original estimate] and do well than to go over and put half your stuff in the backlog. Like I said, it's more of an educational type

> of thing to deal with cultural differences. And after time, three, four sprints and a little coaching, they're fine. (M2)

Another example of the attempt to remove cultural influences from communication between remote teams was the strict content and highly structured e-mail status format used by M3's team (see Figure 2). The e-mail was designed to proliferate maximum information with minimal misunderstandings or miscommunications.

In contrast, M5 advised that cultural differences are an ongoing challenge that managers should not underestimate. M5 offered suggestions to mitigate these challenges, but noted that each situation is different and may benefit from a different approach. One example included quality assurance (QA) engineers in Japan who accepted only highest quality solutions when working with developers from a culture of timely deliverables but minor flaws. M5 reflected, "You need to be aware of that and really set the tone and the expectations properly up front. As a manager, you might choose to keep those teams separate and have them focus on separate areas of the solution" (M5). Another suggestion in addition to setting expectations was to assign a better match for pairs of development and QA engineers to work on a task.

Most managers did not associate language barriers as an obstacle to distributed Agile transformation. M3 stated,

> Language [challenges were] helped a lot with e-mail. Because most people do not speak the languages, but they obviously, in an engineering [way,] write and read. If you have meetings like stand-ups on the Skype, people have to talk. Suddenly,

> you have a Russian or English engineer, they will not understand each other very well. So, it just does not work. E-mails are very good. (M3)

M5 noted that the inability to speak the same language would complicate the adoption process: "[When engineers] don't speak the same language, that's really going to hurt any team, whether it's a completely distributed team or not." However, according to M5, cultural differences have even stronger negative effect on Agile adoption.

My findings from this theme align with Ghafoor et al.'s (2017) rating of obstacles for Agile development in a distributed environment. Ghafoor et al. identified the four biggest obstacles mentioned among 51 articles on Agile distributed projects. Between these four obstacles, communication challenges appeared the most (43%, $n = 22$), followed by socio-cultural differences (28%, $n = 14$), time zone differences (24%, $n = 12$), and language barriers (22%, $n = 11$).

Correlation to conceptual framework. Per Cao et al.'s (2009) AADM framework, appropriation moves include sequences of process adjustments that lead to acceptance or rejection of solutions to challenges of a distributed environment or Agile fit in the organization. The Theme 3 correlation to the conceptual framework is that a variety of appropriation moves surfaced during Agile adaptation as a result of manaters and team members mitigating the communication challenges. As in the case described by M5, restructuring of teams and lines of collaboration to address communication challenges is an appropriation move to improve the development process and overall project outcome. The outcome of appropriation moves may vary depending on numerous factors specific to the organization, environment, team composition, technical expertise,

and other matters (Cao et al., 2009). Therefore, each Agile adoption case may need a tailored approach and a hybrid set of Agile elements introduced at appropriate times during the transformation (Campanelli, Camilo, & Parreiras 2018).

Applications to Professional Practice

Successful implementation of software projects has multifaceted benefits for businesses, employees, and stakeholders (Alahyari, Svensson, & Gorschek, 2017). However, more than half of software development projects fail completely or partially (Olszewska et al., 2016). Introduction of Agile methodology for team and project management increased effectiveness of the team and enabled the techniques to be applied, resulting in higher quality and faster software development (Jovanović et al., 2017). Agile development continues to grow in popularity and is becoming a reputable alternative to older approaches to software development, such as Waterfall (Jovanović et al., 2017). At the same time, the paradigm of software development has shifted toward distributed resource allocation, whereby members of development teams reside in different geographic areas (Langer et al., 2014). Alzoubi et al. (2015) warned that Agile practices are contradictory to environments in which team members work in dispersed locations. Such incongruity is the result of a clash between Agile principles requiring effortless, uninterrupted, face-to-face collaboration and the inability of achieving this level of collaboration with remote teams (Bass, 2016, Beck et al., 2001). Cultural, linguistic, temporal, and geographical distances exacerbate the conflicting attributes of Agile methodology and global software development (Ghafoor et al., 2017).

I conducted this multiple-case qualitative study to explore the strategies that software development managers use in adopting Agile methodology to successfully complete projects in the context of distributed teams. In the course of the study, I interviewed five software development managers with expertise in adopting Agile methodologies for their global teams. From the interviews, the documentation provided by the participants, and extensive literature review, I discovered that acceptance of new Agile methods by teams, sufficient training and coaching, the iterative and incremental approach to tailoring the Agile processes, and attention to communication challenges are the most critical factors in the effective transition to Agile methodology. In addition to these discoveries, I present several practical examples shared by experienced managers about mitigating the challenges of a distributed environment. In general, the study findings are conclusive in the identification of strategies for Agile adoption. The successful strategies should include the following management-led activities:

- team coaching and practical training about the advantages, benefits, and the principles of Agile methods;
- in most cases, an incremental conversion from existing practices to the appropriate level of Agile implementation;
- an all-team inclusive procedure for identification and implementation of continuing iterative improvements of development procedures; and
- awareness and proactive management of communication obstacles that result from cultural, lingual, temporal, and geographical distance.

The finding of this study may enable development managers to progressively improve the performance of their teams without the need for immediate massive organizational changes. The incremental adoption of new methods of management allows for rapid adjustments and evaluation of the effectiveness of these methods. Managers and their teams should expect some failures during Agile adoption. These failures are necessary for course correction and should not discourage managers and their teams from the perpetuation of improvement cycles (Cooper, 2017).

Implications for Social Change

The findings of this qualitative case study on Agile adoption for distributed software teams and the recognition of management strategies used to facilitate the Agile transformation may contribute to a positive social change. A reliable and efficient implementation of software initiatives may further accelerate software innovation and advance the proliferation of intelligent software systems that improve the quality of human lives (Bibri & Krogstie, 2017; Penzenstadler et al., 2014; Siegel & Dorner, 2017). Increases in the ratio of project successes may also reduce waste of IT industry engineering resources who could engage in the meaningful development of successful initiatives (Rashid & Khan, 2014). One of the implications for social change is in the contribution of this study to advancing the business practice of sustainable development for distributed software teams. Venters et al. (2014) stated that sustainable software engineering is achievable through sustainable development processes. More social change may result from increased popularity and spread of the IT industry into local communities.

Specifically, the greater communal proliferation of the IT sector may translate to the greater social modernization of novel cultural situations, stimulate diversity, and accentuate the positive effect of local government (Toivonen, 2016). In addition, the identified strategies and consequential success of project execution may result in increased employment prospects and boost prosperity for families and their communities. Confidence in employment and dependable job opportunities improves the well-being of individuals (Consiglio, Borgogni, Di Tecco, & Schaufeli, 2016). The positive social impact of the successful completion of projects creates the experience of achievement, a sense of significance and relevance at work, and feelings of earned respect and purpose (Gupta & Sharma, 2016).

Recommendations for Action

The goal of my research was to identify and explore strategies that software development managers of dispersed teams use to improve project outcomes by implementing a more effective transition to Agile methodologies. The findings of this study suggest that there are common obstacles to adoption of Agile methodology in a distributed team environment. The findings also include a number of recommended strategies ranging from Agile training and incremental processes adjustments to strategies of nonstop improvements and proactive management.

Considering the results of this research, I recommend that any Agile adoption initiative begin with training and coaching of all team members. A uniform training program for remote and local teams will be beneficial in establishing a common baseline of Agile understanding and acceptance. In most cases, I would also recommend a

measured, incremental approach to team transformation to Agile methodology. The manager in charge of transition would identify several areas of the development process that would especially benefit from the Agile approach. For example, those areas might be team communication challenges, project scope overrun, a lack of consistent scheduling, and others. The manager would design a plan for introducing Agile solutions that target one or only selected problems resolutions at a time. This research also suggests that majority of introduced Agile ceremonies may not work in their initial form unless those rituals are customized to fit the specific organizational environment. Therefore, the manager should expect a slow rate of improvements and possible failures at the start of the Agile transformation.

Considering the study findings, I advocate for a system of continuing review, analysis, and identification of improvement steps during and after completion of the Agile sprint. A common strategy used by practitioners in the field is to follow the Agile ritual of retrospective meetings in which the entire team regularly looks back at completed sprint and detects well-executed and poorly executed elements of the sprint. It is important to have a representative from all project roles such as development, QA, product management or customer, and team manager to participate in these discussions. It is equally important to identify one or more improvement areas and the method of correction on which the team can focus in the next sprint. The team involvement, narrow focus, and close proximity of issue recognition and resolution are effective tools in achieving desired process enhancements. By consistently implementing the retrospective

procedure, a manager may achieve the continuous incremental improvements that are the cornerstone of the Agile approach.

Finally, development managers should be aware and proactively address obstacles to effective collaboration between teams and teammates in both distributed or co-located environments. These proactive measures may include one-on-one discussions with team members to find the individual factors that impede communication or collaboration. By synthesizing individuals' concerns or difficulties, the manager may find and introduce resolution measures before issues begin to affect the team.

To maximize the potential benefits of this study, I will distribute the results through various resources. After approval, this study will be available on the ProQuest Dissertations and Theses database, which is accessible to researchers and organizations. I will disseminate the summary of the findings through a professional network of LinkedIn Agile and project management communities. I will also send the summary to all managers I invited to participate in the study. Also, I intend to submit the summary of the study and the findings to publications such as *Journal of Enterprise Information Management*, *Journal of Systems and Software*, and *Information and Software Technology*, as well as sign up to present my research results on management and software development at relevant conferences.

Recommendations for Further Research

With popularity and abundance of globally dispersed engineering resources, distributed software teams is a common occurrence in the IT industry (Bass, 2016). The literature review conducted as a part of this study revealed a lack of scholarly research

specific to distributed teams and adoption of Agile methodologies. Therefore, I recommend a larger quantitative study to determine how successful the various distributed teams are in the adoption of Agile. Such a study would be instrumental in paving the direction for further research on the topic.

One of the limitations of this study was its narrow selection of participants. In this research, I focused on managers employed in the Silicon Valley area of Northern California, an area of the United States renowned for a high concentration of software development accompanies. It is possible that the approach and complexities of distributed resources utilization in this locale differ from the challenges experienced by companies on the East Coast of the United States or in other technology hubs around the world. Therefore, a similar study conducted with managers from different geographic areas may reveal additional strategies for Agile adoption that may potentially be valuable in the global context.

Campanelli et al. (2018) found that decisions to adopt Agile methods are often influenced by conditions that include external and internal circumstances or prior experiences. In this research, I did not address the impact of motivational factors on the strategies that managers use to implement the transformation. However, from the data collected for this study, there is an indication that Agile implementation strategies may vary depending on the sources of motivation and influence to adopt new project execution approach. Further research on Agile transition motivational factors may assist managers in the selection of better attuned and more closely aligned implementation

strategies, thus streamlining the adoption process and improving the chances for successful project completion.

Reflections

As I reflect on the journey of completing my DBA study, I must admit that the experience was both significantly more educational and more demanding than expected. Through the classwork and residencies, I developed a deeper understanding of scientific methods, acquired a heightened appreciation for factual information, and, most importantly, overcame the fear of formal writing. While working on the prospectus, I learned the principles of conducting scholarly research, the value of qualitative study method, the benefits of various research designs, and the principles of selection and application of a conceptual framework to guide the study focus. Because I was the data collection instrument as well as an expert in the field of study, it was challenging to maintain an objective perspective during data collection, analysis, and formulation of the conclusions.

During interviews with participants who often discussed subjects that were relevant to my past and present work responsibilities, I had to make diligent efforts to contain the urge to ask leading questions or engage in the discussion pertaining to my own experience. As I completed the analysis of collected data, some less expected outcomes emerged. These unanticipated results were an indication of a minimal personal bias that I, as the researcher, may have introduced to the study. Also, my reflection would not be complete without an acknowledgment of sincerest appreciation I have for my

Chair, G. Velkova, who was instrumental in guiding my efforts with the patience, professionalism, and understanding of a great educator.

During my almost 3 years long study, I have dedicated numerous hours to this endeavor, often taking time away from my family and friends. At this time, it is difficult to assess the value of the degree versus its cost. Undoubtedly, the cost in terms of time, effort, frustration, and lost opportunity is significant. Time will reveal the benefits of a doctoral degree. However, even now, I feel an enormous sense of accomplishment and confidence in the ability to take on serious challenges. With my family's support for my lifelong dream of attaining a doctoral degree, I feel fortunate to be surrounded by the love and respect of my parents, my wife, and my children.

Conclusion

The findings of this qualitative study reveal that team training, tailored approach to developing Agile processes and managers' situational awareness are key influencing factors in the successful adoption of Agile methodology for distributed teams. Through analysis of collected data, I determined that complexity of distributed software development could be addressed by educating members of the participating teams about the principles, values, and best practices of Agile. Ahimbisibwe et al. (2017) stated that software projects often fail because managers do not choose appropriate strategies. The findings of this study expose management strategies of incremental transition to Agile methodologies and the benefits of establishing a culture of continuous development process improvements. These strategies offer implementation of customized and team-specific practices leading to successful project execution.

The objective of most corporations is to achieve and maintain profitability. Failure to complete projects successfully may result in financial losses and decrease morale. By adopting Agile methodology and improving the outcomes of software development projects, organizations may increase their competitiveness and the health of their bottom line. Managers of development teams should consider the findings of this study when selecting Agile adoption strategies for their teams.

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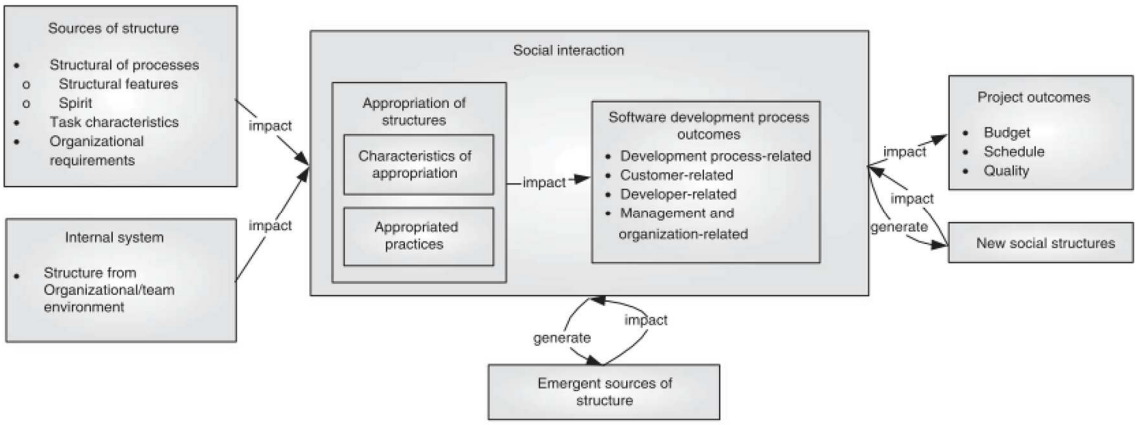
Appendix A: Interview Protocol

Interview: What strategies do software development managers use in adopting Agile methodology to successfully complete projects in the context of distributed teams?	
Activity	Details
Record:	Interview date / time: Location: Interviewee Name / ID:
Greet the participants Introduce the interview and set the stage.	"Good morning/afternoon, <participant's name>. My name is Igor Schtein. Thank you for participating in my study that explores strategies in adopting Agile methodology for distributed teams." "Before we start, I would like to describe few logistics of the interview and post-interview process."
Explain interview logistics and confirm the participant's consent	1. Remind about the confidentiality of the interview. 2. Ask for honesty and restate the value of openness for the success of the study. 3. Explain that I will record the interview for the purpose of transcribing. Explain the steps I will take to assure anonymity, data security, and destruction after five years. 4. Ask permission to contact the participant to validate the correctness of the transcription, quality of interpretation, or to share the study draft for feedback. 5. Read the consent form, sign, and reiterate the participant's right to leave the study at any time. 6. In case of remote video meeting, ask for verbal acceptance of the consent form 7. Share that the interview time is 60 minutes limit and warn that I may interrupt if the timing becomes an issue. 8. Ask permission for audio recording and turn on the recorder.
Observe non-verbal queues Summarize and rephrase as needed Guide with follow-up probing questions to get more in-depth	1. How did your team manage development projects prior to adopting Agile methodology of software development? 2. What motivated you to adopt Agile methodology of software development? 3. What strategies did you find worked best to adopt Agile methodology of software development? 4. How did you address obstacles encountered by your distributed teams when they were adopting Agile methodology of software development? 5. How, if at all, did distributed team members' adoption of Agile methods affect the project outcome? 6. How, if at all, did the distributed nature of the team affect adoption of Agile methodology? 7. How did you monitor the progress of distributed team members' adoption of Agile methodology? 8. What additional information can you provide about your experience with distributed teams' adoption of Agile methods of software development?
Wrap up interview thanking participant	1. Thank for informative responses 2. Ask for a short interview feedback
Schedule a follow-up member checking interview	

Appendix B: Participants' Feedback About Agile Training

	Yes	Somewhat	No
Was this training educational for you personally?	17	12	6
Do you believe the training would help in project execution?	21	11	3
Do you believe this training would benefit the team to adopt scrum?	18	13	4

Appendix C: Representation of AADM Framework



Note: Adapted from "A Framework for Adapting Agile Development Methodologies," by L. Cao, K. Mohan, P. Xu, and B. Ramesh, 2009, *European Journal of Information Systems, 18,* p. 337. Copyright 2009 by Informa UK Ltd.