

MAPPING AGILE PROJECT MANAGEMENT PRACTICES TO PROJECT  
MANAGEMENT CHALLENGES FOR SOFTWARE DEVELOPMENT

A Dissertation

Presented to the  
Faculty of Argosy University/Washington DC  
College of Business

in partial fulfillment of  
The requirements for the degree of  
Doctor of Business Administration

By

Saya Poyu Sone

June, 2008

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### Abstract

Agile project management is gaining attention as an effective method that project management practitioners can use to solve their project management challenges. The use of traditional project management methodologies is criticized, because they may result in unrealistic scheduling issues, frequent scope changes, and lack of customer involvement. The purpose of this study was to construct and investigate a framework of mapping Agile project management practices to project management challenges, and then evaluate the effectiveness of these practices for overcoming the challenges. The findings demonstrate that specific Agile project management practices may indeed help overcome various project management challenges as identified in the framework. These research results help to confirm the effectiveness of Agile project management practices for solving challenges associated with traditional project management methodologies, as well as the framework itself.

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## Dedication

This dissertation is dedicated to my children, Sanshiro and Sid, who have sacrificed so many of their formative years to support their mother in this journey.

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## Chapter One: Introduction

Agile project management is a contemporary approach or methodology for managing software development projects. Some of the most popular conferences on software development in the last decade have been those devoted to agile methods. For instance, the Agile 2007 Conference in Washington, DC drew more than 1,100 attendees (Manns, 2007). One of the goals of Agile project management is to serve as a methodology for executing projects faster and developing software with higher customer satisfaction. Agile project management is based on four major values: (a) interacting with skilled individuals, (b) delivering working software products, (c) establishing close interaction with customers, and (d) adopting changes in a quick manner (Highsmith, 2004). The advent of Agile project management for software development projects was a reaction to traditional or waterfall project management techniques, which were associated with longer delivery cycles and higher project failure rates (DeCarlo, 2004). The use of Agile project management methodologies to solve project management challenges is increasing, while the use of traditional methods for software development is in decline (Fretty, 2005).

Traditional project management methods consist of step-by-step, detailed process groups, formal project plans, well documented customer requirements, detailed product designs and technical documents, and rigorous testing (DeCarlo, 2004). Their process groups are often organized into stages such as initiating, planning, executing, controlling, and closing as shown in Appendix A (PMBOK Guide, 2004). These process groups are also linked together by the results or outcomes of the other process groups. In other



words, the output of one process group is often another process group's input. For example, the output of initiating is the input of planning.

Alternatively, Agile project management consists of principles, practices, and values to assist project management practitioners with impromptu challenges, not possible with the rigidly interlocked processes associated with traditional methods (Highsmith, 2004). Some of the benefits of implementing Agile project management are the ability to build software products in a dynamic and adaptable manner and receive early customer feedback, which enables project managers to perfect their products sooner (Beck, 1999). Agile project management is based on an iterative process that uses smaller, leaner, and flexible software development teams who produce their software products in less time (Basili & Turner, 1975). Agile project management helps developers collect early customer feedback by frequently demonstrating potentially shippable products at frequent intervals during the implementation cycle (Bittner & Spence, 2006). A major characteristic of Agile project management is the ability to embrace change rather than control, minimize, or eliminate change, which is contrary to traditional methods (Beck, 1999). Adapting to change often means willingness to accept new requirements from one's customers, even late in the project (Augustine, 2005). The ultimate goal of Agile project management is to enable software teams to deliver software products with much greater customer-value (Highsmith, 2000; Rico, 2004).

### Purpose of Study

The purpose of this study was to examine whether the use of Agile project management practices helps alleviate project management challenges better than

traditional project management practices. The results of this study may help provide an in-depth understanding of the relationships between Agile project management practices and their effects on common project management challenges.

This study did not intend to repeat scholarship comparing Agile methods and traditional methods, analyzing the gaps between the two methods, or distinguishing among their different components. Additionally, this study did not intend to analyze the effects of adopting an Agile methodology before the implementation of Agile project management practices. Rather, this study was designed to help project management practitioners better understand the role of Agile project management practices in software development, which may necessitate a fundamentally new mind-set (DeCarlo, 2004). The concept of mind-sets for managing projects is defined as “a set of beliefs and assumptions about how the world works” (DeCarlo, p. 15). Forecasting project management outcomes in a dynamic software development environment is often very stressful and frustrating in software projects, which may be easier with Agile project management practices. As an implication of this research, project management practitioners may find it easier to transition to the use of Agile project management practices, because they are inherently more flexible than traditional methods.

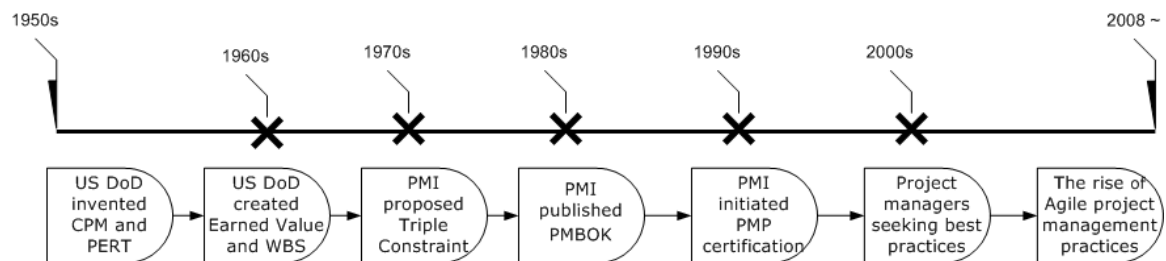
### Background of Study

The focus of this study is within the project management field or research area. However, this study primarily focuses on contemporary approaches such as Agile project management practices and the specific project management challenges project management practitioners may help overcome. Therefore, this section presents a brief

history of project management to help establish the context and need to study, examine, and research Agile project management best practices.

### A Brief History of Project Management

A major goal of traditional project management methods is to successfully develop and deliver unique products and services. The history of traditional project management methods has been characterized as an evolutionary process of creating and establishing a series of major tools, techniques, processes, and even systems to help satisfy its goals and objectives, as shown in Figure 1 the timeline of the project management development.



*Figure 1.* Project management development timeline.

The rise of traditional project management methods began to establish a foothold in the 1950s. At that time, the U.S. Department of Defense (DoD) needed a way to manage the development of complex new computer systems during the cold war. Two major techniques, critical path method (CPM) and program evaluation and preview

technique (PERT), were developed to help manage activity completion (“History of Project Management,” 2007).

In the early 1960s, U.S. the DoD introduced yet another technique called work breakdown structures (WBSs) for managing tasks (“The History,” n.d.). The U.S. DoD also created and started to use earned value management (EVM) as a means of evaluating project performance based on cost and schedule (“The History,” n.d.).

In 1970s, the Project Management Institute (PMI), based in Pennsylvania, started to focus on external factors by incorporating time, cost, scope, quality, and customer satisfaction (“The History”). The concept started with cost, time, and scope to form the basis of the now-famous triple constraint (PMBok, 2004). The three items are so intertwined that a change in one will most often cause a change in at least one of the others. For example, if management establishes time as a priority of project is time, the project team will not only eliminate some requirements but also reduce the costs to meet the time constraints.

In 1980s, the first Project Management Body of Knowledge (PMBok) was published by PMI to provide more specific guidelines for project managers. In 1990s, PMI initiated a program to certify project management professionals (PMPs) to meet the increasing need for trained project management experts. Many organizations recognized modern project management as an effective method to communicate and integrate work across multiple departments and professions (“History of Project Management,” 2007). While traditional project management methods were created for large U.S. DoD projects, scholars began tailoring them for small software projects (Humphrey, 1995).

Late in the 20th century, however, contemporary scholars began to see a mismatch between traditional project management methods and contemporary technologies such as internet software (Highsmith, 2002). Powerful new internet technologies emerged in the 1990s, such as the World Wide Web, internet browsers, and the concept of websites (Downes & Mui, 1998). Internet technologies such as the hyper-text markup language (HTML) and the Java programming language enabled small teams to rapidly produce complex websites (Reid, 1997). Because they could be built quickly, customers saw their finished software sooner and began providing earlier feedback (Beck, 1999). As a result, developers could rapidly refine their software (Highsmith).

This gave rise to what we now know as Agile methods (Highsmith, 2002) and Agile project management methods (Highsmith, 2004). Rico's (2007) study defines Agile methods as consisting of four major factors: iterative development, customer feedback, well-structured teams, and flexibility. Fretty (2005) reports Shine technology found that 93% of its clients reported improved productivity as a result of using Agile methods. Furthermore, the creators of Agile project management methods began to draw sharp distinctions between traditional and Agile project management methods for solving contemporary challenges in software development (Highsmith). They rejected the notion of tailoring traditional project management methods for contemporary software projects (Humphrey, 1995) in favor of creating Agile project management methods specifically designed to address the challenges of creating software in the 21st century (Highsmith). Therefore, the focus of this study is to help determine whether Agile project management

practices do indeed help solve challenges associated with contemporary software development projects.

### Agile Project Management Prelude

Today's information technology (IT) project management practitioners are under increasing pressure to deliver high quality software projects under severe budget and schedule constraints. In addition, the internet and e-business environments continue to change rapidly, leaving many IT management professionals struggling to keep up with the pace. The reliance on traditional project management's rigid procedures to establish order, increase control, and regulate change has met with little success in many complex projects and complicated environments ("Agile project management," 2003).

Johnson (2006) points out the result of a 2004 CHAOS survey conducted by the Standish Group, an IT research company based in Boston, Massachusetts, that showed that only 29% of all software projects were considered successful, 18% were failures and 53% were challenged (see Appendix B for complete survey results from 1994 to 2004). Comparing the 2004 and 1994 figures, 16% were successful, 31% were challenged, and 53% were failures, though the 2004 figures clearly show a marked improvement. However, the 2004 figures showed poorer performance outcomes as compared to the 2002 figures: 34% were successful, 15% were failures, and 51% were challenged. The Standish 2004 CHAOS reports showed that 84% of all software projects were behind schedule (see Appendix C for the survey results on project average behind schedules from 1994 to 2004) and 56% were over budget (see Appendix D for the survey results on projects average cost overruns from 1994 to 2004).

The CHAOS survey results were discouraging to many project management practitioners. IT project management professionals often wonder why traditional, plan-driven project management methods do not work very effectively (“Agile project management,” 2003). On the basis of another CHAOS survey of success criteria, the Standish Group concluded that customer involvement is listed as the first success factor, as shown in the Appendix E for the top 10 project success factors (“Unfinished voyages,” 1995). Within this context, the rise of Agile project management is recognized as a new methodology to address contemporary project management challenges. Using Agile project management, project teams may be able to execute their projects faster, deliver their software products sooner, show finished software products to their customers earlier in order to solicit valuable feedback in a timely fashion, and refine their software products based upon this feedback. For example, Shine Technology’s 2003 survey results showed that projects based upon Agile methods had 93% improved productivity, 83% better business satisfaction, and 88% better quality (Fretty, 2005).

### Statement of Problem

Traditional software project management methodologies are similar to those used for civil engineering and construction projects (DeCarlo, 2004). Within traditional project management methods, blueprints are the foundation used for predicting the success of the project. For example, a bridge cannot be built without a drawing or a building cannot be built without completion of a model. Traditional project management methods often extend the concept of managing construction projects and are based upon linear, step-by-

step development cycles as shown in Figure 2 for the linear process. For example, the construction phase cannot start until design phase is complete.



*Figure 2.* Traditional software development life cycle.

Traditional project management is designed to be a predictable process and includes stages or phases for analysis, design, construction, certification, and deployment (Shenhar & Dvir, 2007). This rigid process is also characterized by compliance with standards, regulations, and guidelines. Project success often depends on whether the project's deliverables comply with standards (Shenhar & Dvir). Traditional project management may have worked for some organizations in the past, and may yet work in some circumstances in the future (DeCarlo, 2004). However, in the case of software development projects, traditional methods may only add cost and complexity, while providing a false sense of security based on the incorrect belief that dynamically unpredictable software projects can be forecasted and controlled much like more predictable civil engineering and construction projects (DeCarlo).

Managing software projects is different from managing construction projects. Reliance on predictable results adds stress to software project teams because of the rapidly changing nature of software project requirements. Since a stable environment does not present in a software development projects, following a rigid process may only confuse software project teams and add chaos to the project ("Agile project management," 2003).



Therefore, the use of traditional project management methods may lead to difficulty in estimating and managing changes rapidly enough to deliver reliable results. Because of this problem, the software project management community introduced Agile project management as a response to frustrations with traditional methods better suited for civil engineering and construction projects (DeCarlo, 2004).

Furthermore, it is important to review how many project management professionals are using the traditional project management method. Stine (2004) notes a total of nearly 95,000 project management professionals worldwide in 2004. The Project Management Institute has claimed in 2007 that nearly 260,000 individuals earned the project management professionals (PMP) credential across 171 countries (About PMI, 2007). This represents about a 64% growth rate in the past three years. Among the total population, 86% of them are information technology project management professionals, reported by Balestrero (2004).

Wheeling (2004) reports there were 16.5 million project management practitioners worldwide and 4.5 million in the U.S in 2004. Wheeling adds that \$10 trillion (U.S.) is spent globally on projects yearly. Stine (2004) notes that PMI membership continues to grow even during economic downturns. For example, in 1992, the U.S. Gross Domestic Product (GDP) only grew 2% of growth, but Project Management Institute US membership had a growth rate of more than 45% in the U.S. Therefore, the impact of using Agile project management practices may not only apply to project management projects, but to the larger body of project management professionals as well.

As managing software project becomes important to project management practitioners, organizations, and economics, the traditional project management method faces a dilemma in dealing major project management challenges (DeCarlo, 2004; Chin, 2004; Shenhar & Dvir, 2007). The aim of this study is to explore Agile project management practices in dealing with project management challenges. The problem is that there is a gap in literature review that does not address what specific Agile project management practices can overcome what specific project management challenges and the effectiveness of the Agile project management practices. The research contained in this study was to create a mapping framework to explore the relationship between Agile project management practices and project management challenges. The stated problems suggested three research questions in the next section.

### Research Questions

The basic research area to be explored was whether project management practitioners have used any approaches or practices to help deal with specific project management challenges. A closely related area was identifying the kind of project management challenges project management practitioners have encountered and in what situations, along with the project management approaches or practices that project management practitioners have used to manage their challenges. This study examined the effectiveness of mapping Agile project management practices to project management challenges for software development projects. Specific questions in the study were as follows:

1. What Agile project management practices are useful in solving specific project management challenges?
2. How effective are Agile project management practices in solving specific project management challenges?
3. How useful is the conceptual framework for mapping Agile project management practices to specific project management challenges?

### Significance of the Study

Agile project management has become one of the most dominant project management methodologies of our time among software developers (Chin, 2004). In spite of its popularity, project management practitioners need more empirical evidence. Do Agile project management practices help lead to resolving some of their software project management challenges?

The goal of this study was to examine whether the use of Agile project management activities for managing software development projects can help overcome project management challenges. There are many studies proposing ways to deal with Agile adoption challenges. For example, Borges, Gilmore, and Oliveira (2007) of the Harvard Business School discuss their challenges associated with the adoption of Agile methods. Sidky (2007) develops an Agile adoption framework to help organizations adopt and apply Agile methods for software development. Cloke (2007) presents his study on the Agile adoption process of Yahoo Inc, the world's largest global online network of integrated services, headquartered in Sunnyvale, California ("Company Overview," 2007). Some studies have even proposed Agile project management practices

to manage Agile projects. For example, both Highsmith (2004) and Augustine (2005) outline their best practices in Agile project management to help project management practitioners manage software development projects. However, few studies, if any, examine which Agile project management practices can be used to handle project management challenges with any degree of specificity. Therefore, this study proposes to investigate the effectiveness of mapping Agile project management practices to specific project management challenges for software development projects.

One of the contributions of this study to the field of software project management is to provide a conceptual framework for mapping Agile project management practices to specific project management challenges (see Figure 6). This conceptual framework may help project management practitioners better manage software development projects. The conceptual framework introduced by this study may be used as a guide to help practitioners better understand what Agile project management practices map to their project management challenges, and conversely, which do not.

### Assumptions and Constraints

The basic assumption of this study was that Agile project management activities will not replace traditional project management processes in all industries. This study only focused on the use of Agile project management for software development projects. Only limited studies exist examining Agile project management practices and project management challenges, suggesting that Agile project management research is still in its infancy. Additionally, Agile methodologies come in a large number of variations and include, but are not limited to, eXtreme Programming, Scrum, the dynamic systems

development methodology (DSDM), Adaptive Software Development, Crystal Methods, Feature-Driven Development, and the Rational Unified Process (RUP) (Rico, 2007).

Major Agile methods are described as follows. eXtreme Programming is a lightweight software development method based on principles of simplicity, customer feedback, pair programming, and rapidly-changing requirements (Beck, 1999). Scrum is a simple project management framework consisting of implementing a small number of prioritized feature requirements in two to four week sprint cycles (Schwaber, 1995). The dynamic systems development methodology process includes five phases: feasibility, business study, functional model iteration, design and build iteration, and implementation (DSDM Consortium, 1997; Boehm & Turner, 2003). Adaptive software development was created to replace the traditional waterfall cycle and consists of product initiation, adaptive cycle planning, and concurrent feature development with a repeating series of speculate, collaborate, and learn cycles (Highsmith, 2000). Crystal methods involve frequent delivery, reflective improvement, close communication, personal safety, focus; easy access to expert users, and a technical environment with automated testing, configuration management, and frequent integration (Cockburn, 2002). Feature driven development involves developing an overall model, building a features list, planning by feature, designing by feature, and building by feature (Palmer & Felsing, 2002). The rational unified process involves project management, business modeling, requirements, analysis and design, implementation, test, configuration management, environment, and deployment workflow (Kruchten, 2000).

The extent to which each method defines its own Agile project management practices varies, some being more clear and explicit than others. It was not the purpose of this study to minimize the importance of these practices. Instead, this study focused on creating a conceptual framework for mapping Agile project management practices to the specific project management challenges they may help overcome.

Although there are many types of software project management and development methods, this study did not attempt to cover all aspects of the various types of software project management methods. Special types of software development methods designed to address non-functional requirements such as security, safety, or maintainability, have not been considered in this study.

Furthermore, this study did not address all Agile project management studies and will not attempt to do so. The literature review only examined recent surveys and focused on scholarly studies of Agile project management practices related to this study. In other words, this study only focused on examining the links between major Agile project management practices and specific project management challenges.

## Chapter Two: Literature Review

This study is designed to examine the relationship between Agile project management practices and specific software project management challenges. This literature review includes five sections. The first section presents the software project management challenges based on surveys and scholarly studies. The second section demonstrates why traditional project management methods do not address those challenges. The third section introduces the fundamental principles of Agile project management. The fourth section explains how Agile project management practices map to Declaration of Interdependence methods. The fifth section discusses the need for a new study of Agile project management. The sixth section introduces a conceptual framework as the basis of this study. The last section summarizes the chapter.

### Project Management Challenges

Survey studies such as those by the Standish Group, Project Management Institute (PMI), VersionOne, and scholarly studies such as Glass (1998), Ford (2004), Schwaber (2004), and Johnson (2006) show that software project managers face many major challenges. This is true whether they are using traditional or Agile project management practices in Agile or non-Agile organizations. These challenges fall into 19 major areas: (a) scarce resources competition, (b) project management incompetence, (c) issues related to organizational culture, (d) lack of accountability, (e) insufficient team skills, (f) cross-functional teams, (g) poor planning, (h) poor quality, (i) lack of tools, (j) unclear scope or vision, (k) lack of customer involvement, (l) scheduling issues, (m) scope changes, (n)

risk management, (o) uncertain dependencies, (p) technology issues, (q) resistance to change, (r) lack of proper processes, and (s) lack of organizational support.

Out of 19 major project challenge patterns, two of them appear in all three surveys which were conducted by Standish, Project Management Institute, and VersionOne: lack of customer involvement and resistance to change (see Appendix F). The Standish Group, a West Yarmouth, Massachusetts-based consulting group specializing in research on information technology investments, conducted a survey in 1994 and highlighted its top 10 project management challenges in which lack of user input is the top challenge ("The Chaos Report," 1994). PMI's 2004 survey ranked inconsistent approaches to managing projects as its top challenge ("Deliverables," 2004). One of the most recent surveys was conducted in June 2007 by VersionOne, an Atlanta, Georgia-based company providing enterprise project and lifecycle management solutions for agile development. VersionOne's findings indicate that general resistance to change is one of the five major barriers to an organization adopting Agile practices ("Survey Result," 2007).

Four research studies of project management relevant to this study include those from Glass (1998), Ford (2004), Schwaber (2004), and Johnson (2006). Each of these studies also identified patterns of challenges to software project management. Glass nicknamed troubled software projects as "runaway projects" and characterized them as over budget, behind schedule, and having difficulty building the software they were chartered to deliver. He concluded that the challenge is to get these out of control projects back on track. Ford also lists the top 10 challenges, although most are more related to



traditional project management. Ford's study shows that traditional project management had more challenges associated with uncertainty such as unrealistic deadlines, scope changes, uncertain dependencies, and poor risk management. Schwaber identifies eight major challenges to Agile project management from his experiences teaching project management practitioners. Schwaber notes that a top-down, hierarchical command and control organization is one of the most prevalent obstacles to Agile project management. Unlike the other studies, Schwaber lists organizational culture as one of the impediments as well. Johnson offers 10 lessons learned from chaotic projects. Johnson ranks lack of user involvement as the number one reason or challenge for project failure or success.

A summary of these findings is shown in Appendix G, describing recent scholarly studies of project management challenges for their challenges related to 19 challenge patterns. Although each study explains project management challenges in different ways, there are many similarities among these four studies.

A total of 60 project management challenges were culled into 19 project patterns from these studies. Those project management challenges are ranked and shown in Table 1, the results of challenge patterns. The top three project management challenges are: (a) scarce resources competition, (b) unclear scope or vision, and (c) lack of customer involvement. The results of 60 challenge patterns were ranked from one to seven. On the basis of this ranking, project management practitioners can identify the most and least significant challenges to Agile project management. Project management practitioners can also use this ranking to prioritize what challenges they should focus on first.

Table 1

*The Results of Challenge Patterns*

No.	Challenge Patterns	Frequency	Rank
1.	Scarce resources competition	9	1
2.	Unclear scope or vision	8	2
3.	Lack of customer involvement	6	3
4.	Project management incompetence	6	3
5.	Lack of proper processes	4	4
6.	Scheduling issues	4	4
7.	Lack of organizational support	3	5
8.	Scope changes	3	5
9.	Poor planning	3	5
10.	Technology issues	3	5
11.	Issues related to organizational culture	2	6
12.	Resistance to change	2	6
13.	Lack of tools	1	7
14.	Poor quality	1	7
15.	Insufficient team skills	1	7
16.	Cross-functional teams	1	7
17.	Risk management	1	7

No.	Challenge Patterns	Frequency	Rank
18.	Uncertain dependencies	1	7
19.	Lack of accountability	1	7
	Total	60	

### Examining Traditional Project Management Best Practices

Examples of traditional project management practices are summarized in the Guide to the Project Management Body of Knowledge (PMBoK) (2004) first published in the 1980s by the Pennsylvania-based Project Management Institute (PMI). The PMBoK was an effort to standardize traditional project management best practices and establish guidelines for the certification of project management professionals (PMPs). Even though a new version of the PMBOK was published in 2004, the latest version of PMBoK still emphasizes the importance of traditional project management practices, such as Gantt Charts and work breakdown structures (WBSs). Both Gantt Charts and WBSs were popular as part of project management methodologies in the 1950s, though some of these techniques were created as early as 1900 (DeCarlo, 2004). After more than a century, a controversy formed as to whether traditional project management practices were applicable to contemporary software development projects (Beck, 1999).

DeCarlo (2004) asserts that traditional project management, which is characterized by a linear approach to product development, is not effective in today's software project management environment, and should be abandoned altogether. DeCarlo

maintained that traditional project management works only if the project context is stable and certain. For example, a detailed blueprint works for a construction project, and a business plan can be executed for starting a fast food franchise without too much risk. In other words, a well-planned, time-tested, and step-by-step process may indeed be applicable in a highly stable environment. However, managing software development projects is more like managing chaos (Highsmith, 2004), and in many cases, it is more like striking out into the unknown. Furthermore, in today's environment, it has become commonplace for project sponsors to cut project budgets and shorten project timelines due to increasing competitive market demands and global competition. A well-defined project plan is valid only until the project sponsor presses the change button.

DeCarlo's (2004) view is that a well-defined project plan is needed only if the future is predictable. In the software project environment, development and marketing work in parallel. The software project requirements are never finalized until they are released, changes are inevitable, and project managers cannot rationalize those changes. They must continuously accept the changes, and also the reality of change itself (DeCarlo).

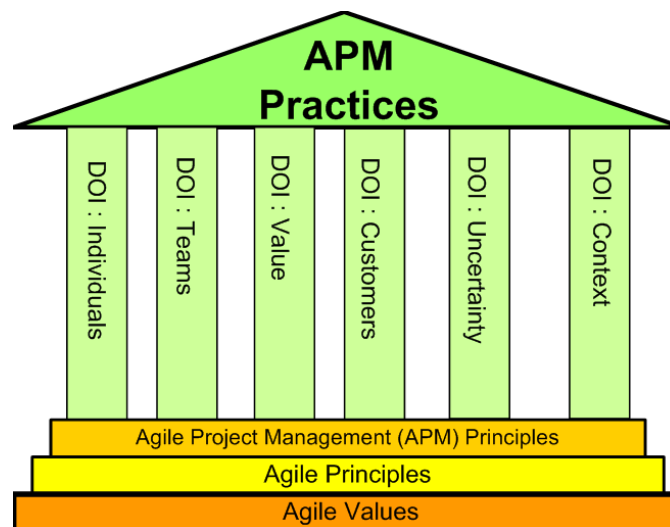
DeCarlo (2004) identified five major reasons why traditional project management is not working: (a) traditional project management is past-oriented and cannot fit into the current changeable world; (b) traditional project management is task-oriented (It focuses on managing tasks and pushes people to comply with their assigned tasks. Furthermore, it does not focus on encouraging people to discover the best solution or cultivate discovery of new innovations); (c) traditional project management makes people the servants of the

process and documents, but not the actual status of the project (Project managers spend most of their time in preparing and updating documents); (d) traditional project management controls people's minds (Pre-defined plans control the project team's activities. People not only lose their ability to adapt to change, but also begin to resist the change); and (e) traditional project management focuses on the traditional triple constraint (e.g., delivering the project on-time, within budget, and within scope). Within these constraints, traditional project management results in a gap between actual performance and the delivery of valuable products that customers want and need.

### Agile Project Management Foundation

If traditional project management activities cannot adapt to swift changes and market demands, organizations need to find a new project management paradigm to survive in the modern software development environment. Agile project management may indeed be that modern software project management paradigm. The purpose of this study is to examine whether Agile project management practices could be applied to overcome specific types of project management challenges.

Agile project management practices are categorized into six Declarations of Interdependence value areas: (a) individuals, (b) teams, (c) value, (d) customers, (e) uncertainty, and (f) context ("Declaration," 2005). The six Declaration of Interdependence values are derived from Agile project management principles, which are based on values and principles of Agile methods. The relationship among these components is shown in Figure 3, indicating the foundation upon which Agile project management practices are based.



*Figure 3.* The foundation of Agile project management (APM) practices.

### Agile Values and Principles

Agile values are derived directly from Agile methods (Manifesto, 2001). Stated very simply, Agile methods are software development approaches based on meeting customer needs by eliminating waste. Poppendieck and Poppendieck (2003) list seven areas of waste from their studies of lean software development: (a) failure to integrate into the production environment; (b) producing unnecessary documentation; (c) implementing unwanted features; (d) assigning people to multiple projects, minimizing resource and time utilization; (e) delays in starting a project, in staffing, or in finalizing requirements documents; (f) moving artifacts or handing off documents to another person; and (g) undiscovered defects.

Over the past decade, Agile methodologies have evolved into a variety of different software development methods (Abrahamsson, Salo, Ronkainen, & Warsta, 2002), although this study does not intend to focus any particular method. In early 2001, a group of industry experts representing different Agile methodologies, such as eXtreme Programming, Scrum, DSDM, Adaptive Software Development, Crystal Methods, Feature-Driven Development, and others, formed the Agile Alliance (“Join the Agile,” n.d.). As a result of trying to find a common ground between their various software development methods, they outlined four broad values and 12 principles (“Manifesto,” 2001). For analytical and illustrative purposes, the 12 principles are artificially paired with the four values as shown in Appendix H, mapping Agile principles to Agile Manifesto. Each element of the Agile Manifesto contains a primary and a secondary value (“Manifesto”). The focus is on the primary value, which is usually started first, according to the 17 Agile experts who signed the Agile Manifesto in 2001. For example, in the first element of the Agile Manifesto, the primary value, individuals and interactions, is more important than the secondary value, processes and tools. This element contains three Agile principles: (a) build projects around motivated individuals, give them the environment and support their need, and trust them to get the job done; (b) the most efficient and effective method of conveying information to and within a development team is face-to-face conversation; and (c) the best architectures, requirements, and designs emerge from self-organizing teams.

## Declaration of Interdependence Values

The job of software project management is to lead software development teams to implement software products to both satisfy their employer's objectives and meet their customer's needs (Martin, 2003). A community of Agile project leaders followed the Agile Alliance path and met in 2005 to create six Declaration of Interdependence statements as Agile project management values ("Declaration," 2005). The Agile project leaders define successful projects as the ones that achieve increasing return on investment, deliver reliable results, expect uncertainty, unleash creativity and innovation, boost performance, and improve effectiveness and reliability ("Declaration"). They state that the Declaration of Interdependence values were derived from the primary values of the Agile Manifesto ("Declaration"). The links between the Agile Manifesto's primary values, Declaration of Interdependence statements, and Declaration of Interdependence values are shown in Appendix I, linking Agile values, Declaration of Interdependence statements, and Declaration of Interdependence value areas. For example, the primary Agile value, individuals and interactions, contains two Declaration of Interdependence value areas, individuals and teams. The Declaration of Interdependence value area on value itself is derived from an emphasis on increasing value by delivering workable products. The Agile value on customer collaboration is consistent with Declaration of Interdependence value area on customers. The Agile value on responding to change has evolved into two Declaration of Interdependence value areas, uncertainty and context, because Agile leaders need to manage uncertainty through specific organizational strategies, processes and practices.



The Declaration of Interdependence rejects the notion that successful projects are the only ones that deliver within scope, time, and budget. The Agile project leaders believe that successful projects are measured by Declaration of Interdependence values derived from an interdependent set (“Declaration,” 2005). Interdependence means project teams, their customers, and their stakeholders work together by using appropriate methods to achieve project success. These methods are used to achieve the Declaration of Interdependence objectives. Both methods and objectives are derived from six Declaration of Interdependence statements as shown in Appendix J, Declaration of Interdependence objectives, methods, and major Agile project management practices. For example, the Declaration of Interdependence statement on “We unleash creativity and innovation by recognizing that individuals are the ultimate source of value and creating an environment where they can make a difference” contains the two objectives, unleash creativity and innovation and two methods as follows: (a) recognizing that individuals are the ultimate source of value and (b) creating an environment where they can make a difference.

Declaration of Interdependence values provide a guideline for software project management practitioners to create best practices for specific challenges within their own environments. Content analysis based on keywords reveals that each Declaration of Interdependence statement contains three components: (a) value areas, (b) objectives, and (c) methods. The three components can be viewed in Appendix J, Declaration of Interdependence objectives, methods, and major Agile project management practices. Each Declaration of Interdependence statement includes one objective and consists of

one to three methods. For example, in the team value area, there are two methods, establishing group accountability and building a viable team that shares responsibility for team effectiveness. Project management practitioners use these methods to take actions to achieve the six Declaration of Interdependence objectives.

### Agile Project Management Principles

With the core values of the Agile Manifesto in mind, DeCarlo (2004), Highsmith (2004), Augustine (2005), and Leach (2005) propose a set of Agile Project Management principles to help project teams, their customers, and their stakeholders work together to deliver the greatest possible value to customers. This study examines those studies of Agile project management principles related to the six Declaration of Interdependence objectives: (a) unleashing creativity and innovation to deliver reliable results, (b) boosting performance, (c) increasing return on investment, (d) delivering reliable results, (e) expecting uncertainty, and (f) improving effectiveness. A summary of studies related to Agile project management principles is shown in Appendix K for the scholarly studies of Agile project management principles and practices. A discussion of Agile project management principles and the six Declaration of Interdependence objectives is presented as follows.

*Unleashing creativity and innovation (individuals).* The Agile project management principles related to unleashing creativity and innovation are people-oriented principles in two respects, cultivating individuals and providing an environment for individuals. According to DeCarlo (2004), people-oriented values mean taking care of people's well-being first, maintaining people's quality of life, communicating honestly,

and encouraging innovation. Highsmith's (2004) principle on encouraging exploration aims to inspire individuals to reach their goals, visions, and ability to innovate. Augustine (2005) states that his principle related to encouraging emergence and self-organization seeks to help project leaders build on their own personal strengths in order to manage commitments through personal interactions.

*Boosting performance (teams).* The objective aimed at boosting performance focuses on fostering team commitments and forming a self-disciplined team (Augustine, 2004). Augustine also aligns people with common goals to eschew competition and foster cooperation. DeCarlo (2004) proposes leadership by commitment to self-mastery, which is based on encouraging leaders to gain and sustain team member commitment. The principle of self-mastery is based on asking leaders to bind themselves together with their teams in order to be entrusted to them. Highsmith (2004) proposes building adaptive teams that blend with responsibilities, self-discipline, and self-organizing structures. Leach (2005) focuses on team-building through four phases: forming, storming, norming, and performing. In addition, Leach emphasizes that team leaders must guide the team towards its goal with dynamic and continuous efforts throughout the life of the project.

*Increasing return on investment (values).* The concept of Agile project management principles to achieve increasing return on investment lies in delivering workable and valuable products, sharing open information, eliminating waste, and using the right solutions (DeCarlo, 2004; Highsmith, 2004; Augustine 2005; Leach, 2005; Schwaber, 2004). DeCarlo states that values based on sharing fast failures, delivering early value, and results orientation help teams reach the goal of delivering valuable

products. DeCarlo defines the fast failures value as giving customers an early indication of unachievable project objectives long before losing all investments. Customers usually benefit from early value if the development team can give them something to use as soon as possible. DeCarlo remarks that leaders should focus more on delivering results, rather than on tracking tasks. Sharing information can also help achieve the value objective, according to DeCarlo. He emphasizes setting up real-time communication and keeping projects transparent to all stakeholders. Similarly to DeCarlo's concept, Augustine (2005) proposes his principle of encouraging emergence and self-organization by suggesting that delivering valuable products results in an open flow and exchange of information among project team members and customers.

Highsmith (2004) notes that delivering customer-value lies in creating innovative products. Dealing with competition and creating innovative products not only sustains market share, but also increases potential return on investment. For example, the Apple company, headquartered in Cupertino, California, revived its leading role in the IT industry because of its successful and innovative iPod product line. Highsmith notes that eliminating waste involves tailoring or removing unnecessary processes to reduce production costs. For example, if the document approval process does not add any value for delivering valuable products, it is a waste of production costs. Leach (2005) takes a different approach to eliminate waste by implementing a visual project flow to eliminate scheduling waste. The visual flow includes three areas: to-do, checked out, and tests passed on a white board. The requirements are written mostly on index cards and posted in the to-do area. Developers and testers move the index cards around when they have

completed their tasks. Another way to increase return on investment is what Leach identifies as building the right products or implementing the right solutions to meet customer's needs.

*Delivering reliable results (customers).* The objective of delivering reliable results focuses in on obtaining clear product visions from customers and collaboration and interaction with customers. DeCarlo (2004) notes that clarifying project objectives helps teams understand their goals of delivering early project results quickly. Leach (2005) proposes that using a project charter as a guiding vision leads to project success. Highsmith (2004) and Augustine (2005) emphasize that product visions guide software development teams to deliver the best customer-value.

DeCarlo (2004) recommends checking with customers frequently, and determining if they are receiving valuable responses to their requests. He interacts with customers to determine their satisfaction with project progress. For example, if the project wastes a lot of effort to get only a little value, it is a good time to ask the customer the question, "Is it worth it to develop the product?" Highsmith (2004) maintains that Agile teams should constantly seek customer involvement and always seek feedback from customers if the right product is being developed for the right market. Augustine (2005) notes that customers actually drive or direct the process on Agile projects and create and maintain shared expectations.

*Expect uncertainty (uncertainty).* The objective of managing uncertainty is to respond to changes. Studies from Highsmith (2004), Augustine (2005), and Leach (2005) focus on Agile management principles related to accepting changes, accepting adaptive

actions, and employing iterative feature delivery. Highsmith states that only by accepting change, can project teams move on to implementing successful projects. Highsmith notes that responding to change lies in employing iterative processes to deliver partial products. Incremental development helps discover early design defects and create innovative software products. Augustine proposes instituting learning and adaptation with adaptive leadership to track and monitor project uncertainty. Augustine believes that changes are both dangerous and beneficial. The danger arises from uncontrolled projects. Beneficial change comes from creating new business opportunities due to acceptance of changes. Augustine's Agile project management principle is to adopt change, not to use corrective actions to control changes. Leach proposes the principle of managing variation. He uses the notion of inserting buffer time into project schedules as a means of managing project uncertainty and variations.

*Improve effectiveness and reliability (context).* When providing context for achieving the improved effectiveness and reliability objective, DeCarlo (2004), Highsmith (2004), Augustine (2005), and Leach (2005) suggest keeping simple rules and building customer value-centered organization principles. DeCarlo notes that a rule of keeping it simple coupled with a flexible project model are needed for improving effectiveness. Highsmith states that achieving the objective of improved effectiveness and reliability requires project managers and teams to simplify processes with a minimum set of rules. Augustine also encourages interaction among people and self-organization by following simple rules and processes. He implements a set of simple, adaptable, and methodical rules that allow Agile teams to deliver business value rapidly and reliably.

Leach suggests establishing a simple project management system to effectively keep team momentum focused on project success. Another way to achieve the effectiveness and reliability objective is to build a customer value-centered organization, according to DeCarlo and Highsmith.

Although DeCarlo (2004), Highsmith (2004), Augustine (2005), and Leach (2005) propose unique Agile project management principles. Their goals are to help teams determine what practices are appropriate. Furthermore, they encourage teams to create new practices when they are needed, generate new practices that are necessary, and evolve existing practices into Agile project management practices based on their principles.

#### Map Agile Project Management Practices to Declaration of Interdependence Methods

The lack of effective Agile project management practices leads to unpredictability, repeated error, and wasted effort (Chin, 2004). Customers are disappointed by slipping schedules, growing budgets, and poor quality (Johnson, 2006). Developers are disheartened by working longer hours to produce poor software (Johnson). Most project management practitioners experience the lack of effective practices that leads to wasted efforts, slipped schedules, cost overruns, and unsatisfactory quality (Glass, 1998). Development teams are often disheartened by customer feedback about unwanted software products after working long hours to produce them (Glass). The best practices from traditional project management methods result in a formidable learning curve in response to changing environments and pressure to deliver projects faster to customers (DeCarlo, 2004). Using Agile project management principles as a

foundation, project management practitioners instead look for innovative practices to help them deal with these challenges in Agile and non-Agile organization environments.

In software development, principles and practices are guides, because they encourage thinking, acting, and interacting (Highsmith, 2004). Most Agile project management practices are derived directly from Agile project management principles. For example, DeCarlo (2004) uses an eXtreme Agile project management model for practices. Highsmith creates an Agile project management framework based on his own two Agile project management principle categories, product delivery and leadership-collaboration. Augustine (2005) develops six practices from his three Agile project management principles. Leach (2005) develops Agile project management practices from his lean project management principles. Although Schwaber (2004) does not specify his Agile project management principles, he developed his Agile project management practices from his experiences in implementing Scrum.

Declarations of Interdependence methods are used to achieve six Declaration of Interdependence objectives (See Appendix J for the relationships between objectives and methods). This section discusses those studies on Agile project management practices that map to Declaration of Interdependence methods in the six Declaration of Interdependence value areas: (a) individuals, (b) teams, (c) value, (d) customers, (e) uncertainty, and (f) context.

### Individuals

Agile project management recognizes individuals who can make a difference by creating an environment where they can contribute value to the project (“Declaration,”



2005). Based on the definition of Declaration of Interdependence methods, four major Agile project management practices are identified: (a) hiring the right people, (b) training and pair programming, (c) maintaining quality of work life, and (d) building a working environment based on decentralized control. Highsmith (2004) remarks that getting the right people on the project is a critical factor to success. Schwaber (2004) notes that hiring the right people with leadership skills could make team members commit to the project performance.

After recognizing valuable individuals, project leaders should coach or train team members on how to improve their knowledge and skills (Highsmith, 2004). Project leaders should pair less experienced team members with more experienced people with different technical skills in order to broaden each person's technical capability (Highsmith, 2004; Schwaber, 2004). In eXtreme Programming, pairing individuals to work on the same tasks is called pair programming (DeCarlo, 2004). Augustine (2005) says the advantage of pair programming is disseminating knowledge among team members.

DeCarlo (2004) and Augustine (2005) point out that improving the quality of work life provides teams with autonomy and flexibility. Augustine emphasizes that a decentralized and less controlled environment provides individuals with more room for innovation and creativity. Highsmith (2004) says learning the participatory decision making process promotes the best solutions to problems from all team members and creates a better working environment.

## Teams

One of the goals of Agile project management is to build a high performance team by establishing group accountability for sharing results and building a viable team that shares responsibility for team effectiveness (“Declaration,” 2005). In comparison to Declaration of Interdependence methods, Agile project management practices in the team value area are identified as follows: (a) emphasizing commitment and leadership, (b) coaching and mentoring, and (c) building a self-organizing team. DeCarlo (2004) and Schwaber (2004) focus on establishing group commitment and Highsmith (2004) insists on team accountability. Augustine (2005) says treating team members as whole persons is important.

One way to unleash and continuously improve team member capabilities is to coach and mentor teaming skills (Highsmith, 2004). Leach (2005) suggests that project leaders use the four phases of team building skills: forming, storming, norming, and performing. Augustine’s (2005) team building concept is to encourage project leaders to build an organic team, which enables connections and adaptation through close relationships on small and flexible teams. Highsmith suggests having team members themselves manage their day-to-day tasks and interact with each other on a daily basis. DeCarlo’s (2004) success factor, self-mastery, is aimed at building a self-bound and self-organized project team.

## Value

One of the goals of Agile project management is to achieve high return on investment by focusing on the continuous flow of value (“Declaration,” 2005). To match

Declaration of Interdependence methods, five major Agile project management practices derived from prior studies are: (a) prioritizing feature lists for return on investment, (b) creating innovative products, (c) sharing open information, (d) eliminating waste, and (e) using the right tools. DeCarlo (2004) believes people would focus more on their individual contributions if they used return on investment as a goal. Schwaber (2004) says that the Scrum development team usually works on the most valuable feature first. Schwaber teaches product owners how to prioritize the feature list from the product backlog based on return on investment. Highsmith (2004) proposes prioritizing product feature lists, feature cards, performance requirements cards to align with business value, and implementing low-cost technical practices for ongoing product releases.

Highsmith (2004) states that creating innovative new products is one way to use competitive advantage in order to increase return on investment. On the other hand, DeCarlo (2004) points out that sharing open information is essential to increasing return on investment. DeCarlo says providing open real-time communication to ensure open information flow helps people get fast results, obtain early project value, and detect early failures. Highsmith remarks that delivering project value requires a project release roadmap, a project datasheet, and an iteration plan. Augustine (2005) feels that one way to increase return on investment is to create an open flow for the exchange of valuable information among project team members and other associated external groups. Schwaber (2004) recommends using a war room as a place where the Scrum teams can share daily information.

Highsmith (2004) explains that streamlining a project means eliminating any activity that does not deliver value to the customer. Applying proper approaches to determine the necessary delivery activities can reduce production cost. Leach (2005) suggests building a project system related to critical chain resource management to eliminate waste time for available resources in order to reduce cost. Leach points out that selecting the right tools for the right solutions not only reduces production time, but also increases return on investment.

## Customers

Customers can be viewed as the ultimate judge of project success (“Declaration,” 2005). In order to deliver reliable results, project leaders must frequently interact and share product ownership with customers. Two major Agile project management practices associated with Declaration of Interdependence methods are: (a) creating simple vision statements and (b) engaging customer participation. Augustine (2005) notes that engaging customers in frequent interactions and shared ownership results in delivering customer-value on projects. The goal of Agile development teams is to build software products based on customer needs (DeCarlo, 2004). Providing the development team with the bigger picture can help clear up the ultimate goal of what customers need. Concurring with Highsmith (2004), Augustine agrees that designing a vision box and developing an elevator statement can help transform customer needs into products. Highsmith says some complicated projects with high-level concepts or visions of the product may need supplemental documents such as product datasheets, financial

analyses, or product architectures as a design guideline. Leach (2005) notes that creating a project charter helps clear up the project vision among teams and project sponsors.

A successful business process lies in client collaboration and stakeholder communication skills, according to DeCarlo (2004). He suggests that project managers frequently examine the following four business questions with their project stakeholders: (a) Who needs what and why? (b) What will it take to do it? (c) Can we get what it takes? and (d) What is it worth? Highsmith (2004) says the development team not only needs to set up an interface with the customer team, but also needs to interact daily with the customer team. Schwaber (2004) states that customers drive the development project at each iteration of the process by participating in planning and review meetings. Augustine (2005) notes that an on-site customer representative can help the project team write user stories, prioritize feature lists, and perform user acceptance tests.

### Uncertainty

If change is inevitable, the way to manage uncertainty is through iteration, anticipation, and adoption (“Declaration,” 2005; Augustine, 2005). Three major Agile project management practices match Declaration of Interdependence methods and form the uncertainty area: (a) applying iterative and incremental change, (b) observing and assessing practices, and (c) taking adaptive actions. Highsmith (2004) employs iterative feature delivery to cope with project scope changes. Schwaber (2005) implements incremental release and planning as a part of the Scrum process. Augustine (2005) develops iteration plans and task backlogs, which contain necessary user stories and detailed tasks.

Because project change is unpredictable, DeCarlo (2004) urges project management practitioners to accept the reality of change and then to adopt it. Augustine (2004) says that observing different situations and conducting different scenarios during planning can help project management practitioners manage unexpected future events. When dealing with unrealistic project schedules, Leach (2005) notes that inserting buffer time into project schedules is an efficient means of managing project uncertainty.

Augustine (2005) says that good project management practices should be used to continuously monitor the project and help the team cope with changes. Augustine points out that continuous learning and adaptation in response to feedback helps match outcomes to customer needs. With respect to adaptive action, Highsmith (2004) proposes that best practices involve the use of proper tools, review sessions, and adaptive actions to update teams and customers with the status of the product and project. Highsmith describes how to deal with changes in the adapt phase of his Agile project management framework.

## Context

Managing context is vital for improving effectiveness and reliability by providing the best strategies to adapt to changes (“Declaration,” 2005). There are two major Agile project management practices that correspond with Declaration of Interdependence methods in the uncertainty area: (a) keeping simple rules and (b) building customer-value organization. DeCarlo (2004) remarks that the best strategy is to keep simple rules in an Agile organization. Highsmith (2004) proposes a self-organization strategy based on

tailoring processes. Augustine (2005) suggests implementing a set of simple adaptable methodology rules that allow agile teams to deliver business value rapidly and reliably.

In order to build a customer-value organization, DeCarlo (2004) suggests that organizations need to implement a flexible project model to enable project management practitioners and stakeholders to keep projects under control and deliver business value in a volatile environment. A flexible project model is a change-responding process which includes four iterative cycles: (a) visionate, (b) speculate, (c) innovate and reevaluate, and (d) disseminate. In addition, DeCarlo also recommends that organizations support change-tolerant processes and deliver customer-value to projects.

#### Need for a Study of Agile Project Management Practices in Dealing with Project Management Challenges

Based on the literature review, it appears there is a need for a comprehensive, in-depth study of Agile Project Management practices and project management challenges. There are numerous gaps and problem areas in the literature associated with Agile project management practices and project management challenges. First, there are an insufficient number of scholarly studies of Agile project management principles and practices. The textbooks only mention notional concepts of Agile project management, but not theoretical frameworks and models of Agile project management. Second, there appears to be no Agile project management articles based on scholarly qualitative or quantitative research methodologies. Third, there are no published studies about Agile project management challenges. Only one author, Schwaber anecdotally mentioned his experience when implementing Agile project management in his book. None of the

articles mentioned in the literature review addressed Agile project management challenges, but listed project management challenges in-general. The missing piece is the connection between the theories and the implementation of Agile project management practices.

This study serves to examine the relationship between Agile project management practices and project management challenges. There is a need to identify, categorize, and map Agile project management practices to specific challenges. Based on identifying gaps in the literature review, this study seeks to answer the question: How do Agile project management practices map to project management challenges for software development projects? The next section discusses the creation of a conceptual framework for mapping Agile project management practices to project management challenges. Furthermore, it will deal with very specific project management challenges to help satisfy the need for this study, as well as the methods used to validate the conceptual framework.

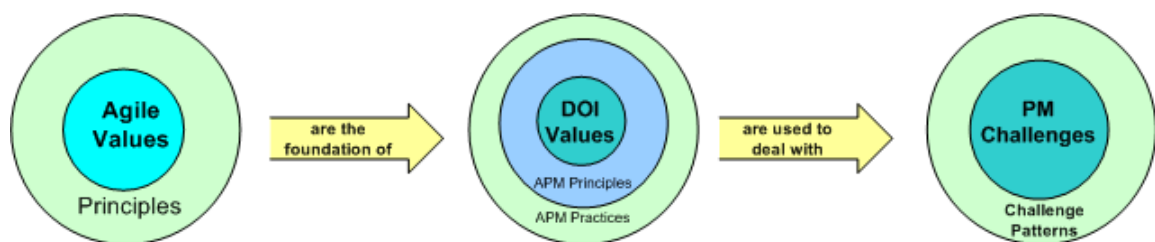
### Creation of the Conceptual Framework

Since the links between Agile project management practices and project management challenges were missing from the literature, the first challenge was to construct a conceptual framework. The framework identifies Agile project management practices, project management challenges, and their relationships. The focus of this study is to link Agile project management practices to project management challenges using the six Declaration of Interdependence value areas including (a) individuals, (b) teams, (c) value, (d) customers, (e) uncertainty, and (f) context. Therefore, this section discusses



how project management challenges are mapped to the six value areas and how the conceptual framework was designed.

In the previous section, the way Agile experts establish Agile principles and Agile values were investigated. The prior section then presented a discussion of how Agile project management principles and practices are captured based upon Declaration of Interdependence values. Most of this information came from prominent Agile project leaders and was designed to help deliver projects more successfully. After carefully grouping and summarizing Agile project management practices into the six Declaration of Interdependence value areas, the intention was to introduce effective practices to deal with major project management challenges. The relationships among Agile values, Declaration of Interdependence (DOI) values, Agile project management practices, and project management challenges is shown in Figure 4.

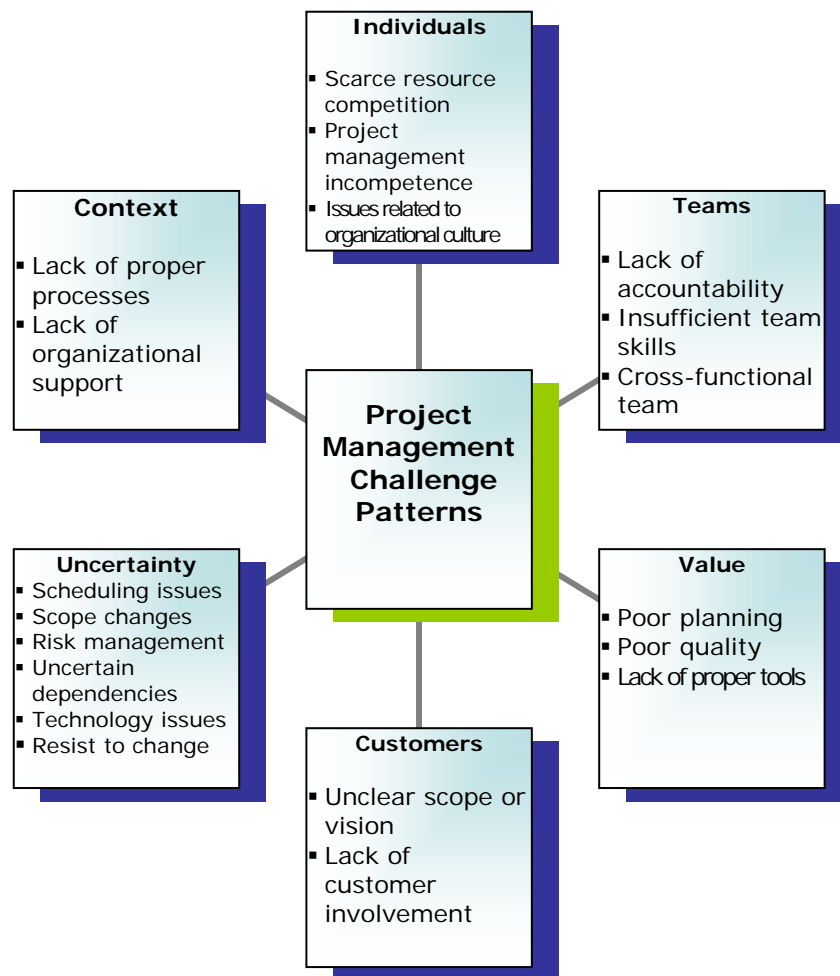


*Figure 4.* Agile values, Declaration of Interdependence (DOI) values, Agile project management (APM) practices, and project management (PM) challenges.

### Challenge Patterns Mapped to Declaration of Interdependence Areas

As the first step in identifying solutions to the project management challenges, they were categorized and grouped into six common project management areas related to Declaration of Interdependence values. Because Agile project management practices were grouped into six Declaration of Interdependence value areas, project management challenge patterns were categorized into the same Declaration of Interdependence value areas. This was done because it was necessary to check whether any particular practices could be used to deal with specific software project challenges in the same areas.

If there were no apparent relationships between software project management challenges and the six Declaration of Interdependence value areas, two additional steps were taken to link them based on further content analysis. The first step was to analyze the 19 project management challenges from Table 1, based on recent surveys and scholarly studies. The second step was to identify the relationship between each pattern and each value area. For example, in the customer area, it was obvious that two challenge patterns, unclear scope or vision and lack of customer, are grouped into this category. The grouping between Declaration of Interdependence areas and major project management challenges is presented in Figure 5 for further detail. The sources of major project management challenge patterns and their references are also provided in Appendix L for reference.



*Figure 5.* Major project management challenge patterns grouped into the six Declaration of Interdependence areas.

### Mapping of Agile Project Management Practices to Project Management Challenges Framework

The purpose of this study was to examine the relationships between Agile project management practices and project management challenges. Five studies were analyzed: DeCarlo (2004), Highsmith (2004), Schwaber (2003), Augustine (2005), and Leach

(2005). Nineteen major Agile project management practices were selected to deal with 19 major project management challenges: (a) training and pair programming, (b) hiring the right people, (c) maintaining quality of work life, (d) decentralizing control, (e) emphasizing commitment and leadership, (f) coaching and mentoring, (g) building a self-organizing team, (h) prioritizing feature lists for return on investment, (i) creating innovative products, (j) eliminating waste, (k) sharing open information, (l) using the right tools, (m) creating simple vision statements, (n) engaging customer participation, (o) applying iterative and incremental strategies, (p) observing and assessing practices, (q) taking adaptive actions, (r) keeping simple rules, and (s) building customer-value organization.

After conducting a content analysis, the conceptual framework mapping Agile project management practices to project management challenges was produced as shown in Figure 6. The framework represents the results of the analysis of 19 Agile project management practices and 19 major challenges. The basic notion is that Agile project management practices can be used to overcome project management challenges. The conceptual framework defines the goals, scope, and boundaries of this study. The following sections investigate how Agile project management practices, Declaration of Interdependence value areas in-specific, can help project management practitioners successfully overcome these challenges.

Mapping Agile Project Management Practices to Project Management Challenges Framework			
DOI Value Areas	APM Major Practices	H (+)	PM Major Challenges
Individuals	Hiring the right people	1.	Project management incompetence
	Training and pair programming	2.	Scarce resource competition
	Maintain quality of work life	3.	Issues related to organizational culture
	Decentralizing control		
Teams	Emphasizing commitment and leadership	4.	Lack of accountability
	Coaching and mentoring	5.	Insufficient team skills
	Building a self-organizing team	6.	Cross-functional team
Value	Prioritizing feature list for return on investment	7.	Poor planning
	Creating innovative products		
	Eliminating waste		
	Sharing open information	8.	Poor quality
	Using right tools	9.	Lack of tools
Customers	Creating simple vision statements	10.	Unclear scope or vision
	Engaging customer participation	11.	Lack of customer involvement
Uncertainty	Applying iterative and incremental strategies	12.	Scheduling issues Scope Changes
	Observing and assessing practices	13.	Risk management Uncertain dependencies Technology issues
	Taking adaptive actions	14.	Resistance to change
Context	Keeping simple rules	15.	Lack of proper processes
	Building customer-value organization	16.	Lack of organizational support

Figure 6. Mapping framework for Agile project management practices to project management challenges.

*Hiring the right people (individuals).* A leading cause of project failure is project management incompetence. Glass (1998) notes poor management is the cause of poor planning and poor project performance. Johnson (2006) says a project manager should

have the basic skills necessary to direct and lead a high performance team. Johnson remarks that lack of project management competence leads to diversions and missing of the targeted goals. Both Highsmith (2004) and Schwaber (2004) state that hiring the right people who like to learn is the key to overcoming the project management incompetence challenge.

*Training and pair programming (individuals).* Based on surveys and scholarly studies, one of the biggest challenges to working on software development projects is the issue of scarce resources. Projects usually compete for scarce organizational resources against other projects and initiatives, placing the project manager in the position of competing head-on for organizational-level resources. Schwaber (2004), Highsmith (2004), DeCarlo (2004), and Augustine (2005) use pair programming, a training method adapted from eXtreme Programming, to pair junior and senior programmers together on the same task. The advantage of pair programming is the exchange of information and transfer of knowledge more quickly (Jensen, 2003). Pair programming is used to build a resource pool (Lui & Chan, 2006). In most situations, projects may be continued without interruption because of the resource pool created by pair programming. For example, if one developer is sick, the other developer can still code. Another solution to scarce resource competition is to provide continuing training to individuals (Erdogmus & Williams, 2003). DeCarlo points out that eliminating unknown barriers to individuals is essential so they can do quality work.

*Maintain quality of work life and decentralizing control (individuals).* Some of the largest challenges associated with software development projects are issues related to

organizational culture. In order to implement Agile project management, practitioners must help organizations change their cultures. Most organizations are in the traditional command-and-control system. This command-and-control culture is a blocker for autonomy, flexibility and speed (Schwaber, 2004; DeCarlo, 2004). Augustine (2005) proposes that creating a high quality of work life allows team autonomy and flexibility, and a customer-value focus without sacrificing control. Augustine emphasizes that a decentralized and less controlled environment provides individuals with more room for innovation and creativity. Highsmith (2004) points out that one of the organizational culture barriers is improper decision-making processes. He proposes a participatory decision-making process to help conceive solutions to problems based on information and input from all team members, not just from the team members who can argue the loudest.

*Emphasizing commitment and leadership (teams).* Lack of accountability is a critical team issue, as stated by Ford (2004). The project team and stakeholders are not held accountable for the project results or lack of reaching project goals. Schwaber (2004) says project management practitioners need to cultivate team commitment. Schwaber notes that team member commitments to each other increase productivity, because they help one another out whenever necessary. DeCarlo (2004) encourages project management practitioners to establish trust among team members. A sign of team commitment is when its members are able to freely exchange their emotions, thoughts, and interactions. Sustaining commitment to others is critical to project success. Leach (2005) feels project management is more about leading people than it is about managing

tasks. In order to make the project succeed, Leach says it is important to make stakeholders commit to the project.

*Coaching and mentoring (teams).* Another team-related issue is insufficient team skills, according to Ford (2004). Tasks should be assigned based on the team member availability and should not be based on their skill sets. To close the skill gaps, Highsmith (2004) suggests coaching and mentoring team members to unleash their capabilities and improve business knowledge and technical skills. Moreover, project managers need to provide team members with the resources necessary to meet their needs, including training, hardware, and software. Leach (2005) suggests that project leaders continue to coach and mentor team members on how to reach their project goals.

*Building a self-organizing team (teams).* Managing a cross-functional team is a big challenge for project managers (Schwaber, 2004). Schwaber notes that many team members are often split among several teams. It is difficult to allocate their time in such a way as to concentrate on only one set of tasks. This challenge is also caused by a shortage of all cross-functional skills. Augustine (2005) suggests that the first step that should be used to overcome the cross-functional team challenge is to build an organic team. Augustine defines an organic team as a self-organizing team. Team members manage their own workload without direct command and control on what tasks they have to work on. For example, with an all-volunteer pull task management system, team members can sign up for their own tasks by themselves. Highsmith (2004) remarks that a self-disciplined team can perform effectively because it eliminates the time members spend waiting for their next task. DeCarlo (2004) explained that if team members are learning



self-mastery, they can also help themselves leverage their strengths in a cross-functional team. Self-mastery means to recognize one's abilities to contribute to the team. Schwaber states that through team collaboration and integration meetings, teams also help each other to overcome cross-functional team skill incompetence. For example, testers, developers, and designers can work on functional designs together, instead of having only the designer working on the design alone. Augustine (2005) also introduces the concept of redundancy of function to solve the needs of cross-functional team members. Redundancy of function means instead of adding other functional team members, such as business analysts, developers or testers, the existing team members should pick up the extra functions themselves. For example, a developer can also code and design for the same project on each iteration.

*Prioritizing feature list for return on investment, creating innovative products, and eliminating waste (value).* If valuable software projects are not delivered to customers on time, the subsequent software products may miss the time to market. Most failed projects are delivered late or are over budget (Chin, 2004). When the cause is poor planning, the Agile project management solution is not to offer a better planning process, but to prioritize feature lists for return on investment and create innovative products. Schwaber's (2004) product backlogs and Highsmith's (2004) product feature cards are used to prioritize product features. The product manager instructs the development team to only work on the software project's most valuable features and not waste their time on valueless features. Another cause of poor planning is due to market competition (Johnson, 2006). The project team needs to successfully create new products that are

synchronized with market trends (Highsmith). In addition, Highsmith suggests that project management practitioners must eliminate any activity that does not deliver value to the customer. Leach (2005) proposes a project system to eliminate wasted time associated with waiting for available resources.

*Sharing open information (value).* Lack of information is often the cause of poor product quality. To solve this problem, Augustine (2005) suggests openly sharing information by using the project's value stream map, customer feedback, daily integration meetings, and interaction with customers. For example, when a customer sends requirements to the development team, the project manager should then assemble a value stream map to show the customer the whole process, and specify which units will be responsible for delivering the project's product. Encouraging customer feedback and inviting customers to daily integration meetings are Agile project management practices that help build projects based on customer's needs and wants (DeCarlo, 2004). Based on real-time communication, the customer can understand what has been undertaken and determine the project's potential value to the market as early as possible. Highsmith (2004) suggests sharing a project release roadmap, project datasheet, and iteration plan to help deliver valuable products from projects. Schwaber (2004) recommends using a physical place (e.g., team co-location) for teams to openly share information.

*Using the right tools (value).* Johnson (2006) found that failed projects do not usually use the right tools. Leach (2005) suggests that project management practitioners develop various tools and alternative solutions to the problem. Leach also wants project management practitioners to keep in mind that selecting the right solution that can best

reflect customer requirements is of utmost importance. For example, project managers can create a weighted model based on selection criteria to rank alternative solutions in order to determine which solution may be the best choice.

*Creating simple vision statements (customers).* Communicating vague goals only creates confusion and results in poor team performance (Ford, 2004). The solution to the problem is to create a simple vision statement (Johnson, 2006). Augustine (2005) suggests designing a product box as an example (e.g., the carton in which shrink-wrapped software is contained). He says that the project team should not review the project requirements document, but instead asks them to visualize colors, designs, logos, and the brand name on the product box first. The product vision box, project statement, project charter, and project data sheet all serve as communication tools to ensure stakeholders understand the scope of the project, the needs of the project, the short and long term goals of the project, and the expectation of the project sponsors (Highsmith, 2004). For example, most people use the Google search engine. Google's success rests largely on the simple vision of their co-founder, Larry Page, that the search engine "would understand exactly what you mean and give back exactly what you want" ("Our Philosophy," n.d., para. 1).

*Engaging customer participation (customers).* A clear project vision created by customers does not guarantee that the project team will deliver what customers want until the release of the software. Continuous customer involvement in the development process is critical to project success (DeCarlo, 2004; Highsmith, 2004; Schwaber, 2004). DeCarlo suggests applying his four business questions to the Agile project management practices

in order to reflect the latest expectations within projects. Ongoing customer collaboration makes projects transparent to the stakeholders and helps customers find the quick path to determine risks or fast failures. Having a close relationship to the customer is regarded as one of the best Agile project management practices (Highsmith, 2004).

*Applying iterative and incremental strategies (uncertainty).* The challenge for traditional project managers is to deliver projects on time, within budget and within scope. According to Ford (2004), most projects have unrealistic deadlines to complete their scope. The best way to deal with changes is to “make change your friend” (DeCarlo, 2004, p. 41). Agile project management involves the implementation of iterative and incremental release plans (Larman, 2004). Schwaber (2004) introduces Scrum, a short iteration process, in which project teams deliver a shippable software product in 30-day development cycles. Because of the short development cycle, customers are allowed to make any changes during the process they wish; and project teams embrace the changes and are able to deliver end products matching customer needs. Poppendieck and Poppendieck (2003) note that delivering projects quickly, before customers change their minds, is a good strategy for Agile project management releases.

*Observing and assessing practices (uncertainty).* The *PMBok Guide* (2004) teaches project management professionals to use risk management plans to manage uncertain dependencies and risk issues. However, a well-planned project is not always flexible enough to handle all kinds of changes (DeCarlo, 2004). Augustine (2004) says that observing different situations and considering different scenarios can help deal with unpredictable outcomes. By assessing project schedules, Leach (2005) notes that

inserting buffer time into project schedules is an efficient means of managing project uncertainty.

*Taking adaptive actions (uncertainty).* Glass (1998) raises one question: “Does project failure lie with the use of new technology or the people using it” (p.102)? Glass said the answer could be both. It is dangerous to have a group of inexperienced people using immature or old technology to implement software products. Highsmith (2004) notes that taking adaptive action can impact technical activities such as extending the iteration cycles, but the benefit is making an effective product by integrating new technology. Augustine (2005) comments that adapting to changes involves converting the team member’s mindset from making corrections to learning, and from lessons-learned to project reflection. Augustine suggests project managers are not there to manage changes, but to influence them. The question is how to influence people to adapt to change? Kendrick (2006) remarks that most project managers manage the project when the team members do not report to them. One of Kendrick’s three principles for controlling projects is to influence people. Influencing people includes the ability to gain people’s trust and respect. Gaining cooperation is easier if people have positive attitudes.

*Keeping simple rules (context).* When projects become complex, it is difficult to use prescriptive processes, because a step-by-step, linear process cannot be applied (Schwaber, 2004). Scrum and other Agile methods such as eXtreme Programming use simple rules and keep the project visible to all stakeholders (Drobka, Nofitz, & Raghu, 2004; Schwaber, 1995). Augustine (2005) notes that forcing team members to follow complex and rigid regulations limits creativity and innovation. Agile project management

uses minimal planning and other related processes to manage complex projects.

Schwaber and Beedle (2001) introduce the application of Scrum to the management of large and complex projects in a multiple-application environment. A multiple-application project was branched out into sub-teams. A shared resource team was formed to support or enhance each component. For example, in the billing system, employee identification numbers are the root objects. The sub-systems were benefits, 401K, and compensation packages. Another way to keep rules simple is to tailor and customize existing processes (Highsmith, 2004). For example, when the organization requires that all projects need to provide a project plan, the self-organizing team should discuss whether or not the project plan will help the software project. If not, the development team should make a request to the organization to eliminate this process for their project.

*Building customer-value organizations (context).* Jedd (2007) discussed how organizational culture relates to project management failure. The project success factors hinge on gaining senior management support and integrating project management into the organization's culture. Unlike Jedd's report, Agile project management demands organizational changes in order to overcome project management challenges and support Agile project management (Chin, 2004). A bureaucratic organization is a barrier to implementing Agile project management practices. Upper management commitment to projects is critical to fulfilling an organization's business strategy. DeCarlo (2004) proposes creating a self-organizing Agile environment. Schwaber (2004) emphasizes building a customer-oriented organization to focus on return on investment. Highsmith (2004) expects the organization not only to focus on customer value, but also to use an

adequate decision-making process based on participatory decision making, where everyone participates in the process. Highsmith states that efficient participatory decision-making processes speed up decision-making and eliminate the time wasted while waiting on senior management decisions. Because organizations can make quick decisions, project value can be delivered more quickly to customers.

### Summary

This chapter served as an examination and analysis of studies related to project management challenges and the foundation of Agile project management practices. This chapter also highlighted the shortage of studies related to the mapping of Agile project management practices to project management challenges. In fact, no information was found that explicitly mapped Agile project management practices to project management challenges. Since the links between Agile project management practices and project management challenges were missing from the literature review, a conceptual framework was designed to allow exploration and validation of these relationships. Further investigation of the mapping relationships between Agile project management practices and project management challenges will be explored in the next chapter. Both qualitative and quantitative research methods were used to conduct this study.

### Chapter Three: Methodology

The aim of this study was to examine the extent to which Agile project management practices can be used to address project management challenges in software projects. Both quantitative and qualitative methods were used to collect and analyze the data. The qualitative analysis was used in order to capture, describe and understand the phenomena from the point of view of the participants (Leedy & Ormrod, 2005). This study intended to determine how people perceived, described, and judged their experiences with project management challenges, and how they dealt with their challenges through their understanding of Agile project management practices. The use of quantitative analysis was employed to present the effectiveness ratings to answer two research questions: a) How effective are Agile project management practices in solving specific project management challenges? b) How useful was the conceptual framework for mapping Agile project management practices to specific project management challenges?

#### Phenomenology

The qualitative research tradition for this study was phenomenology. Creswell (2007) describes “the basic purpose of phenomenology is to reduce individual experiences with a phenomenon to a description of the universal essence” (p.58). The phenomenological approach may be used to explore how project management practitioners transform their experiences into essences and consciousness through reflection (Patton, 2002). Researchers start with their interest in a particular phenomenon



(Creswell). The focus of this study is to explore project management practitioners' experiences in managing software projects. Gall, Gall, and Borg (2003) remark that phenomenological research methods are used to investigate people's thinking, changes in the way people think, and the results of such changes. This study investigated practitioner experiences in encountering project management challenges, their thinking about how they dealt with project management challenges, and their thinking about how Agile project management practices were used to deal with these project management challenges. Agile project management practices were new for some of the participants and introduced to some of them for the first time.

Through data collection from people who experience a phenomenon, researchers interpret the data and develop "a composite description of the essence of the experience" (Creswell, 2007, p.58). The process of data collection is performed through single or multiple in-depth interviews (Creswell). In-depth interviews were conducted with people who had direct experiences with the phenomenon under study (Patton, 2002). This study sought to understand practitioner experiences in managing software projects through the use of in-depth interviews. Rubin and Rubin (2005) suggest developing a conversational partnership between the interviewer and interviewees. Patton says an open-minded and flexible approach enables researchers to anticipate discovering more information when participants unfold their stories in a narrative way. The primary benefit of discovering and capturing emerging, real life experiences of participants is enrichment of the data (Patton).

### Sampling

The population for this phenomenological study consisted of project management practitioners, such as project leads, managers, and project liaisons who were involved in software development activities. Announcements were made in the newsletters of the Agile Project Leadership Network (APLN), Washington, D.C. chapter and Project Management Institute (PMI), Washington, D.C. chapter. Data was collected from a sample size of 27 participants, drawn from both project management communities.

This study used a mixed purposeful sampling strategy. Patton (1992) notes the purposeful sampling strategy is used to select a rich sample, strategically and purposefully, to meet the interests and needs of the study. For example, only project management practitioners who encountered project management challenges were interviewed. During data selection, three project practitioners without project management challenges were not selected to participate in this study.

The two types of purposeful sampling strategies for this study were criterion sampling and snowball sampling. Using a criterion sampling strategy (Gall, et. al, 2003), four groups were selected for this study: (a) project management practitioners who were encountering project management challenges in an Agile environment; (b) project management practitioners who were encountering project management challenges in a non-Agile environment; (c) project management practitioners who knew how to deal with their project management challenges; and (d) project management practitioners who did not know how to deal with their project management challenges. This study also

employed snowball sampling to identify potential participants referred by project management practitioners (Patton, 1992).

### Overview of the Participants

A total of 30 volunteers from Agile and non-Agile project management communities expressed interest in participating in this 14-week study. Three out of the 30 volunteers failed to meet selection criteria because they were not managing software projects. A total of 27 people participated in the interview process. Among 27 people, three of them did not continue with the second interview due to their busy schedules or because they were taking on new projects. Therefore, a total of 24 people provided the ratings of the effectiveness of Agile project management practices in dealing with project management challenges.

The way the interviews were conducted varied. There were four face-to-face interviews and 43 telephone interviews. Some telephone interviews were conducted with the aid of a computer tool called Live Meeting. This enabled the interviewees to visualize the design of the conceptual framework presented in the literature review. Furthermore, it allowed the implementation of the associated effectiveness ratings in an interactive, online style. The tool was also used for real-time member checking and to validate the data. For example, interviewees could correct any misrepresentation online when the researcher was typing the data they provided.

Demographic data were gathered during the first interview (see Appendix O for the interview protocols). The demographic data was used for background information and for rating components when presenting the effectiveness ratings found in the conceptual

framework. As shown in Figure 7, the distribution list of Participants' Demographic Information shows that there are four components associated with the demographic data: a) years of project management experience b) project management knowledge related to Agile or non-Agile method, c) organizational environments, and d) project type.

Based on the results, project management experience was divided into four groups: a) 3-6 years, b) 7-13 years, c) 14-20 years, and d) 21-25. The second component is project management in-depth knowledge related to Agile, waterfall, mix (both Agile and waterfall), or other, such as organizations' own methods. The Agile cell shows numbers of interviewees who were Certified Scrum Masters (CSMs). The Scrum Alliance is the official organization authorizes to certify software project management professionals in the use of Scrum. The waterfall cell displays numbers of interviewees who are certified project management professionals (PMPs) by the Project Management Institute. Only one interviewee had both certifications. The next cell includes interviewees who are not included in any of the aforementioned columns. The third component is organizational environments, including: (a) Agile, (b) waterfall, (c) mix (both Agile and waterfall), and (d) other, such as Spiral, a process in between waterfall and Agile which contains four phases: planning, evaluation, risk analysis, and engineering (Boehm, 1986). The last component is project types, which includes: a) government projects, b) commercial projects, c) non-profit projects, and d) mixed type of projects including government, commercial, or others.

Demographic Backgrounds	Counts
<b>Project Management Experiences</b>	
3-6 Years	5
7-13 Years	9
14-20 Years	8
21-25 Years	5
<b>Project Management Knowledge in</b>	
Agile (Certified ScrumMaster)	5
Waterfall (PMP)	12
Both	1
Other	9
<b>Organizational Environments</b>	
Agile	10
Waterfall	3
Mix	11
Other	3
<b>Project Types</b>	
Government	10
Commercial	13
Non-profit	2
Mix	2

Figure 7. Distribution list of participants' demographic information.

### Data Collection

This study utilized semi-structured interviews as the primary means of data collection. Yin (2005) notes interviews are essential sources for finding evidence in specific situations. All participants received a letter of consent (see Appendix M for the original copy) before conducting the first interview for this study. Audio records of the interviews were made to validate the transcripts in order to keep the original data sources.

The data collection process was designed to help ensure data quality (see Appendix N for the detail flow of the data collection process). The process started with the development of interview questions and announcements in newsletters associated

with the Agile Project Leadership Network, Scrum Alliance, and Project Management Institute. The next step was to identify potential participants from project management communities. Data selection was restricted based on two criteria: a) project management practitioners must manage software development projects and b) they must have encountered project management challenges. When qualified participants were identified, the next step was to schedule the first interview and prepare an interview protocol (see Appendix O for the questionnaire) for the two interviews.

During the first interview, challenges faced by the participants were captured. Based on their knowledge of Agile project management practices, the conceptual framework was introduced to most practitioners (See Figure 6, the mapping framework for Agile project management practices to project management challenges). If the practitioners had implemented Agile project management practices already, the practitioners were given the effectiveness ratings (See Appendix P for the rating template of the major Agile project management practices). If the practitioners just learned the Agile project management practices for the first time during the first interview, the participants were encouraged to implement Agile project management practices to solve their challenges. In addition, follow-up interviews were scheduled. Participants were informed that they would be asked to rate the Agile project management practices during the second interview. The timeframe between each interview was 3 to 12 weeks, depending upon how soon each participant could implement Agile project management practices to address their challenges.

The second interview involved asking the participants to evaluate the results of their implementation of Agile project management practices and the effectiveness of the conceptual framework (see Figure 6, the mapping framework for Agile project management practices to project management challenges). During the second interview, the scales were explained to the participants, which were organized from 1 through 7 and would be used to evaluate the level of effectiveness of the Agile project management practices and the conceptual framework. For example, 1 is for strongly disagree, 2 for disagree, 3 for somewhat disagree, 4 for neither disagree nor agree, 5 for somewhat agree, 6 for agree, and 7 for strongly agree.

#### Data Analysis Process

The data analysis process (see Appendix Q) displays the process on how the end-results were produced. The data analysis process consisted of five steps: (a) reviewing data, (b) coding, (c) matching themes, (d) categorizing, (e) patterning, and (f) presenting qualitative and quantitative data (Yin, 2005).

Afterwards, reviewing data included transcribing data, organizing notes, and then reviewing transcripts and notes. The next step was to analyze the transcribed data and field notes from interviewees. After reviewing the raw data, the data were clustered into two major categories, project management challenges and Agile project management practices. Strauss and Corbin's (1998) three level coding structure consisting of open, axial and selective codes were applied to the data analysis. Open codes in numerical order were used for project management challenges, axial codes were assigned for related Agile project management practices, and selected codes were used after rating of each

theme. In addition, this study categorized selected codes into five patterns. The development of code structure is shown in Figure 8.

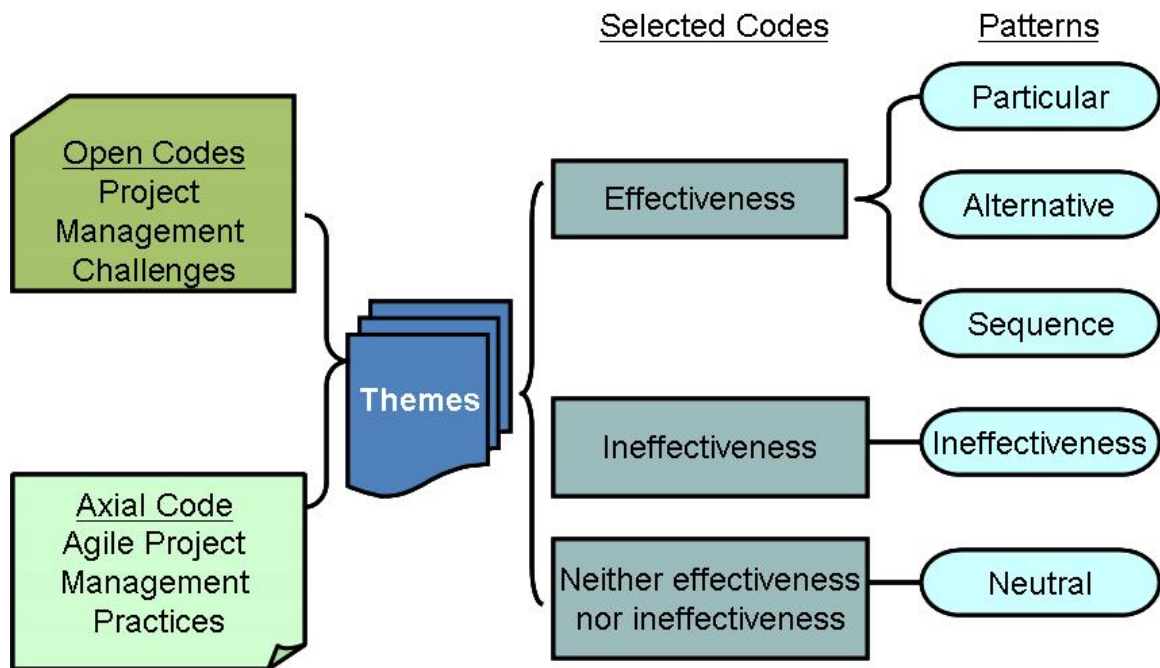


Figure 8. Code structure containing open, axial, selected, and pattern codes.

The detailed coding structure for project management challenges, Agile project management practices, themes, and patterns is outlined in Appendix R for the complete structure. After applying open and axial codes, the next activity was to identify themes. Each theme was composed of pairing one Agile project management practice with one project management challenge related to the practice. A total of 52 themes were identified, excluding three themes categorized as N/A (not applicable), because no responses were received for these three themes. Identified themes were distributed in the



six Declaration of Interdependence value areas with a theme number such as theme 1-2, in which 1 stands for axial code and 2 stands for open codes.

Based on the effectiveness ratings results, selected codes were used to categorize all themes into E (effectiveness), I (ineffectiveness), and N (neutral or neither effectiveness nor ineffectiveness). If the average score of the theme was higher than 4.0 in the effectiveness ratings column of Appendix R, the theme would be in the category effectiveness. If the score was lower than 4.0, the theme would be included in the ineffectiveness category. However, if the average score was exactly 4.0, it would be in the neutral category, neither effectiveness nor ineffectiveness.

The next step was to search for patterns in the identified themes. Manns and Rising (2005) believe that patterns help provide solutions to problems. When patterns are organized, people encounter less stress when finding solutions to deal with their problems (Manns & Rising). The patterns help project management practitioners identify what practices they can use to deal with their challenges. Patton (2002) suggests the use of a cross-classification technique to review the impacts at all levels. A pattern matching technique was used to map out what practices may work better in certain circumstances or what events usually trigger a particular challenge. For example, a self-organizing team can only be built with sophisticated team members, and an attempt to build a self-organizing team from inexperienced members usually triggers specific project management challenges. Another example is that all projects encounter scheduling issues because of time-to-market pressure.

Based on the rating scores, the existing patterns were pattern effectiveness (E), ineffectiveness (I), and neutral (N). After analyzing the effectiveness category, pattern E was evolved into three patterns, Particular, Alternative, and Sequence, which can be also called pattern P, A, and S by using the first letter of each pattern. Pattern P means a particular Agile project management practice can be used to deal with a specific project management challenge. Pattern A means project management practitioners can choose more than one Agile project management practice to deal with a specific project management challenge. Pattern S means project management practitioners may implement a sequence of Agile project management practices to deal with their specific project management challenges. A total of five patterns explaining the relationships between Agile project management practices and project management challenges were produced as a result (see Appendix S for the five relationship patterns).

The final step was to present quantitative and qualitative results and data to help answer the research questions. The quantitative data was based on the average score from the ratings of the major Agile project management practices (see Appendix P for the rating template), and was used to identify specific Agile project management practices that can be used to deal with specific project management challenges. Another set of quantitative data was based on the interviewee's average rating scores on the conceptual framework. This data was used to answer the third research question on how useful the conceptual framework was (see Appendix T, the template for the ratings of the mapping framework). Qualitative interpretation began with the construction of meanings from the data (Patton, 2002). This qualitative study sought to interpret facts from the descriptive

data. After understanding the descriptive data, then a discussion and comparison to the concepts found in the literature review could begin to be formulated. Patton notes that it is important to consider causes, consequences, and relationships among data before drawing conclusions about the phenomenon.

### Scope Limitations

In the course of this study, the limitations were identified in five respects. First, participants were asked to voluntarily participate in the study. The views of the volunteers only reflected a very limited perspective regarding Agile project management practices. Second, some participants did not want to share their experiences on how to handle failed projects, because project management practitioners were hesitant to identify their weaknesses or known in the community for having weaknesses. Third, qualitative research was used for this study and seemed to uncover biases among some participants and their responses regarding the use of traditional versus Agile project management methods. Fourth, participant's responses regarding the level of effectiveness of the implementation of Agile project management practices were dependent on their own experiences and comfort level. Finally, this study did not attempt to discriminate by factors such as gender, age, organizational type, project type, educational background, or project management experience. Some of these factors were used to provide greater insight into interpreting results.

## Validity

Validity refers to the question of whether the data collected for a study truly reflects reality, and whether its accuracy can be verified (Gall, et. al, 2003). Gall et. al note valid results should be replicable by other researchers. For this study, a potential threat to validity is replication. Researchers cannot replicate the same results of this qualitative study. When other researchers study the same topic again, respondents may rarely say or do exactly the same things. However, Gall et. al point out that it is common that the same data procedures may not guarantee the accuracy or truth of qualitative analysis.

To mitigate the risk of validity threat, Creswell (2003) proposes a member-checking method to increase the credibility of data findings. Participants received a summary of their challenges after the first interview in order to check the accuracy of the data. Participants were given the opportunity to review a summary of the interview data and effectiveness ratings online through the use of the Live Meeting software. Another way to obtain accurate data relies on the researcher's role. Patton (1992) says a researcher is an instrument to collect data. Patton indicates that a well-trained, experienced, and knowledgeable researcher may be able to obtain more accurate data. For example, the researcher for this study was a project management practitioner with in-depth project management knowledge in both Agile and traditional methods. Creswell (2003) suggests researchers spend sufficient time in the field in order to develop an in-depth understanding of the phenomenon under study and to establish their credibility during fieldwork. In addition, the researcher conducting all of the in-depth interviews alone can

minimize the chances of producing partial, mistaken, or biased analyses. For example, only one interviewer was used to collect data and to record the transcripts for this study.

The next chapter presents qualitative and quantitative data collected from project management practitioner from Agile and non-Agile communities.

## Chapter Four: Results

This chapter presents the research results including the qualitative and quantitative data. The qualitative data display Agile project management practices, which correspond to the identified methods from the Declaration of Interdependence. The data also map those methods to specific project management challenges for software projects. The quantitative data display the ratings of the effectiveness of Agile project management practices in dealing with project management challenges from the conceptual framework as shown in Figure 6.

The first section reiterates the purpose of this study. The second section illustrates the qualitative data that were collected in order to address the first research question relating to Agile project management practices and specific challenges. The third section illustrates the quantitative data that were collected to help validate the effectiveness of Agile project management practices in solving specific project management challenges to answer the second research question. The final section presents a final set of quantitative data to help validate the effectiveness of the conceptual framework for mapping Agile project management practices to specific project management challenges for software projects.

### Restatement of the Purpose

The purpose of this study was to investigate the relationships between Agile project management practices and specific project management challenges. The purpose also included evaluating the effectiveness of Agile project management practices in

overcoming specific project management challenges. And, finally, the purpose was to assess the value of the conceptual framework for mapping Agile project management practices to specific project management challenges for software development.

Traditionally, project management practitioners use a linear process to manage their software development projects (e.g., waterfall methodology). Project management practitioners have tried various methods to address the reasons their project deliverables have failed to meet business needs over the decades. Needless to say, these methods have met with limited success. As a result, the project management leadership community was faced with creating Agile project management practices to deal with the problems associated with traditional methods. As it became clear that Agile project management practices had not been mapped to specific project management challenges, a conceptual framework (see Figure 6) was created for this purpose, hence this study. The resulting conceptual framework introduced in chapter 2 was used as a basis for data collection and analysis. After analyzing the data, this study specifically sought to answer three research questions:

1. What Agile project management practices are useful in solving specific project management challenges?
2. How effective are Agile project management practices in solving specific project management challenges?
3. How useful is the conceptual framework for mapping Agile project management practices to specific project management challenges?

The intent of this section is to illustrate how the participant's responses were used to answer the research questions. The names of interviewees were not used in order to protect privacy; only their first and last initials were used. In many situations, direct quotes were used from the interview manuscripts.

### Specific Practices in Dealing with Specific Challenges

This section presents findings related to the first research question addressing those Agile project management practices that are useful in solving specific project management challenges. Based on the 27 interview results, the relationships between Agile project management practices and specific project management challenges are inter-dispersed into an expanded conceptual framework (see Appendix U for the graphical view). The conceptual framework mapping the relationships between Agile project management practices and challenges are linked and organized into patterns. Although the data was presented in patterns to answer the first research question, an explanation on how Agile project management practices were derived and how the data and patterns were organized was also provided.

As described in chapter 3, the code structures were open code, axial code, and selected code, and were divided based on the project management challenges, Agile project management practices, and effectiveness ratings. The selected codes were organized into three categories such as effectiveness, ineffectiveness, and neither effectiveness nor ineffectiveness. The selected codes were produced based on the average ratings in each theme. Interviewees were given a scale of 1 through 7 in which to rate a total of 52 themes. In relation to the levels of ratings, 7 scales ranging from strongly



disagree to strongly agree were used for this study. Participants were asked to rate effectiveness based on the 7 scales. For the selected coding purpose, 7 were divided into three categories (e.g., strongly disagree, disagree, and somewhat disagree). The scale for neither effective nor ineffective is neither disagree nor agree. The scale for effectiveness includes slightly agree, somewhat agree, agree, and strongly agree.

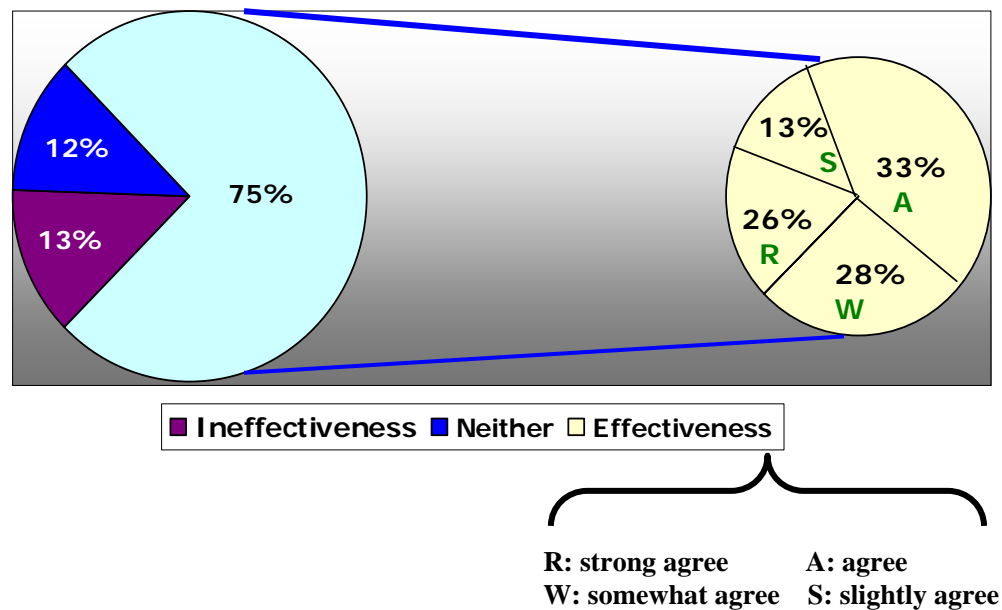
Interviewees rated all 52 themes from the six Declaration of Interdependence areas. The detailed results of these ratings are shown in Figure 9 for the effectiveness rating results in six Declaration of Interdependence areas. Among the six Declaration of Interdependence areas, the individuals area had the most responses with a rate of 23%. The teams area had the second most with 21% and the value area had 19%. Both uncertainty and context areas had the same response rate of 15%. The customer area had the lowest response (e.g., 6%).

	Individuals	Teams	Values	Customers	Uncertainty	Context	Total	%
Strongly Disagree	0	0	0	0	0	0	0	0.0%
Disagree	1	1	0	0	1	0	3	5.8%
Somewhat Disagree	1	1	2	0	0	0	4	7.7%
Neither Disagree or Agree	3	2	1	0	0	0	6	11.5%
Slightly Agree	0	3	1	1	0	0	5	9.6%
Somewhat Agree	2	2	2	0	2	3	11	21.2%
Agree	2	1	3	2	2	3	13	25.0%
Strongly Agree	3	1	1	0	3	2	10	19.2%
Total	12	11	10	3	8	8	52	100.0%
%	23%	21%	19%	6%	15%	15%	100%	

*Figure 9.* Effectiveness rating results in six Declaration of Interdependence areas.

The results of the ratings for the six Declaration of Interdependence areas as shown in Figure 9 were 13% for the ineffective Agile project management practices. This was determined by adding the total percentages of the responses for strongly disagree,

disagree, and somewhat disagree. The total percentage after adding responses from slightly agree, somewhat agree, agree, and strongly agree was 75%. The responses for neither disagree nor agree were 12%. The response ratings for the 19 Agile project management practices were thus distributed into the categories of effectiveness, ineffectiveness, and neither effectiveness nor ineffectiveness areas, as shown in Figure 10.



*Figure 10.* Rating distributions of ineffectiveness, neither effectiveness nor ineffectiveness, and effectiveness with 4 scales.

When analyzing the effective Agile project management practices, the ratings were redistributed into four sub-areas based on 4 scales: S (slightly agree), W (somewhat agree), A (agree), and R (strongly agree). The results show that 33% of the interviewees

agreed that Agile project management practices are effective while 28% said they strongly agreed. Furthermore, 26% said they somewhat agreed and 13% said they slightly agreed.

As described in chapter 3, the ineffectiveness category was transformed into pattern ineffectiveness (I) and the category neither effectiveness nor ineffectiveness has become pattern neutral (N). The effectiveness category was divided into particular (P), alternative (A), and sequence (S) to distinguish among the different patterns. The patterns were composed of Agile project management practices and specific project management challenges (see Appendix S for understanding how 52 themes were categorized in five patterns).

#### Pattern Particular

All interviewees responded that they could use a particular Agile project management practice to solve their specific project management challenge. Pattern particular (P) is an effective pattern, which contains 21 different project management challenges and 14 different Agile project management practices from the six Declaration of Interdependence areas. The data presentation for the six areas begins with individual, and proceeds on to teams, value, customers, to uncertainty, and context.

*Themes related to the individuals area.* Agile project management practices consisting of hiring the right people, training and pair programming, and decentralizing control were implemented by three project management practitioners to deal with different project management challenges. When overcoming the challenge of project management incompetence, RW indicated her company was hiring the right people who

have the knowledge in Agile project management to replace those who were using old or ineffective methodologies when her organization was transitioning to Agile methods. RW confidently said, “They hired people from India and they have people from their Sydney office. They continue to look for the right people in the U.S.”

The other challenge described by RW was lack of people who understood how to use the development tool. RW said through the use of training and pair programming, her company was seeking lower cost and customized technology to trim out the use of 20 years old platforms (e.g., computers). Two other project management practitioners also agreed that training and pair programming were an effective Agile project management practice. LB stated that one way to make the practice work on her scarce resources competition challenge was to pair one developer with one tester. In this way, “the tester could quickly identify the issue”. MV said the practice helped him resolve his unique resource issue. When the unique resource was a subject matter expert allocated to multiple teams, the expert needed to attend many Scrum meetings. It was an issue that the expert did not have time to work, but rather attend meetings. Through training and pair programming, the expert was able to train junior developers, so they could use the expert for attending meetings.

When BS’s organization was transitioning to Agile, he said his organization had to abandon all centralized controls to become a flat organization. BS’s example of decentralized control practices was related to how his development team dealt with organizational cultural issues. BS said his development team was very centralized on development efforts and the layer by layer control was not effective in solving any

development issues. His team started to show increases in productivity when they broke through the centralized controls and treated everyone equally. BS emphasized, “in order to accommodate the Agile fashion, they must use decentralized control.”

*Themes related to the teams area.* In the teams area, Agile project management practices emphasizing commitment and leadership and building self-organizing teams were implemented by five project management practitioners to deal with three different project management challenges. RW and JY both experienced a lack of accountability issue. RW said her company was building a new leadership team to institute leadership commitments. JY said her problem was that the customer’s team was not fully committed to her projects. By continuing to emphasize the importance of commitments, she has seen more inputs from the customer team than ever before. BM used the same practice, but in the challenge relating to team resistance to new leadership style. When BM took over a new team, the team resisted the new leadership style, because the team was used to the old one. Through emphasis on the commitment and leadership practice, BM convinced his inherited team to implement these practices. He urged his team to work together to establish a new leadership paradigm.

BS was encountering a cross-functional team issue. BS said the issue was that the resources allocated across multiple teams led to resources not being available when the teams needed them. One way to deal with this issue was to build a self-organizing team. BS said, “The team needs to have all of the resources they need to do the work. They are not necessarily cross-functional, but they are a part of the team and have responsibilities.”

*Themes related to the value area.* Agile project management practices on prioritizing the feature lists for return on investment, eliminating waste, and using right tools were implemented by four project management practitioners to deal with three different project management challenges. SK said “we did do a good job on prioritization” to optimize our return on investment. SK continued to address his other challenge on the high costs. He said, “What we have done for eliminating waste is that we actually offshore. We pass off our designs by the end of the day, so they can work on them during the day when it is night-time in the U.S.”

EP and GG commented on their success on using the right tools to deal with their common challenge of lack of proper tools. EP said his Agile team is using “organic tools” and explained:

We use 3-by-5 cards. We use word templates. We have a Sprint sheet, but we don't use it every Sprint. We have a capacity management sheet to show available resources for the project. We also block off times on the calendar for important dates. We use those kinds of tools. We like to use 3-by-5 cards and a magnetic board. A lot of people are using them.

GG reflected that the right tools help in dealing with his challenge. GG said, “It is a new tool and we need to know how to use it; because it is better than no tool. What we use is PVCS tracker,” a communication tool for basic progress control of issues, tasks, and changes (“Product Overview,” n.d.). GG continued, “We don't have a lot of flexibility. It is very useful.”

*Themes related to the customers area.* Agile project management practices on creating simple vision statements and engaging customer participation were implemented by 10 project management practitioners to deal with three different project management challenges. Five project management practitioners all described how they used the creating simple vision statements practice to deal with their challenges of unclear scope and lack of vision issues. BS said he heard of people using simple vision statements to solve this problem. However, they implemented it differently than he did. BS said, “We tended to do engineering. We focused on individual behavior. We refer to vision statements on a daily basis.” BS continued, “Because we still need customers to clear their end on what they want, we ask them to write down their thoughts.” GG said,

We have done that with moderate success. We are better off. I would say again that it is something we are improving. Hopefully, we will continue to improve, but let us say I somewhat agree the effectiveness of the practice for now.

SK said, “We created vision statements for large projects. Basically we created teams with a variety of stakeholders and we shared visions with the entire team. We also have scope documents.” LB commented,

Creating simple vision statements could apply to waterfall. Sometimes, to get it started you just have to ask your business sponsor to have a vision statement. That will make that person to think about the software product a little more. That will end with having a good prototype.

After learning how the Agile project management practice on engaging customer participation could be used to deal with lack of customer involvement and poor

communication from the first interview challenges, seven project management practitioners provided their feedback on the results. DD said his client did show up to participate in the team meetings, but was often late for the meetings. Therefore, he wanted to continue the practice by using a different approach. He said, “I just need to utilize peer or team pressure to ask my client to show up on time.” KB emphasized, “Having customers involved is always the key and they know what they want.” SK agreed that the practice is an effective one. SK said, “We actually have customers in our Agile group. We have customers on site 4 to 5 hours a week. We have customers that can answer the questions. Development teams can get the answers right away.” When implementing this practice in the waterfall environment, LB said, “Even in waterfall, we have weekly meetings. And, it works fine by including business owners in weekly meetings. Sometimes they are just busy. But we have a designated person to attend the meetings.” MV implemented the practice differently as an Agile coach. He said,

We began setting up a workshop, an eight-hour overview, writing stories and talking about the product owner role. That will take a couple of weeks to let stakeholders know what they need to do so we can design something they have in mind.

MV has government customers. He used another approach to implement the practice. He said knowing the right customers is the key to engaging customer participation. He emphasized, “You need to get the right people at the right time.” BN was also working for government projects and he was happy with the results. He said, “We’ve been getting more participation lately.”



When dealing with poor communication among customers, WM used his own approach to implement engaging customer participation. He indicated that the better way is to reverse your point of view so you can see what kind of customer environment you are facing.

*Themes related to the uncertainty area.* Agile project management practices on applying iterative and incremental strategies, observing and assessing practices, and taking adaptive actions were implemented by four project management practitioners to deal with five different project management challenges. The first challenge is lack of product value to customers. BM commented that after applying iterative and incremental strategies, it added more product value to customers. By using the same practice to deal with the challenge on poor quality, JR, an Agile consultant, stated,

I can talk about an actual client. They wanted to finish the project in six months.

By the end of six months, they found out they did not finish the project or discovered that they had too many defects. They either have to extend their project or release a product that is not acceptable to their customers. So I told them to use time boxes (iterative and incremental strategies). They will implement features inside the time box. That has now worked beautifully for them for three years. I have evidence that it works. I have empirical evidence.

JS used the observing and assessing practice to overcome her challenge of dealing with uncertain dependencies. JS stated, “When clients gave us all the requirements, it was difficult to uncover all the dependencies. The best way is to keep observing and assessing the Agile practice to deal with uncertain dependencies.” By using the same practice, MH

successfully applied it to help deal with her technology issue related to lack of new tools. She said her team kept observing and assessing new tools and checked the compatibility in their environments for expected effects.

When dealing with the challenge of resistance to change for a new process, JS emphasized that the team can only succeed by taking adaptive actions. She said, “From the project management perspective, it’s important for team building. You have to decide and follow through. Otherwise, the team will lose face with you.”

*Themes related to the context area.* The Agile project management practice for building a customer-value organization was implemented by five project management practitioners to deal with three different project management challenges. WM strongly agreed that this practice was effective in dealing with the first challenge, different organizational environments. When implementing this practice to deal with government customers, WM stated,

It is very difficult to understand the government. The value to this government agency is not the same as the value for the entire organization. It is different from the commercial environment. If it is commercial, it is standard practice to have staff directed to immediately see what the customers need. Government organizations are not straight forward and present a challenge here. This practice is really needed to bring the government over to let them see what the real value is.

Although EP used the same practice on building a customer-value organization, he commented on this practice by observing that it is critical to overcome lack of executive support in order for this practice to succeed. He stated, “Most organizational

executive support is very important for supporting Agile. I don't think it will succeed if you don't have executive support. I know that is true, that you don't guarantee success without it.”

CB, JS, and MP remarked that building a customer-value organization was important for Agile project management practices. During organizational transition from waterfall to Agile, CB said they lacked organizational support. However, CB expressed optimistically, after they worked on building a customer-value organization, they gained more support from the organization. JS said that her upper management did not support Agile project management, which required a less command-control oriented organizational culture. However, after a series of bottom-up activities to emphasize the concept of customer-value more than customer-service, JS said her organization received the benefits of building a customer-value centered organization and they began to support their Agile team. MP said building a customer organization was effective for dealing with the lack of organizational support. MP said her team was recognized by her organization for being very flexible and quick to build products to meet customer needs.

#### Pattern Alternative

When one project management challenge could be overcome with more than one Agile project management practice, it is categorized as pattern alternative (A). Pattern A is also an effective pattern that is used to collect only effective responses. This pattern includes eight different project management challenges. The specific challenge also crosses different Declaration of Interdependence areas. The data appear by the name of the challenge in alphabetical order.

*Agile with Non-Agile teams challenge.* The first challenge in this category was Agile team dealing with non-Agile teams. Alternative Agile project management practices include keeping simple rules and building a customer-value centered organization. MP strongly agreed that the practice of keeping simple rules worked. MP said the other non-Agile teams had more processes than her Agile team. Two teams had come to an agreement on a simple rule. MP's Agile team just needed to fill in out an online form to be aligned with that non-Agile team's process.

MP also practiced building a customer-value organization to deal with non-Agile teams in the same organization. MP's Agile team has proven that they were more flexible in adopting new processes and could deliver products quicker. MP's Agile team gained trust from the other non-Agile teams. EP also implemented building the customer-value centered organization practice. He used influence skills to deal with the system administration team, a non-Agile team. He said, "They don't care about customer-value. It was my duty to help them understand who the customers are and what value we will be delivering."

*Distributed teams challenge.* The second challenge was to deal with issues related to distributed teams. DD used an alternative Agile project management practice, building a self-organizing team or sharing open information to manage his remote team. His virtual teams included development and customer teams. After implementing the practice of building self-organizing teams, DD said, "I think the team is getting better, taking on more responsibilities and is well-organized" (DD-II-6:39). Although DD agreed that sharing open information could help deal with the distributed team issue, he felt his

customer team could do better by sharing more information if they could show up for Scrum meetings on time.

*Insufficient team skills challenge.* The third challenge was related to insufficient team skills. Alternative Agile project management practices include hiring the right people, training and pair programming, or coaching and mentoring. RF strongly agreed that hiring the right people could solve the insufficient team skills issues completely. However, RF said it is only by chance that the right people are hired. RF states, “you can't tell if you are hiring the right people from interviews, because there is misdirection and misconception.”

Training and pair programming could solve the insufficient team skills issue, agreed by both RF and SL. RF said this is true as long as the resources are willing to learn. It is an effective practice to overcome the challenge. SL said, "Training is the solution if there is resource incapability in order to provide an accurate estimation.”

Coaching and mentoring can affect individuals and teams and help solve the problem of insufficient team skills, according to SL. ML said he agreed that coaching and mentoring addressed their problem of insufficient team skills. “For the time involved, it gives the team some chances and opportunities to get their skills developed.”

*Lack of proper processes challenge.* The fourth challenge is lack of proper processes. Alternative Agile project management practices include keeping simple rules and building customer-value centered organizations. Four project management practitioners agreed that keeping simple rules was the solution for lack of proper processes. BS said keeping simple rules reduced threats and helped his team do things the

right way. MK said “it is a lot of easier to enforce a simple process. Even the complicated one is difficult to enforce.” RW said the purpose for changing the organizational structure from a matrix to functional one is to keep simple rules and proper processes. WM said proper processes can be established only by keeping simple and effective rules.

RW chose another alternative for building a customer-value centered organization to deal with the lack of proper process challenge. RW said her company focused more on customer-value and less on customer service. She commented people started to accept the work flow after they received positive customer feedback.

*Multitasking challenge.* The fifth challenge is to overcome the multitasking issue. Alternative Agile project management practices consist of emphasizing commitment and leadership and prioritizing feature lists for return on investment. CB said her organization was transitioning from waterfall to Agile while her resources were still multitasking on multiple projects. CB found that if she emphasized commitment and leadership, her resources could commit to her Agile team and solve the multitasking issue. Another alternative she took was to prioritize the features list. After her resources realized what work they should perform first, it lessened the resource multitasking issue.

*Poor planning challenge.* The sixth challenge is to deal with the poor planning issue. Alternative Agile project management practices are to prioritize feature lists for return on investment and to share open information. BS agreed that prioritizing feature lists is very important for requirements planning to sort out desired customer needs. JS said “the issue is really to reprioritize the features and how to implement them. I have run into the situation that we have to redo things because customers do not know what their

business needs are.” BS and JS all agreed that the other alternative Agile project management practice of sharing open information during planning could uncover missing information, avoid rework, and increase product quality.

*Scheduling challenge.* The seventh challenge is related to the scheduling issue. Alternative Agile project management practices are training and pair programming and applying iterative and incremental strategies. SL stated that scheduling issues were caused by his developer’s inability to provide accurate estimates. Therefore, he agreed that training and pair programming would work in dealing with scheduling issues.

Another alternative solution to applying iterative and incremental strategies was also recommended by four project management practitioners to deal with scheduling issues. CB commented that their release schedule is based on time box development and prioritized feature lists. DL said their iterative development process met their customer’s expected delivery time. JR said iterative development worked very well to help deal with scheduling issues when product owners could not come up with all of the requirements. LB said even in her waterfall environment, her team has built their products incrementally to deal with scheduling issues. SL commented that scheduling issues were more about lack of resources in the past, but they could be solved by prioritizing feature lists and by building incrementally.

*Scope change challenge.* The eighth challenge is to overcome scope change issues. Alternative Agile project management practices include applying iterative and incremental strategies and keeping simple rules. BS stated that scope change was caused by uncertainty, so he could not agree more that applying iterative and incremental

strategies is the best solution to deal with scope changes. GG said their company was comfortable with them not following the formal process for product deliverables because of scope changes. Using incremental deliverables reduces their rework on the products and the time to reproduce formal designs. LB said scope changes happened to her project very often and concluded that it was primarily because of budgetary issues. She agreed that incremental deliverables could eventually deliver something to customers even though the project suffered for lack of budget in the end. MK said he strongly agreed with using iterative and incremental strategies to deal with scope change because “business stakeholders always want to change. We are able to do two-week iterations and the business stakeholder is not pressured to decide anything up front. This is a better practice for businesses to do.”

KB took the alternative solution to deal with her scope change. KB said her team set up a simple change management process for their product owner to manage. They have found that their customer could handle scope changes better because of the simple rules their team set up.

### Pattern Sequence

The last effective pattern is pattern sequence (S). Some project management practitioners commented that they needed not only solutions, but also effective ones. Four project management practitioners suggested that by sequencing Agile project management practices; they could deal with specific project management challenges better than just using a particular Agile project management practice. Pattern S is a category for project management practitioners to implement a sequence of Agile project



management practices to deal with their specific project management challenges. The results of the interview data contain four different project management challenges, which are presented in alphabetic order. Examples of individual experiences based on each theme are provided in figure 11 for specific challenges needed a sequence of Agile project management practice. The names of the interviewees were DD, RF, RW, and WM.

<b>Distributed team</b>	<ol style="list-style-type: none"> <li>1. Training and pair programming</li> <li>2. Building self-organizing team</li> <li>3. Sharing open information</li> <li>4. Using right tools</li> </ol>
<b>Insufficient team skills</b>	<ol style="list-style-type: none"> <li>1. Emphasizing commitment and leadership</li> <li>2. Coaching and mentoring</li> </ol>
<b>Resistance to change to new processes</b>	<ol style="list-style-type: none"> <li>1. Hiring the right people</li> <li>2. Taking adaptive actions</li> </ol>
<b>Unclear scope or vision</b>	<ol style="list-style-type: none"> <li>1. Creating simple vision statements</li> <li>2. Engaging customer participation</li> </ol>

*Figure 11.* Specific challenges needs a sequence of Agile project management Practices.

When dealing with distributed teams, DD suggested that the Agile project management practices could be more effective if they are executed by the following sequence: a) training and pair programming, b) building self-organizing teams, c) sharing open information, and d) using right tools. DD is a co-founder of a consulting company and has 25 years of project management experience. His development team is overseas and his client is in the U.S. His challenge is that he could not have many face-to-face interactions with his team. Most time he could only interact with them by telephone. His company has just transitioned to an Agile development environment and he had tried to implement all of the Agile project management practices simultaneously, but could not satisfy his original expectations. He suggested that his team needed some time to adapt to the new methodology. They needed to learn all of the concepts about pair programming, self-organizing teams, and other Agile concepts first. Then the team would be ready for him to help them organize in a more effective manner. After the team has gained confidence in Agile techniques, the team will start to share more information about their challenges and work status. The last step is to provide teams with a communication tool such as a Wiki, on which users can post their comments online and the team will be comfortable using it.

When dealing with insufficient team skills, RW suggested that the Agile project management practices could be more effective if they are executed in the following sequence: a) emphasizing commitment and leadership and b) coaching and mentoring. RF is a program director and works for a government consulting company. Having more than 25 years of experience as a project management practitioner, RF strongly suggested

that insufficient team skills issue could not be solved unless project management practitioners implement them in a sequence. Being a senior manager, RF said project management practitioners can coach and mentor their team members only when their team members are accountable. In this way, team members can effectively implement what they have learned from their coaches or mentors. For example, RF used the expression, “You can lead a horse to water, but you can’t make him drink.”

When dealing with resistance to change to a new process, RW suggested that the Agile project management practices could be more effective if they are executed in the following sequence: a) hiring the right people and b) taking adaptive actions. RW has been a project management practitioner for more than 15 years in the health care industry. RW has said she is a very optimistic and flexible person and can accept almost any new process. But, RW said many of her co-workers just simply refuse to accept any new process. When RW’s company had difficulty implementing new strategies, her company took the action of laying off the “old timers” and hired new people to fit the company’s needs. This was a loss for those people who were unable to adapt to the new strategies.

When dealing with unclear scope, WM suggested that the Agile project management practices could be more effective if they could be executed in the following sequence: (a) creating simple vision statements and (b) engaging customer participation. WM is working for a government consulting company. WM commented that he did ask his client to create simple vision statements, but they were changed quite often because of conflicting vision statements. WM finally figured out that he needed to have all of the

stakeholders involved in writing the vision statements. Therefore, in order to effectively solve the unclear scope issue, WM strongly recommended executing both of the aforementioned Agile project management practices in sequence.

### Pattern Ineffectiveness

Pattern ineffectiveness (I) is the opposite pattern from Pattern P, A, or S, and represents an ineffective pattern. Six project management practitioners reported that six Agile project management practices were ineffective in certain situations. Those ineffective Agile project management practices are introduced in alphabetic order based on the first word of the practice.

The first ineffective practice in this pattern is applying iterative and incremental strategies, which failed to deal with the distributed team issue. JR, an independent management consultant said the short time-box iteration kept the management team busy working through each development cycle and led them to ignore managing their distributed team. It has been difficult to determine how iterations can be effective when working with both local and global teams. Unfortunately, JR, also an author of several management books, has not written a new one to provide data for her arguments about the poor performance of the iterative and incremental strategies practice in dealing with the challenge of the distributed team issue.

RF disagreed that building a self-organizing team could adequately deal with insufficient team skills in his government consulting projects because he included professional skills as a part of team skills. RF said team members need to learn how to be self-organizing by themselves first. RF argued that the practice won't work because a

self-organizing team can't be built without the requisite skills. For example, "People can't learn Java overnight."

Another ineffective Agile project management practice that RF somewhat disagreed with was on coaching and mentoring to address the challenge of the lack of accountability. RF said he can coach and mentor individual's soft skills, but he cannot teach them accountability when they are only motivated to work for paychecks. "You can give them the direction, but you can't force them to follow your direction if the other direction has more dollar (\$) signs."

When JS said she had a lot of rework after the product had been developed, she commented that eliminating waste could not solve the poor quality issue. For example, JS said her vendor did not produce a good quality product when they eliminated an additional step to test another software platform such as Vista. JS argued that the poor quality issue that happened to her project was caused by the lack of experience in prioritizing feature lists. She said people did not realize that eliminating some development work had negative side effects that resulted in poor quality.

GG doubted that hiring the right people is a valid approach when dealing with the cross-functional team issue. GG said the practice was too ambiguous for him when working for a government consulting company. GG said he was hiring the right people with the right skill sets for the position, but his team was just a small team and couldn't have the cross-functional skills they were looking for. He even tried to give his team members the capability to make adjustments, but they are limited to the skills they have as individuals and by the skills available within the teams.

WM also works for government consulting company. WM said training and pair programming could not deal with his customer incompetence issue. WM said his customers usually do not disclose the issues to the development team. WM said his development team really needs to train their customers to ensure they understand their development work. However, WM commented, “if they were not the right customers you focused on, the training efforts would be in vain.”

The last ineffective practice is that using the right tool did not help solve the distributed team issue. DD said he was using the right tool to communicate with his remote team, but it was not effective at all (e.g., Wikis). There were only two people signed on to use the tool. DD was investigating if there are any other reasons preventing team members from using use popular communication tools such as Wikis. He speculated the problem may be related to cultural barrier. He said his overseas team members might not be that open or candid in public as most Americans are.

#### Pattern Neutral

Pattern neutral (N) includes those themes that are unrated by project management practitioners. They neither agree nor disagree with the specific Agile project management practice that can help deal with the specific project management challenges. The data is presented by the name of the Agile project management practice in alphabetical order. Among these four practices, the practice of hiring the right people was repeated three times in this pattern.

Both BM and BN stayed neutral by not rating the practice of hiring the right people in dealing with three specific project management challenges. BM said hiring the

right people may not be used to solve the challenge due to budgeting and cost issues. BM said, “Resource and budget go together. You need the right people to do the project. However, the right people means more cost and customers do not want to pay for them.” BN said he couldn’t comment on the practice of hiring the right people to deal with the lack of proper processes challenge, because he has not hired the right people yet. BN said he needed to have a proper configuration management process for his government projects and the right person to help develop the process. BN was also reluctant to provide his ratings on this practice of dealing with the challenge of not being able to provide a good estimation. He said they have finally hired a resource, but it is too early to tell if he is the right one. It might take at least three months to know the results.

RF commented that he needs more than six months to determine whether the practice of building a self-organizing team to help deal with the lack of accountability is effective. RF tried to build a self-organizing team to determine if all of the team members are accountable. RF planned on using peer pressure to influence his less accountable team members.

JR said she was hesitant to agree or disagree with the practice of creating innovative products as a means of dealing with the lack of global products. JR said even when a team prioritizes their feature lists and delivers valuable products to customers; many companies have mistakenly thought that project management practitioners are the ones creating iterative and global products. Many companies have “local innovation, but lack global innovation.”

When commenting on the practice of emphasizing commitment and leadership to help deal with the lack of good leaders, NB said it was too early to determine effectiveness at this time. NB said they did identify a good leader who seemed to be committed to the project and could establish a good leadership style. However, NB said he won't have the results for a while.

### Effectiveness Ratings of Specific Practices in Dealing with Specific Challenges

This section helps answer the second research question on the effectiveness of Agile project management practices for solving specific project management challenges. First, the method for scoring each theme is described. Second, the data and the manner in which themes are distributed at different rating levels are presented. Third, the data showing the ratings of the results of each theme is presented along with the themes with the highest scores.

The effectiveness of each theme is determined based on the average of the rating scores, because the ratings inputs varied for each theme. Some themes may have up to 10 inputs for the rating. Some themes may have only one input for the rating. The rating scale ranged from one through seven: 1 is for strongly disagree, 2 for disagree, 3 for somewhat disagree, 4 neither disagree nor agree, 5 for somewhat agree, 6 for agree, and 7 for strongly agree. For example, 3 inputs were provided for the practice of building a customer-value centered organization to deal with the challenge of Agile teams dealing with non-Agile teams. The scores were 6, 6, and 4, so the average of which is 5.3. The theme was categorized at the "somewhat agree" level. However, based on the results, one more level was added between 4 and 5, it is ranked as 4+, "slightly agree." For example,



if a set of scores was 6, 2, and 6, the average is 4.7. In this case, the theme was rated as a “slightly agree” on the effectiveness of the specific practice dealing with the specific challenge.

A total of 52 themes were rated. Based on the 7 scales, the data show that nine themes were rated as strongly agree and share the 17% of the entire population. 12 themes were rated as agree and share 23% of the population. 12 themes were rated as somewhat agree and share 23% of the population. Six themes were rated as slightly agree and share 6% of the population. Six themes were rated as neither disagree nor agree and share 12% of the population. Four themes were rated as somewhat disagree and share 8% of the population. Three themes were rated as disagree and share 6% of the population. There was no input for any theme rated as strongly disagree (See Figure 12, inputs collected for all themes on seven scales).

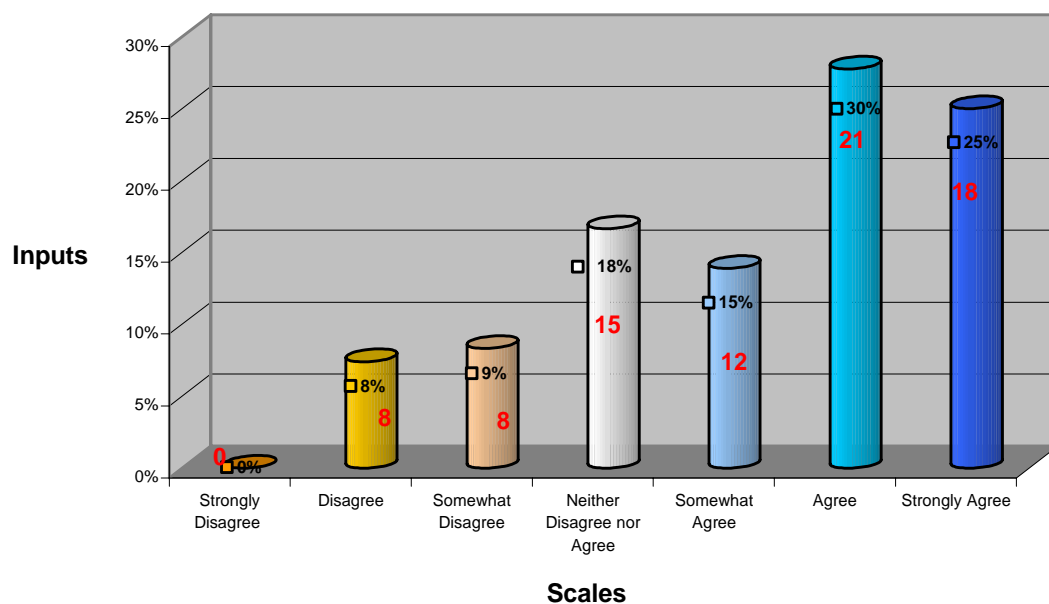


Figure 12. Inputs collected for all themes based on 7 scales.

The detailed data and analysis of the effectiveness ratings are shown in Appendix V for more detail about Agile project management practices effectiveness ratings. The data for the results are shown and ranked at the strongly agree, agree, somewhat agree, and slightly agree levels. The highest score is 7.3 for the strongly agree level, 6.6 for the agree level, 5.8 for the somewhat agree level, and 4.8 for the slightly agree level. In fact, some project management practitioners actually gave the highest scores on these top ranking themes. Their comments on those themes are provided with supporting data as follows.

Theme 8-26, prioritizing the feature list for return on investment to help deal with poor planning, was ranked by two project management practitioners as the top theme on the strongly agree level. Both BS and JS gave top scores for this theme. BS said they have implemented a lot of requirements in the past, but, prioritizing feature lists does help with planning, and it also gives them a chance to obtain customer feedback. JS said they had a lot of waste in the past due to rework on the requirements. Prioritizing the feature list is intended to save implementation costs.

Theme 14-35, engaging customer participation to help deal with lack of customer involvement, was rated by seven project management practitioners and the final average score is ranked as the top theme on the agree level. BN, LB, SK, and KB actually gave their top scores to this theme. BN said the most important thing is to get their customer's feedback on what they have to do. LB said customer involvement not only helped them to set customer expectations in the end, but also helped them understand the features better. SK was managing a large distributed team and he commented that through customer

involvement, the team could select suitable solutions from the various options proposed by different people from different locations. KB's team had trouble with frequent scope changes and after asking her customers to manage the change control process, her customer said they were happy to get involved in development activities.

Theme 17-44, taking adaptive actions to help deal with resistance to change to new processes, was ranked as the number one theme on the Somewhat agree level. JS actually rated this theme with a score of 7.5, although the average was only 5.8. JS said it is very important from a project management practitioner's perspective to use adaptive actions for team building. If project management practitioners do not take a quick action to determine what to follow and adapt, "you will start losing face with the team," said JS.

Theme 5-14, emphasizing commitment and leadership to help deal with the lack of accountability, was ranked as the top theme on the slightly agree level. RW gave the top score to this theme, although the average score was only 4.8. RW said both the product and development teams were experiencing lack of accountability issues when her company transitioned from a matrix to a functional-type organization. The issue could not be resolved until a new executive officer implemented leadership summit programs to emphasize commitments and leadership. RW said although it is an on-going process, she has seen effective results in that both product and development teams are more accountable and credible than before.

### Effectiveness Ratings of the Conceptual Framework

This section helps answer the third research question about the usefulness of the conceptual framework (see Figure 6, the mapping framework for Agile management

practices to project management challenges). The approach for mapping the Agile project management practices to specific project management challenges for software projects was presented to all interviewees at the first interview. However, only 67% of the total interviewees rated the effectiveness of the conceptual framework. First, the method for rating the effectiveness of the conceptual framework is explained. Second, the scores for the categories relating to the demographic data along with supporting information are presented.

The effectiveness of the conceptual framework was determined using the average ratings scores from project management practitioners with similar demographic backgrounds. The demographic background includes four aspects: (a) project management experience, (b) project management knowledge, (c) organizational environments, and (d) project types. Each background contains four different categories. For example, background for the years of project management experience includes: (a) 3-6 Years, (b) 7-13 Years, (c) 14-20 years, and (d) 21-25 years. The scale for scoring ranged from 1 through 7. For example, 1 is for strongly disagree, 2 for disagree, 3 for somewhat disagree, 4 neither disagree nor agree, 5 for somewhat agree, 6 for agree, and 7 for strongly agree.

When a project management practitioner provided his or her rating on the conceptual framework, the score was distributed across all demographic fields related to this interviewee. For example, DD gave 6 as the score for the conceptual framework. The score was also shown in four demographic areas: (a) years of project management

experience; (b) project management knowledge other than Agile or Waterfall, (c) Agile organizational environment, and (d) commercial project type.

The rating results of the conceptual framework are shown in Appendix W for the rating results of the Conceptual Framework. Four categories from four different demographic backgrounds were associated with the highest score: a) 14-20 years of project management experiences, b) project management practitioners have agile project management knowledge, c) Agile environment, and d) mix project type.

CB, EP and KB who all have 15 years of project management experience strongly agreed that the mapping framework is useful for managing software projects. CB said, “I can look at this framework and say yes, this is what I am looking for. It is clear and easy to read. For example, I have to hire the right people to solve my problem.” EP commented, “When I saw this, it is not word for word, more organically, this is my list.” KB said she strongly agreed that the mapping framework gives her a good reference for solving project management problems.

Both MK and MV who have project management knowledge in Agile methodologies agreed that the conceptual framework is useful for managing software projects. MK stated that the conceptual framework is very helpful, but he needs more detail for each Agile project management practice and actions associated with the practices. MV, an Agile coach said, “It is useful because it can be used as a parameter to work on some symptoms you want to work on, and you can always go back to see what things you need to work on.”

DD and MH both work in an Agile environment. DD said, “I agree that this framework is very useful. However, I need more time for some of these major practices. Time does matter in order to test if this framework really works. I think this is very interesting.” MH stated,

I give it a 6 (rating score). This framework can be used to facilitate discussion on how to deal with project management challenges. It is easy to follow and to read. This framework is a good start. But, I can't rate it at 7, because I have not tried all of them. I'd have to try it out more.

EP had experience in managing both commercial and non-profit project types. He said, “This framework helps me organize my challenges into conscious thought. It could enable me to know much more about what my challenges are. It could structure what to talk about and see what the solutions are.”

This chapter has presented data in a variety of forms. Initially all transcribed interviews were discussed. Then the data were presented to answer each of the three research questions. A composite deposition covered the inputs from each of the interviewees, further supporting the data.

The next chapter will take these data and analyze them in order to attempt to draw conclusions from the data and analysis to serve as the basis of this study. The data and analysis will also be used to make recommendations for future studies.

## Chapter Five: Discussion, Conclusions, and Recommendations

This chapter summarizes the analysis of the data presented in the previous chapter and presents a discussion of the findings. The first section describes the key findings and their relevance to the literature review. The second section describes the expanded conceptual framework that was developed as a result of this study. Instructions on how to use the expanded framework are provided to aid project management practitioners when implementing Agile project management practices to deal with specific project management challenges. The third section offers conclusions regarding the research. The next section identifies the limitations and contributions to the study. The last section contains suggestions for further research.

### Comparison on Key Findings with Literature Review

The major findings of this study are the identification of Agile project management practices that may be used to address specific software project management challenges. This includes the effectiveness ratings of the Agile project management practices and the conceptual framework. After comparing the ratings of the Agile project management practices with the initial conceptual framework introduced in chapter 2 (see Figure 6 for the conceptual mapping framework), at least two major differences were identified for this study. First, the data and subsequent analysis resulted in a total of 52 themes and the initial conceptual framework only introduced 16 themes. Second, the data and subsequent analysis resulted in five relationship patterns between Agile project

management practices and specific project management challenges. The initial conceptual framework introduced only two patterns from the literature review.

The purpose of this study was to determine if Agile project management practices could be used to address specific software project management challenges. For each theme, questions were asked to determine if an Agile project management practice could be used to address a specific software project management challenge. The proportion of themes expanded as a result of this study. That is, the greater the number of participants, the greater the number of new themes discovered. This is probably due to the rather diverse nature of projects, environments, and experiences of project management practitioners interviewed for this study. For example, thirty-three themes were rated by only one project management practitioner.

Another surprising finding was that Agile project management practices associated with the initial conceptual framework derived from the literature review were all rated effectively by the project management practitioners (as shown in Appendix V for the effectiveness rating results of the Agile project management practices). The focus was to compare the final conceptual framework to the initial conceptual framework derived from the literature review. The comparison of challenges from literature review and the additional challenges collected from the data collected is shown in Figure 13 for what specific challenges were added to the list. In general, Agile project management practices in each area can handle more challenges as compared to those in the literature review. For example, the practice of hiring the right people can be used to deal with



project management incompetence based on the literature review and insufficient team skills based on the data collected.

	APM Major Practices	Challenges from Literature	Added Challenges from Data
Individuals	Hiring the right people	Project management incompetence	Insufficient team skills
	Training and pair programming	Scarce resource competition	Distributed team, Insufficient team skills, Lack of understanding of tools, Scheduling issues
	Decentralizing control	Issues related to organizational culture	
Teams	Emphasizing commitment and leadership	Lack of accountability	Multitasking, Team resistance to new leadership
	Coaching and mentoring	Insufficient team skills	
	Building a self-organizing team	Cross-functional team	Distributed team
Value	Prioritizing feature list for ROI	Poor planning	Lack of prioritization, Multitasking
	Creating innovative products	Poor quality	
	Sharing open information		Poor planning, Distributed team
	Eliminating waste		High cost
Customer	Using right tools	Lack of tools	
	Creating simple vision statements	Unclear scope or vision	
	Engaging customer participation	Lack of customer involvement	Poor communication
Uncertainty	Applying iteration and incremental strategies	Scheduling issue, Scope Changes	Lack of product value to customers, Poor quality
	Observing and assessing practices	Uncertain dependencies, Technology issue	
	Taking adaptive actions	Resistance to change to new processes	
Context	Keeping simple rules	Lack of proper processes	Agile with non-agile team, Scope changes
	Building customer-value organization	Lack of organizational support	Agile with non-agile team, Different organizational environments, Lack of executive support, Lack of proper processes

*Figure 13.* Comparisons of challenges from literature and additional challenges added by data results.

The next section discusses the comparison of the Agile project management practices in dealing with project management challenges in the six Declaration of Interdependence areas.

### The Individuals Area

In the individuals area, three practices were rated by 12 project management practitioners. Ten themes were added to this area along with the three existing themes from the framework. The data support Highsmith's (2004) and Schwaber's (2004) theories of the practice of hiring the right people to help resolve issues with project management incompetence. The data also support the notion that the practice can be used to effectively deal with insufficient team skills challenge.

In the literature review, Schwaber (2004), Highsmith (2004), DeCarlo (2004), and Augustine (2005) mentioned that training individuals and pair programming were techniques used to create a resource pool to handle competition for scarce resources. The data not only support this theory, but also show that it can be used effectively to overcome other obstacles, such as managing a distributed team, insufficient team skills, lack of understanding of particular tools, and scheduling issues.

Although the practice of maintaining a quality of work life was not rated, project management practitioners favored the use of decentralizing control to deal with organizational culture challenge. One participant described his organization as shifting from command and control to autonomy, as a part of transitioning processes from traditional to Agile project management methods. This participant's organizational changes supported earlier findings by Schwaber (2004) and DeCarlo (2004).

### The Teams Area

In the teams area, three practices were rated by 12 project management practitioners. Seven themes were added to this area along with the three existing themes.

The practice of emphasizing commitment and leadership was rated effectively to deal with the challenge related to lack of accountability as proposed by Schwaber (2004) and DeCarlo (2004). In addition, the same practice was successfully applied to handle the challenges of multitasking and team resistance to new leadership. The practice of coaching and mentoring was used to effectively deal with insufficient team skills as suggested by Highsmith (2004). When dealing with the cross-functional team challenge, one participant corroborated the effectiveness of this practice. This participant rated the practice of building self-organizing teams as an effective practice for overcoming cross-functional team issues. This participant's experiences corroborated Schwaber's theory that resources working collaboratively help achieve common software project management goals.

#### The Value Area

In the value area, two practices were also rated by 10 project management practitioners. Eight themes were added to this area along with the two existing themes. The practice of prioritizing feature lists for return on investment adequately dealt with lack of prioritization, multitasking, and poor planning as recommended by Schwaber (2004) and Highsmith (2004). One participant agreed that eliminating waste helped control costs as theorized by Highsmith (2004). One participant also agreed that openly sharing information helped deal with issues related to distributed teams. This participant tried to use websites for sharing open information, but didn't receive all of the responses from his team that he expected. Two participants also agreed that this practice helped

deal with poor planning challenges because they were not using a roadmap for tracking project status as suggested by Augustine (2005) and Highsmith (2004).

The last practice in this area was using the right tools to deal with the challenge of lack of tools. Leach (2005) emphasizes tools are one of the solutions to this problem. However, the results did not create themes to deal with this challenge as suggested by Highsmith (2004) and Augustine (2005), because no responses were received from interviewees. For example, no themes were created for the practices of creating innovative products and eliminating waste to deal with poor planning challenges. Additionally, no practitioners mentioned that the practice of openly sharing information could deal with poor quality.

#### The Customers Area

In the customers area, two practices were rated by 13 project management practitioners. Only one theme was added to this area along with the two existing themes. One participant corroborated Highsmith's (2004) suggestion to ask his customer to create simple vision statements. As a result, he was able to deal with the challenge of lack of vision or scope statements when managing a large scale project. He actually integrated the vision statement into his daily meetings. Six project management practitioners gave high scores to the theme of engaging customer participation to help deal with the lack of customer involvement. They said they either talk to their customers every day or invite customers to their daily team meetings. There was concurrence on Highsmith's theory that having a close relationship with the customer is one of the best Agile project

management practices. In addition, two participants said engaging customer participation was one of the most effective practices in dealing with poor communication challenges.

### The Uncertainty Area

In the uncertainty area, three practices were rated by 14 project management practitioners. Three themes were added to this area along with the five existing themes. One participant strongly agreed with Schwaber's (2004) theory of iterative development. This participant said her customer has proven that the iterative process works for them since they started to implement short-cycle development three years ago. Another participant strongly agreed that applying iterative and incremental strategies do help deal with the scope change challenge as DeCarlo (2004) theorized. This participant also stated that his customer favored the two-week iteration. Another participant said customers get higher value products through the iterative practice. Still others said iterative development also provides better quality to customers. When using the practice of observing and assessing, one participant actually used what Augustine (2004) suggests, i.e., observing different situations and conducting different planning scenarios to deal with uncertain dependencies. Another participant used a different approach, consisting of using the same practice to assess new technologies to see if their software development tools were up to date. When another participant transitioned to a different methodology, she took what Kendrick (2006) advised on influencing people to adapt to the changes. However, this participant commented that the practice of taking adaptive actions could only be effectively implemented at the right time and with the right people.

## The Context Area

In the context area, two practices were also rated by 13 project management practitioners. Six themes were added to this area along with the two existing themes. When implementing the practice of keeping simple rules, one participant said it was easier to enforce a simple process than a complex one. This comment is similar to Augustine's (2005) theory that the development team will not accept complex and rigid processes, because they limit their creativity and innovation. In addition, the practice was extended to deal with the challenge related to Agile and non-Agile teams and scope changes. Two participants said their teams set up a simple, but effective process for other teams to follow to help deal with scope changes. Chin (2004) theorized that organizational support was necessary for building a customer-value centered organization. Several participants agreed with Chin's remark. Those project management practitioners all agreed that the more they build customer-centered organizations, the more support they received. The data and analysis also reveal that the practice of building customer centered organizations can deal with challenges related to Agile and non-Agile teams, different organizational environments, lack of executive support, and lack of organizational support.

The data and analysis also showed that one more relationship pattern was added to the conceptual framework as mentioned in the literature review. The two relationship patterns from the initial conceptual framework were: (a) one practice dealing with one or multiple challenges, and (b) more than one practice dealing with the same challenge. Based on the research results, five patterns were presented on the relationships between

Agile project management practices and specific project management challenges as shown in Appendix S for the relationship patterns. As described in chapter 3, the effectiveness patterns are P, A, and S. P means a particular Agile project management practice can be used to help deal with one or more specific project management challenges. Pattern P corresponds to the first relationship pattern in the conceptual framework. Pattern A means project management practitioners can choose more than one Agile project management practice to help deal with their unique and specific project management challenge. Pattern A matches the second relationship in the conceptual framework. Pattern S is for project management practitioners to implement a sequence of Agile project management practices to help deal with their specific project management challenges. The ineffective pattern is I, and the pattern N is for neither effectiveness nor ineffective.

The comparison between the results and conceptual framework is pattern S as shown in figure 11 in chapter 4, which was produced from the research results. Project management practitioners also determined the effectiveness of the Agile project management practices when implemented in a sequence. For example, when dealing with the insufficient team skill challenge, one participant suggested that the most appropriate sequence was to emphasize commitment and leadership first, and then to implement the coaching and mentoring practice second.

#### Instruction for Using the Expanded Framework

This study resulted in the design and construction of an expanded conceptual framework for mapping Agile project management practices to specific software project

management challenges (see Appendix U for the graphic view of the expanded framework). The new conceptual framework is illustrated in a diagram showing which Agile project management practices were found to help deal with specific project management challenges. The new conceptual framework also presents of the effectiveness ratings for the Agile project management practices based on the rating results (see Appendix V for a complete list). Furthermore, five patterns produced from the relationships between Agile project management practices and specific project management challenges are also shown (see Appendix S for more detail of the relationship patterns for all themes).

The intent of this study was to help project management practitioners make better use of their available resources. A process flow including instruction for using the expanded framework is provided in Appendix X for a graphical view. The instruction starts with identifying project management challenges, determining challenges from Declaration of Interdependence areas, checking the effectiveness rating list to find matching themes and patterns, and then implementing the Agile project management practices to help deal with specific software project management challenges. Practitioners can then determine whether to continue the implementation of a specific practice, based on continuous evaluation of its effectiveness. For example, if the practice is effective, it can be reported in the retrospective review for a lesson learned report and further organizational institution. However, if the practice is ineffective, a new theme can be created to deal with the challenge.



## Conclusions

The motivation of this research study was inspired by the six statements of the Declaration of Interdependence. These statements were theorized to form the basis of a conceptual framework for benchmarking Agile project management practices among software project management practitioners. Related to the six statements, a conceptual framework was created as a means of evaluating the validity of the six Declaration of Interdependence statements. Another motivation for this study was the inherent need to identify best practices to help deal with common software project management challenges and to identify solutions to help project management practitioners deal with their frustrations when managing software projects.

Based on the research findings, the research questions were adequately addressed to the greatest extent possible. The objectives of this study were adequately satisfied. The research methodology was found to be useful for collecting data and helping software project management practitioners transform their experiences into useful essences and conscious thoughts. And, more importantly, a useful conceptual framework was expanded and produced based on the information in the literature review.

One of the goals of this study was to help software project management practitioners diagnose their problems by designing a conceptual framework for mapping Agile project management practices to specific project management challenges. However, it was imperative to develop an approach for rating both the Agile project management practices as well as the specific software project management challenges themselves, in order to help software project management practitioners select the best

choices for addressing practical, real-world issues. In doing so, this study made the first step in a positive direction, not only to help the participants of this study, but software project management practitioners in general. This was one of the fundamental goals and objectives of this study. And, this study made positive contribution in this regard.

The results have shown how the 52 themes linking Agile project management practices to specific software project management challenges could be used by software project management practitioners (see Appendix V for the complete list). Other results of this study are the effectiveness ratings of those identified themes, as presented in chapter 4. These themes were rated in a scale with 7 levels. Project management practitioners could use these ratings as a useful tool to determine which specific practices could be used to effectively solve specific project management challenges. For example, the practice of creating simple vision statements is used to deal with the lack of scope or vision statements. The data also show that the conceptual framework could aid practitioners in dealing with their challenges. The implication of these findings is that the use of the conceptual framework may help software project management practitioners and eventually increase the success of their software development projects, as well as the resulting software products themselves.

Based on the historical strengths of qualitative, phenomenological research, which are to unlock the experiences of the research subjects, in-depth interviews were conducted with software project management practitioners. Not only did the interviewees have direct experience with both software project management and Agile project management, but they were extremely experienced and talented as well. Therefore, the

use of phenomenological research and highly experienced research subjects were combined to result in the design of a highly useful conceptual framework that can be used by other software project management practitioners to improve the success of their software projects and products.

### Limitations and Main Contributions

The limitations on this study include the limited scope, time constraints, and limited number of Agile project management practices and project management challenges. The contributions were the evidence gathered to support the theory that Agile project management practices can indeed be used to help deal with specific software project management challenges. Another major contribution of this study was to help validate the conceptual framework. In doing so, the conceptual framework may be used for future reference by software project management practitioners struggling with everyday, real-world software project management challenges.

#### Limitations

This study was limited to the research and analysis of software development projects. A further limitation was the short time frame allowed for software project management practitioners to implement the recommended specific Agile project management practices. Responses from some software project management practitioners were that some specific practices related to behavioral change, such as emphasizing commitment and leadership, could not be fully evaluated because it takes a longer time to determine the effectiveness ratings. Moreover, some practices such as organizational

support for building customer-value centered organizations may take years before the effectiveness can be adequately measured.

Another limitation was the recommended Agile project management practices selected for this study. Only a few of the study participants developed their own solutions to deal with their challenges. Furthermore, due to the participant's busy schedules, the study was limited to software project management challenges the participants have encountered in the recent past. Therefore, all items from the conceptual framework could not be rated if they did not correspond to a participant's limited experiences.

### Contributions

The literature review indicated that the Declaration of Interdependence statements had not been validated or evaluated for effectiveness. This study may suggest that the Declaration of Interdependence statements have some validity, effectiveness, and applicability for participants in this study as well as software project management projects and practitioners in general. The results of this study, as well as effectiveness of the conceptual framework were directly related to the experience, knowledge, environments, and project types of the study's participants (see Appendix W for the rating results of the conceptual mapping framework).

### Recommendations for Future Research

One recommendation for future research may be to limit the evaluation of the conceptual framework to one organization and apply it to specific Agile project management practices for that organization (see Figure 6, the conceptual mapping

framework for Agile project management practices to project management challenges). In doing so, it may be easier to verify whether the organization's performance improved after the implementation of solutions to specific challenges and culture of that organization. Similarly, it is recommended that the conceptual framework be applied to a specific type of project, such as government consulting projects, so as to identify challenges specific to a type of project domain. Project management practitioners often comment that managing government projects is very much different from commercial ones. Alternatively, researchers may elect to extend the conceptual framework to other types of projects rather than software development (e.g., new product development projects for hardware products or even service industries). For example, the research could validate this framework in marketing or legal projects.

Another recommendation is to initiate group discussions based on specific themes identified within this study (or others not identified in this study). For this study, the factors used to determine whether a theme is effective, ineffective, or neither effective nor effective were based on the average rating scores from the participants. Through the use of group discussions, software project management practitioners who are facing the same challenges can exchange their experiences and reach a consensus on the ratings for a specific theme.

An action research-oriented recommendation may seek to add observation as one of the study methods. Through the use of observation, the researcher could better understand in the actual situations the practitioners may be facing when implementing

Agile project management practices as well as the insertion of specific solutions to the challenges. Observation could lead to further validation of the conceptual framework.

Another opportunity for future research is to replicate this study, in order to further validate the final, expanded conceptual framework and independently determine its effectiveness. Future research may also include developing additional conceptual frameworks for helping software project management practitioners effectively deal with their software project management challenges.

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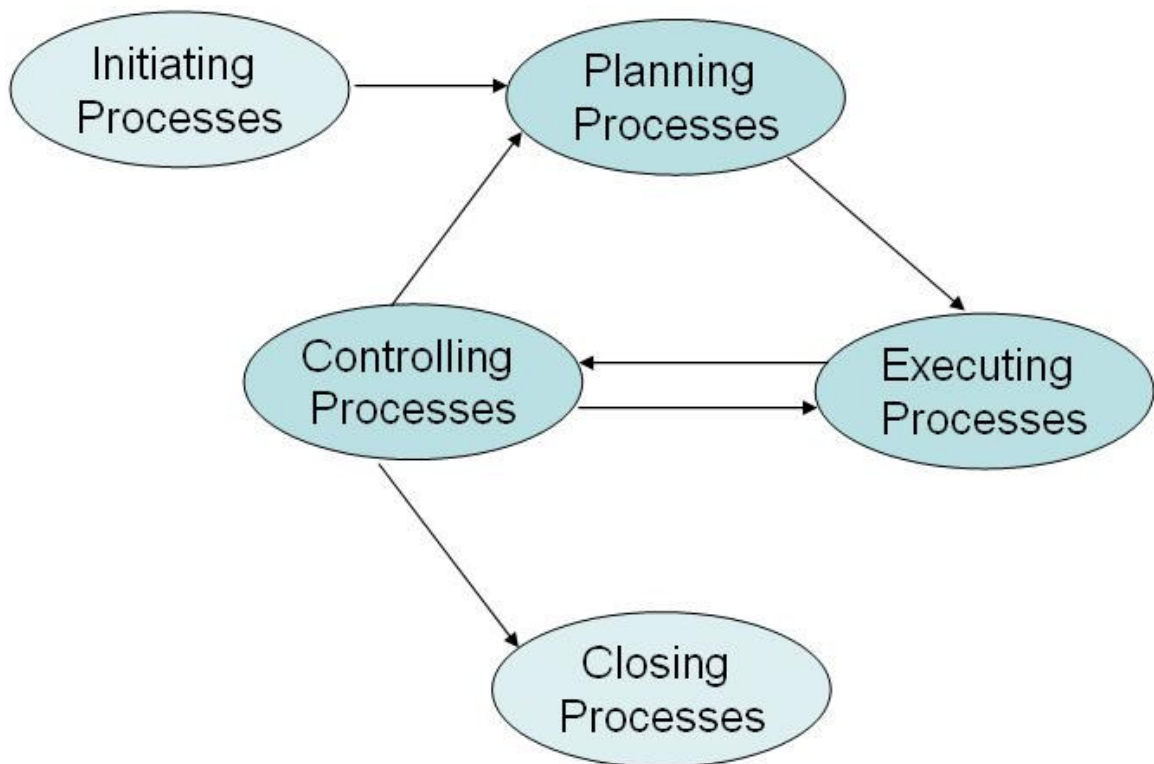
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## Appendices

## Appendix A

### Project Management Process

The Project Management Process



Source: PMBOK Guide, Figure 3-1 Links among Process Groups in a Phase

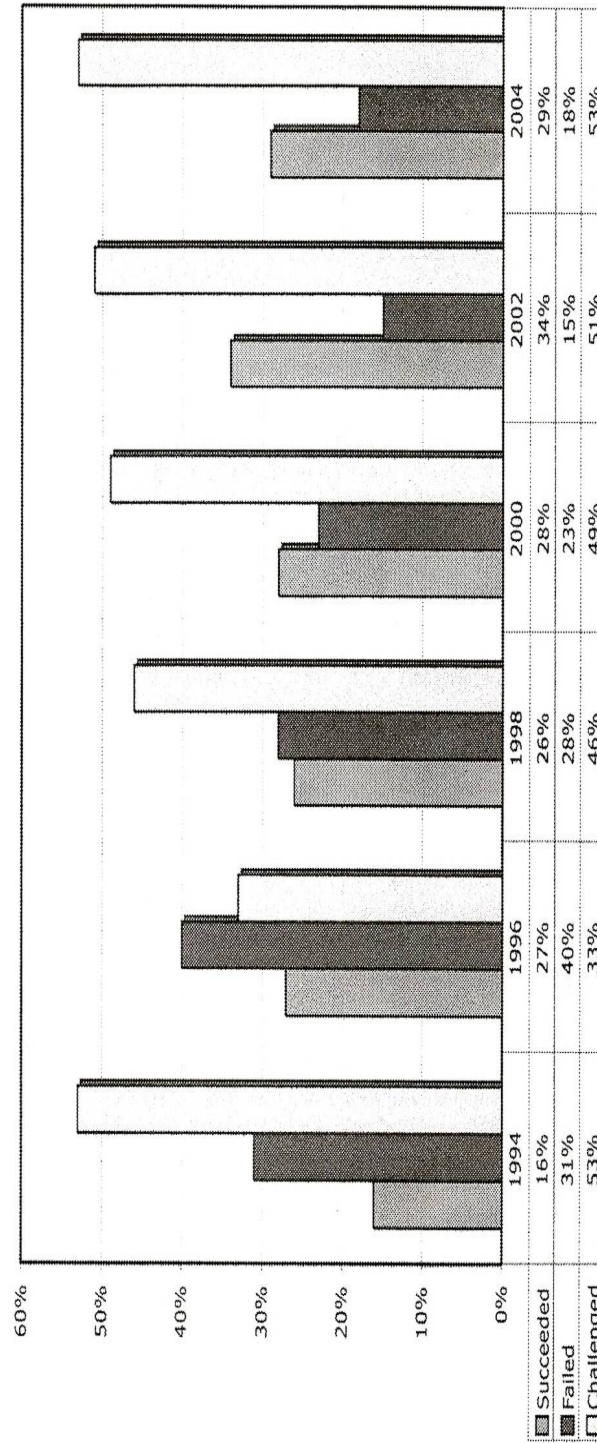


## Appendix B

Projects Succeeded, Failed, and Challenged from 1994 to 2004

# Project Succeeded, Failed, and Challenged from 1994 to 2004

Project Resolution by Type: 1994 - 2004



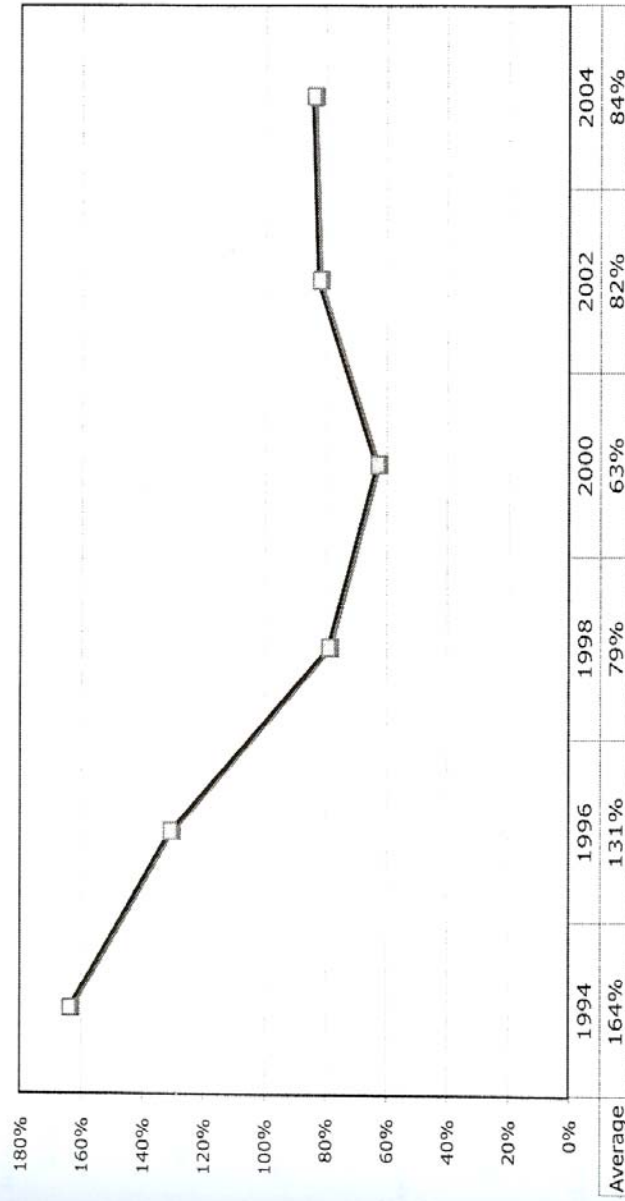
Source: CHAOS Database surveys results polled 1994 - 2004

## Appendix C

Projects Average behind Schedules from 1994 to 2004

### Projects Average behind Schedules from 1994 to 2004

1994 - 2004 Average Percent Time Overruns



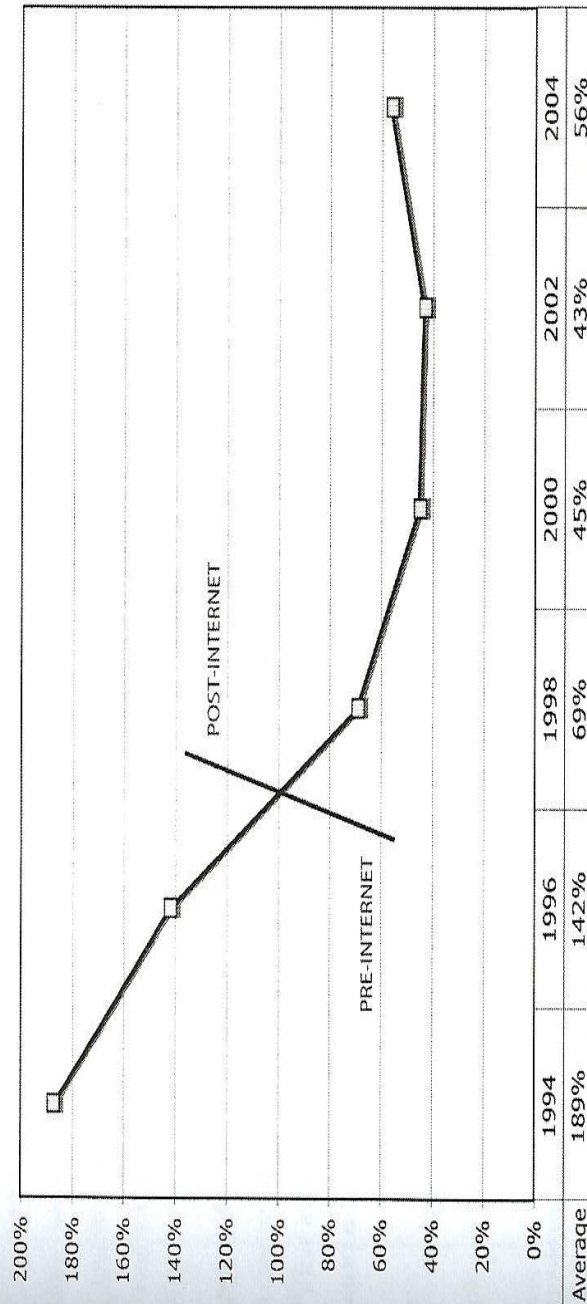
Source: CHAOS Database, surveys conducted 1994 thru 2004

## Appendix D

### Projects Average Cost Overruns from 1994 to 2004

### Projects Average Cost Overruns from 1994 to 2004

1994 - 2004 Average Percent of Cost Overruns



Source: CHAOS Database, surveys conducted 1994 thru 2004

## Appendix E

### Project Success Factors

## Project Success Factors

SUCCESS CRITERIA	POINTS
1. User Involvement	19
2. Executive Management Support	16
3. Clear Statement of Requirements	15
4. Proper Planning	11
5. Realistic Expectations	10
6. Smaller Project Milestones	9
7. Competent Staff	8
8. Ownership	6
9. Clear Vision & Objectives	3
10. Hard-Working, Focused Staff	3
TOTAL	100

Source: CHAOS database, survey conducted 1995



## Appendix F

### Recent Studies of Surveys of Project Management Challenges

## Recent Studies of Surveys of Project Management Challenges

Year	Sources	Challenges	Patterns
1994	Standish Group	1.Lack of user input	Lack of customer involvement
		2.Incomplete requirements and specifications	Unclear vision and scope
		3.Changing requirements and specifications	Scope changes
		4.Lack of executive support	Lack of organizational support
		5.Technology incompetence	Technology issue
		6.Lack of resources	Scarce resource competition
		7.Unrealistic expectations	Scheduling issue
		8.Unclear objectives	Unclear vision and scope
		9.Unrealistic timeframes	Scheduling issue
		10.New technology.	Technology issue
2004	Project Management Institute (PMI)	1.Inconsistent approaches to managing projects	Lack of proper processes
		2.Difficulties in allocating resources	Scarce resource competition
		3.Too many projects, but not the right projects	Unclear vision and scope
		4.Economic pressures	Scheduling issue
		5.Limited visibility into project activities	Unclear vision and scope
		6.Projects always late and over budget	Poor planning
		7.Project manager competency	Project management incompetence
		8.Customers not satisfied	Lack of customer involvement
		9.Product quality unacceptable	Poor quality
		10.Lack of centralized project management information system	Project management incompetence
2007	VersionOne	1.General resistance to change	Resistance to change
		2.Lack personnel with the necessary Agile experience	Project management incompetence
		3.Organization boundaries	Scarce resource competition
		4.Management support	Lack of organizational support
		5.Customer collaboration	Lack of customer involvement

## Appendix G

### Summary of Project Management Challenges

## Summary of Recent Scholarly Studies of Project Management Challenges

Year	Authors	Challenges	Patterns
1998	Glass	1. Project objectives not fully specified	Unclear vision and scope
		2. Bad planning and estimating	Poor planning
		3. Technology new to the organization	Technology issue
		4. Inadequate and no project management methodology	Project management incompetence
		5. Insufficient senior staff on the team	Scarce resource competition
		6. Poor performance by suppliers of hardware and software	Scarce resource competition
		7. Inefficient performance problems	Scarce resource competition
2004	Ford	1. Unrealistic deadlines	Scheduling issue
		2. Communication deficit	Lack of customer involvement
		3. Scope changes	Scope changes
		4. Resource competition	Scarce resource competition
		5. Uncertain dependencies	Uncertain dependencies
		6. Failure to manage risk	Risk management
		7. Insufficient team skills	Insufficient team skills
		8. Lack of accountability	Lack of accountability
		9. Customers and end-users are not engaged during the project	Lack of customer involvement
		10. Vision and goals not well-defined	Unclear vision and scope
2004	Schwaber	1. Resources allocation	Scarce resource competition
		2. Cross-functional team	Cross-functional team
		3. Unclear requirement	Unclear vision and scope
		4. Waterfall process	Lack of proper processes
		5. Organizational culture	Issues related to organizational culture
		6. Project manager competence -lack of leaders	Project management incompetence
		7. Difficult to adapt the requirement change	Resistance to change
		8. Top-down control through planning	Issues related to organizational culture
2006	Johnson	1. Lack of user involvement	Lack of customer involvement
		2. Lack of executive support	Lack of organizational support
		3. Unclear business objectives	Unclear vision and scope
		4. Less scope optimization	Scope changes
		5. Lack of agile processes	Lack of proper processes
		6. Project management expertise incompetent	Project management incompetence
		7. Poor financial management	Poor planning
		8. Lack of skilled resources	Scarce resource competition
		9. Lack of formal methodology	Lack of proper processes
		10. Lack of tools	Lack of tools

## Appendix H

### Mapping Agile Principles to Agile Manifesto

## Mapping Agile Principles to Agile Manifesto

Agile Manifesto		Agile Principles	
Primary	Secondary	No.	Principles
Individuals and interactions	processes and tools	1.	Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
		2.	The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
		3.	The best architectures, requirements, and designs emerge from self-organizing teams.
Working software	comprehensive documentation	4.	Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
		5.	Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
		6.	Working software is the primary measure of progress.
Customer collaboration	contract negotiation	7.	Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
		8.	Continuous attention to technical excellence and good design enhances agility
		9.	Simplicity--the art of maximizing the amount of work not done--is essential.
Responding to change	following a plan	10.	Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
		11.	Continuous attention to technical excellence and good design enhances agility
		12.	Simplicity--the art of maximizing the amount of work not done--is essential

## Appendix I

### Linking Agile Values, Declaration of Interdependence Statements, and Declaration of Interdependence Value Areas

# Linking Agile Values, Declaration of Interdependence (DOI) Statements, and Declaration of Interdependence Value Areas

Agile Manifesto Primary values	DOI Statements	DOI Value Areas
Individuals and interactions	We unleash creativity and innovation by recognizing that individuals are the ultimate source of value, and creating an environment where they can make a difference	Individuals
	We boost performance through group accountability for results and shared responsibility for team effectiveness.	Teams
Working software	We increase return on investment by making continuous flow of value our focus	Value
Customer collaboration	We expect uncertainty and manage for it through iterations, anticipation, and adaptation.	Customers
Responding to change over	We expect uncertainty and manage for it through iterations, anticipation, and adaptation.	Uncertainty
	We improve effectiveness and reliability through situationally specific strategies, processes and practices.	Context



## Appendix J

### Declaration of Interdependence Objectives, Methods, and Major Agile Project Management Practices

## Declaration of Interdependence Objectives, Methods, and Major APM Practices

DOI Value Area	DOI objectives	Methods	Major APM Practices	References
Individuals	Unleash creativity and innovation	Recognizing valuable individuals who can make the differences	Hiring the right people	Highsmith (2004), Schwaber (2004)
			Training and pair programming	Schwaber (2004), Highsmith (2004), DeCarlo (2004), Augustine (2005)
		Creating an environment where individuals can deliver values	Maintain quality of work life	DeCarlo (2004), Augustine (2005)
			Decentralizing control	Highsmith (2004), Augustine (2005)
Teams	Boost performance	Establishing group accountability for results	Emphasizing commitment and leadership	DeCarlo (2004), Highsmith (2004), Schwaber (2004), Augustine (2005), Leach (2005)
		Building a viable team that shares responsibility for team effectiveness	Coaching and mentoring	Highsmith (2004), Leach (2005)
			Building a self-organization team	DeCarlo (2004), Schwaber (2004), Highsmith (2004), Augustine (2005)
Value	Increase return on investment	Focusing on continuous flow of value	Prioritizing feature list for ROI	Schwaber (2004), Highsmith (2004)
			Creating innovative products	Highsmith (2004)
			Sharing open information	DeCarlo (2004), Highsmith (2004), Schwaber (2004), Augustine (2005)
			Eliminating waste	Highsmith (2004), Leach (2005)
			Using right tools	Leach (2005)
Customers	Deliver reliable results	Sharing product ownership	Creating simple vision statements	DeCarlo (2004), Highsmith (2004), Leach (2005), Augustine (2005)
		Engaging customers in frequent interactions	Engaging customer participation	DeCarlo (2004), Highsmith (2004), Schwaber (2004)
Uncertainty	Expect uncertainty	Managing changes through iterations	Applying iteration and incremental strategies	Highsmith (2004), Schwaber (2004), Augustine (2005)
		Anticipating changes	Observing and assessing practices	DeCarlo (2004), Augustine (2005), Leach (2005)
		Adapting changes	Taking adaptive actions	DeCarlo (2004), Highsmith (2004), Augustine (2005)
Context	Improve effectiveness and reliability	Simplify processes	Keeping simple rules	Highsmith (2004), Augustine (2005)
		Using situational specific strategies and practices	Building customer-value organization	DeCarlo (2004), Schwaber (2004)

## Appendix K

Scholarly Studies of Agile Project Management (APM) Principles and APM Practices

## Scholarly Studies of Agile Project Management (APM) Principles and APM Practices

DeCarlo (2004)		Highsmith (2004)		Schwaber (2004)		Augustine (2005)		Leach (2005)	
Principles	Practices	Principles	Practices	Practices	Practices	Principles	Practices	Principles	Practices
Value area	<b>Customers</b>	Objective	Deliver reliable results						
Client collaboration (SV)	Ongoing interaction and feedback with the customer	Delivering customer-value	Customer team-developer team interface	Ask customers to attend Sprint planning and Sprint review meetings	Encourage emergence and self-organization	Negotiate a customer representative on site			
4 Business Questions	Customer collaboration (SV)		Daily interaction with the customer team						
Build on people's desire to make a difference (2A)	Providing vision to development team		Product vision box and elevator statement		Foster alignment and corporation	Guiding vision-product vision box and elevator statement	Chartering	Project charter	
Clarity of purpose (V8)	Clear goals and objectives		Product data sheet						
Value area	<b>Uncertainty</b>	Objective	Expect uncertainty						
Making change your friend (1A)	Accepting changes and move on	Employ iterative feature delivery	Taking adaptive actions	Incremental release and planning	Encourage emergence and self-organization	Develop iteration plans and task backlogs	Managing variation	Using project buffers	
Early value (V10)	Delivering small packages early and often				Institute learning and adaptation	Conduct scenario planning			
						Adaptive leadership			
Value area	<b>Context</b>	Objective	Improve effectiveness and reliability						
Keep it simple (4A)	Less process and few policies and standards	simplify	Tailoring processes and practices		Encourage emergence and self-organization	Keeping simple rules			
Flexible project model (F3)	Using a Simple iterative process to get job done								
Agile organization (F5)	Need organizational support for Agile								

DeCarlo (2004)		Highsmith (2004)		Schwaber (2004)		Augustine (2005)		Leach (2005)	
Principles	Practices	Principles	Practices	Principles	Practices	Principles	Practices	Principles	Practices
Value area	<b>Customers</b>	Objective	Deliver reliable results	Practices	Ask customers to attend Sprint planning and Sprint review meetings	Encourage emergence and self-organization	Negotiate a customer representative on site		
Client collaboration (SV)	Ongoing interaction and feedback with the customer	Delivering customer-value	Customer team-developer team interface						
4 Business Questions	Customer collaboration (SV)		Daily interaction with the customer team						
Build on people's desire to make a difference (2A)	Providing vision to development team		Product vision box and elevator statement			Foster alignment and corporation	Guiding vision - Product vision box and elevator statement	Chartering	Project charter
Clarity of purpose (V8)	Clear goals and objectives		Product data sheet						
Value area	<b>Uncertainty</b>	Objective	Expect uncertainty						
Making change your friend (1A)	Accepting changes and move on	Employ iterative feature delivery	Taking adaptive actions	Incremental release and planning	Encourage emergence and self-organization	Develop iteration plans and task backlogs	Managing variation	Using project buffers	
Early value (V10)	Delivering small packages early and often				Institute learning and adaptation	Conduct scenario planning			
						Adaptive leadership			
Value area	<b>Context</b>	Objective	Improve effectiveness and reliability						
Keep it simple (4A)	Less process and few policies and standards	simplify	Tailoring processes and practices		Encourage emergence and self-organization	Keeping simple rules			
Flexible project model (F3)	Using a simple iterative process to get job done								
Agile organization (F5)	Need organizational support for Agile								

**Notes:**

- Schwaber's studies only mention Agile project management practices, but not on Agile project management principles.
- In DeCarlo's principles, A stands for accelerators, V stands for values, and F stands for factors. For example, 1A means first Accelerator and 2Q means the second business question. DeCarlo's four business questions include (a) Who needs what and why? (b) What will it take to do it? (c) Can we get what it takes? And (d) Is it worth it?

## Appendix L

### Major Challenge Patterns and Their References

## Major Challenge Patterns and Their References

DOI Value Areas	PM Major Challenge Patterns	References
Individuals	Scarce resource competition	Standish (1994), Glass (1998), Ford (2004), Schwaber (2004), Johnson (2006), VersionOne (2007)
	Project management incompetence	Glass (1998), PMI (2004), Schwaber (2004), Johnson (2006), VersionOne (2007)
	Issues related to organizational culture	Schwaber (2004)
Teams	Lack of accountability	Ford (2004)
	Insufficient team skills	Ford (2004)
	Cross-functional team	Schwaber (2004)
Value	Poor planning	Glass (1998), PMI (2004), Johnson (2006)
	Poor quality	PMI (2004),
	Lack of tools	Johnson (2006)
Customers	Unclear scope or vision	Standish (1994), Glass (1998), PMI (2004), Ford (2004), Schwaber (2004)
	Lack of customer involvement	Standish (1994), PMI (2004), Ford (2004), Johnson (2006), and VersionOne (2007)
Uncertainty	Scheduling issue	Standish (1994), PMI (2004), Ford (2004)
	Scope Changes	Standish (1994), Ford (2004), Johnson (2006)
	Risk management	Ford (2004),
	Uncertain dependencies	Ford (2004),
	Technology issue	Standish (1994), Glass (1998),
	Resistance to change	Standish (1994), PMI (2004), Schwaber (2004), and VersionOne (2007)
Context	Lack of proper processes	PMI (2004), Schwaber (2004), Johnson (2006)
	Lack of organizational support	Standish (1994), Johnson (2006), VersionOne (2007)

## Appendix M

### Informed Consent Letter to Participate



### Informed Consent Letter to Participate

You are invited to participate in a study of project management challenges in software development. Faculty members and graduate students of Argosy University, Washington DC Campus hope to learn whether Agile project management practices can deal with project management challenges in software development in Agile or non-Agile environments. You were selected as a possible participant in this study because either you expressed interest in the research or professionals in the software industry identified you as someone who has the appropriate management responsibilities.

If you decide to participate in this research, you will be invited to participant two interviews to discuss your project management challenges and your experiences or expectations in dealing with those challenges. These interviews will take approximately 30-60 minutes each.

Your participation in this research is strictly voluntary. Your participation involves no obvious risks, but it is possible that you may be uncomfortable revealing particular challenges because you do not want others know about potential failures or frustrations. You have the right to refuse to participate at all, or choose to stop your participation at any point in the research. Your decision whether or not to participate will not prejudice your future relations with either your company or Argosy University, Washington DC Campus.

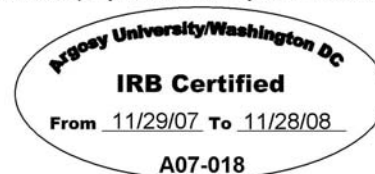
The information and data you provide for this research will be treated confidentially, and all raw data will be kept in a secured file by the researcher. Results of the research will be reported as aggregate summary data only, and no individually identifiable information will be presented. You also have the right to review the results of the research if you wish to do so. A copy of the results may be obtained by contacting Saya Sone at sayasone@yahoo.com.

There may be personal benefits from your participation in this research. This study may not only help project management practitioners examine Declaration of Interdependence, but also help you experiment on some Agile project management practices to deal with your project management challenges.

The results of the research may contribute to Agile project leaders to develop Agile project management practices. If Agile project management practices do not match specific project management challenges, this study will suggest a new areas of study where Agile project management scholars or experts need to perform further investigation.

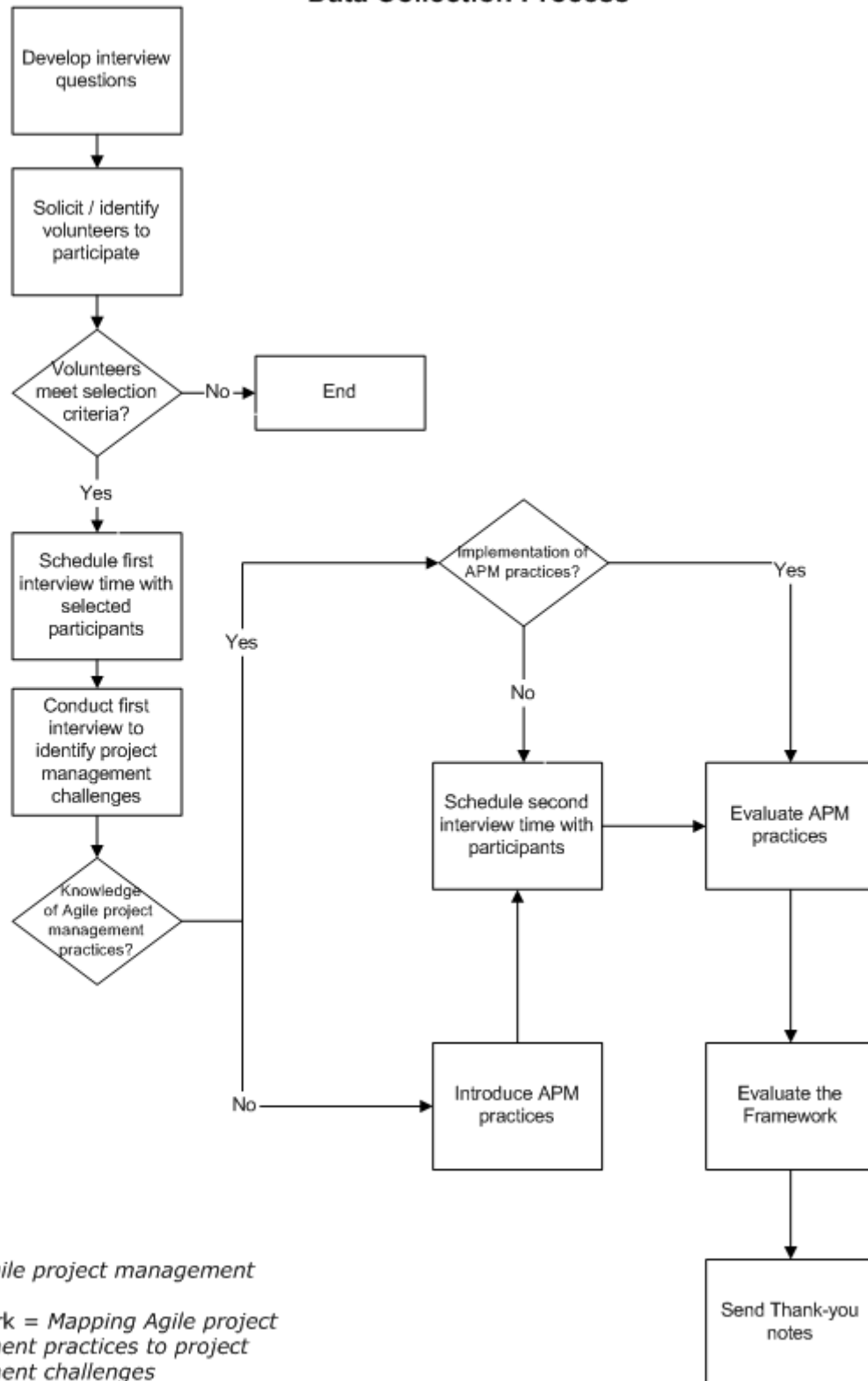
If you have any questions regarding your rights as a participant or concerning a research related problem, please call the Institutional Review Board Chair at (703) 526-5800. If you have any other questions, please contact Saya Sone at sayasone@yahoo.com.

You are making a decision as to whether or not to participate. Your proceeding with the interviews indicates that you have read the information provided above and have decided to do so. You may withdraw at any time without prejudice should you choose to discontinue participation in this study.



## Appendix N

### Data Collection Process

**Data Collection Process**

## Appendix O

### Interview Protocols

## Interview Protocols

### First Interview

#### Section A: Questions related demographic information.

1. What is your position in your company?
2. How many years of experience in managing projects?
3. Are you a certified project management professional from Project management Institute or a certified Scrum Master from Scrum Alliance?
4. Is your company project environment Agile, Waterfall, both, or others?
5. What is your project type? Government, commercial, non-project, or mixed?

#### Section B: Questions related to identify project management challenges.

1. What particular project management challenges are you encountering?
2. Could you describe in what situation or by what causes of the challenges?
3. What kind of Agile project management practices will you use for your project management challenges after introduce the framework on mapping Agile project management practices to project management challenges?

### Follow-up Interview

1. What kind of Agile project management practices were working for your project management challenges?
2. Why do you select particular Agile project management practices in dealing with specific project management challenges? Can you elaborate the detail situation?
3. Can you describe how effective of those Agile project management practices you selected to your project management challenges?
4. Can you explain your decision on evaluating the effectiveness between Agile project management practices and project management challenges?
5. After reviewing the framework, can you rate how useful of this framework? For example, will you use this framework to help you manage your software project in the future?

## Appendix P

### Rating Template for the Agile Project Management Practices

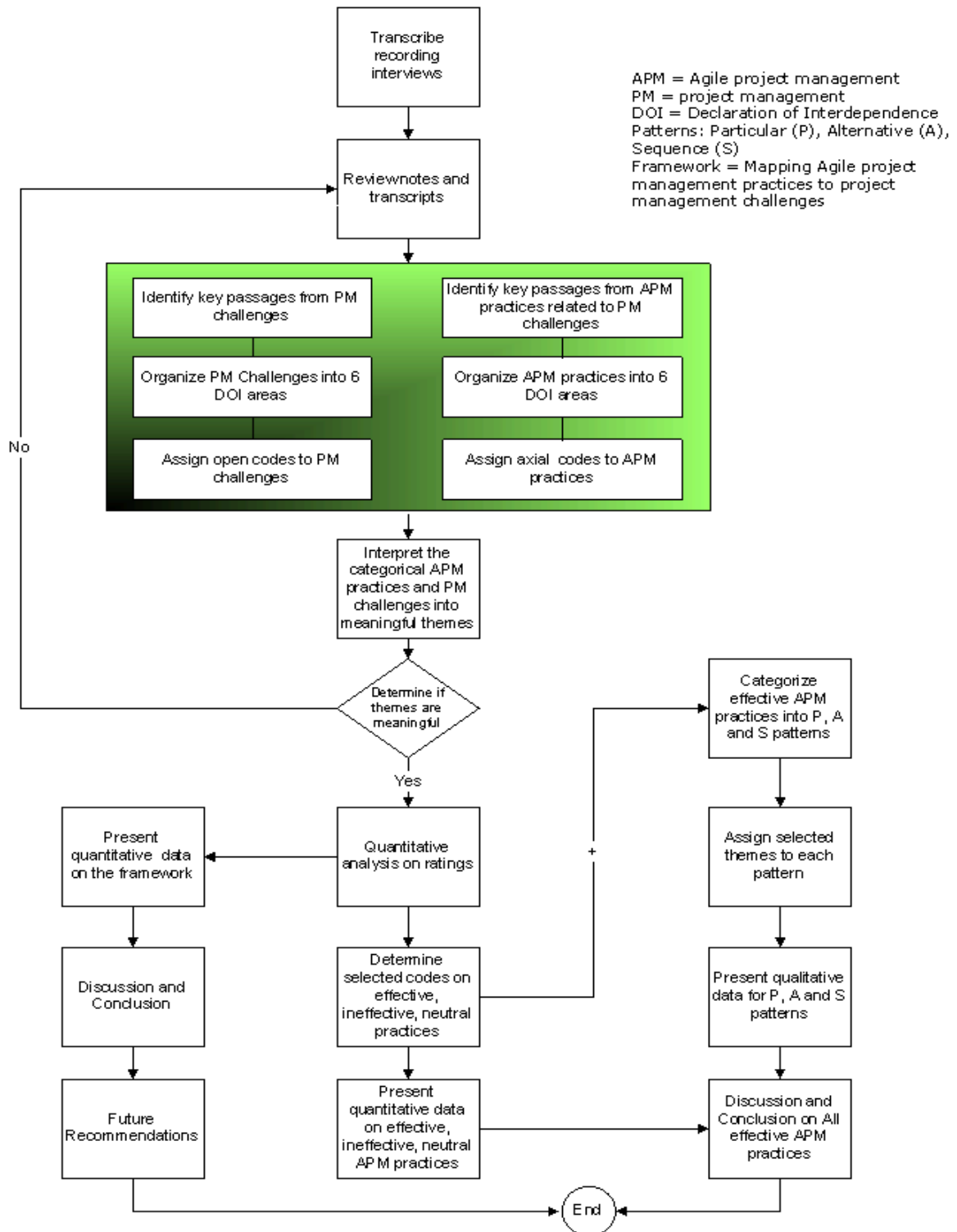
Rating Template for the Agile Project Management Practices								
DOI	Themes	APM Major Practices (Project Management Challenges)	1	2	3	5	6	7
I n d i v i d u a l s	1-1	Hiring the right people ( <a href="#">Budgeting and cost</a> )						
	1-2	Hiring the right people ( <a href="#">Cross functional team</a> )						
	1-3	Hiring the right people ( <a href="#">Insufficient team skills</a> )						
	1-4	Hiring the right people ( <a href="#">Lack of proper processes</a> )						
	1-5	Hiring the right people ( <a href="#">Project management incompetence</a> )						
	1-6	Hiring the right people ( <a href="#">Unable to provide good estimation</a> )						
	2-7	Training and pair programming ( <a href="#">Customer incompetence</a> )						
	2-8	Training and pair programming ( <a href="#">Distributed team</a> )						
	2-9	Training and pair programming ( <a href="#">Insufficient team skills</a> )						
	2-10	Training and pair programming ( <a href="#">Lack of understanding of the tools</a> )						
	2-11	Training and pair programming ( <a href="#">Scarce resource competition</a> )						
	2-12	Training and pair programming ( <a href="#">Scheduling issues</a> )						
	4-13	Decentralizing control ( <a href="#">Issues related to organizational culture</a> )						
T e a m s	5-14	Emphasizing commitment & leadership ( <a href="#">Lack of accountability</a> )						
	5-15	Emphasizing commitment and leadership ( <a href="#">Lack of good leaders</a> )						
	5-16	Emphasizing commitment and leadership ( <a href="#">Multitasking</a> )						
	5-17	Emphasizing commitment and leadership ( <a href="#">Team resistance to new leaderships</a> )						
	6-18	Coaching and mentoring ( <a href="#">Insufficient team skills</a> )						
	6-19	Coaching and mentoring ( <a href="#">Cross functional team</a> )						
	7-20	Building self-organizing team ( <a href="#">Cross functional team</a> )						
	7-21	Building self-organizing team ( <a href="#">Distributed team</a> )						
V a l u e	7-22	Building self-organizing team ( <a href="#">Insufficient team skills</a> )						
	7-23	Building self-organizing team ( <a href="#">Lack of accountability</a> )						
	8-24	Prioritizing feature list for return on investment ( <a href="#">Lack of prioritization</a> )						
	8-25	Prioritizing feature list for return on investment ( <a href="#">Multitasking</a> )						
	8-26	Prioritizing feature list for return on investment ( <a href="#">Poor planning</a> )						
	9-27	Creating innovative products ( <a href="#">Lack of global product</a> )						
	10-28	Eliminating waste ( <a href="#">High cost</a> )						
	10-29	Eliminating waste ( <a href="#">Poor quality</a> )						
	11-30	Sharing open information ( <a href="#">Distributed team</a> )						
	11-31	Sharing open information ( <a href="#">Poor planning</a> )						
	12-32	Using right tools ( <a href="#">Distributed team</a> )						
	12-33	Using right tools ( <a href="#">Lack of tools</a> )						
C u s t o m e r s	13-34	Creating simple vision statements ( <a href="#">Unclear scope or vision</a> )						
	14-35	Engaging customer participation ( <a href="#">Lack of customer involvement</a> )						
	14-36	Engaging customer participation ( <a href="#">Poor Communication</a> )						
U n c e r t a i n t y	15-37	Applying iteration and incremental strategies ( <a href="#">Distributed team</a> )						
	15-38	Applying iteration and incremental strategies ( <a href="#">Lack of product value to customers</a> )						
	15-39	Applying iteration and incremental strategies ( <a href="#">Poor quality</a> )						
	15-40	Applying iteration and incremental strategies ( <a href="#">Scheduling issues</a> )						
	15-41	Applying iteration and incremental strategies ( <a href="#">Scope Changes</a> )						
	16-42	Observing and assessing practices ( <a href="#">Uncertain dependencies</a> )						
	16-43	Observing and assessing practices ( <a href="#">Technology issues</a> )						
	17-44	Taking adaptive actions ( <a href="#">Resistance to change to new processes</a> )						
C o n t e x t	18-45	Keeping simple rules ( <a href="#">Agile with non-agile team</a> )						
	18-46	Keeping simple rules ( <a href="#">Lack of proper processes</a> )						
	18-47	Keeping simple rules ( <a href="#">Scope Changes</a> )						
	19-48	Building customer-value organization ( <a href="#">Agile with non-agile team</a> )						
	19-49	Building customer-value organization ( <a href="#">Different organizational environments</a> )						
	19-50	Building customer-value organization ( <a href="#">Lack of executive support</a> )						
	19-51	Building customer-value organization ( <a href="#">Lack of organizational support</a> )						
	19-52	Building customer-value organization ( <a href="#">Lack of proper processes</a> )						
		<b>Usefulness Tendency</b>						
	1	Strongly Disagree						
	2	Disagree						
	3	Somewhat Disagree						
	4	Neither Disagree nor Agree						
	5	Somewhat Agree						
	6	Agree						
	7	Strongly Agree						

## Appendix Q

### Data Analysis Process



## Data Analysis Process



## Appendix R

### Coding Structure

Coding Structure for Project Management Challenges (Open Codes), Agile Project Management Practices (Axial Codes), Themes (Selected Codes), and Patterns (Pattern Codes)								
DOI Value areas	Axial Codes	APM Major Practices	Open Codes	Project Management Challenges	Effectiveness Ratings	Selected codes E/I/N	Pattern Codes	
Individuals	1	Hiring the right people	1	Budgeting and cost	4.0	N	N <sub>1</sub>	
		Hiring more general skill set, not specialized	2	Cross functional team	3.0	I	I <sub>1</sub>	
		Hiring the right people	3	Insufficient team skills	7.0	E	A <sub>1</sub>	
		Hiring the right people	4	Lack of proper process, lack of good configuration	4.0	N	N <sub>2</sub>	
		Hiring the right people	5	Project management incompetence	5.5	E	E <sub>1</sub>	
		Hiring the right people	6	Unable to provide good estimation	4.0	N	N <sub>3</sub>	
	2	Training and paired programming	7	Customer incompetence	2.0	I	I <sub>2</sub>	
		Training and paired programming	8	Distributed team	6.0	E	A <sub>2</sub> , S <sub>1</sub>	
		Training and paired programming	9	Insufficient team skills	6.0	E	A <sub>1</sub>	
		Training and paired programming	10	Lack of understanding of the tools (Lack people to understand the dev tools)	7.0	E	E <sub>2</sub>	
		Training and paired programming	11	Scarce resource competition	4.3	E	E <sub>3</sub>	
		Training and paired programming	12	Scheduling issues	5.0	E	A <sub>3</sub>	
	3	Maintain quality of work life	N/A	Organizational culture issue	N/A	N/A		
	4	Decentralizing control	13	Organizational culture issues	7.0	E	E <sub>4</sub>	
Teams	5	Emphasizing commitment and leadership	14	Lack of accountability or creditability	4.8	E	E <sub>5</sub>	
		Emphasizing commitment and leadership	15	Lack of good leaders to handle the configuration	4.0	N	N <sub>4</sub>	
		Emphasizing commitment and leadership	16	Multitasking	5.0	E	A <sub>4</sub>	
		Emphasizing commitment and leadership	17	Team resistance to new leaderships	6.0	E	E <sub>6</sub>	
		Emphasizing commitment and leadership	18	Insufficient team skills	4.7	E	A <sub>1</sub> , S <sub>2</sub>	
	6	Coaching and mentoring	19	Lack of accountability	3.0	I	I <sub>3</sub>	
		Coaching and mentoring	20	Cross functional team	4.3	E	E <sub>7</sub>	
	7	Building self-organizing team	21	Distributed team	5.0	E	A <sub>2</sub> , S <sub>1</sub>	
		Building self-organizing team	22	Insufficient team skills	2.0	I	I <sub>4</sub>	
		Building self-organizing team	23	Lack of accountability	4.0	N	N <sub>5</sub>	
Values	8	Prioritizing feature list for Return of Investments (ROI)	24	Lack of prioritization. Customer did not understand the impact of their decision on feature list	5.0	E	E <sub>8</sub>	
		Prioritizing feature list for ROI	25	Multitasking	6.0	E	A <sub>4</sub>	
		Prioritizing feature list for ROI	26	Poor (requirement) planning	7.3	E	A <sub>5</sub>	
	9	Creating innovative products	N/A	Poor planning	N/A	N/A		
		Creating innovative products	27	Lack of global product	4.0	N	N <sub>6</sub>	
	10	Eliminating waste	28	High cost	6.0	E	E <sub>9</sub>	
		Eliminating waste	29	Poor quality	3.0	I	I <sub>5</sub>	
	11	Sharing open information	30	Distributed team	5.0	E	A <sub>2</sub> , S <sub>1</sub>	
		Sharing open information	31	Poor planning	6.0	E	A <sub>5</sub>	
	12	Using right tools	32	Distributed team	3.0	I	I <sub>6</sub> , S <sub>1</sub>	
		Using right tools	33	Lack of tools for tracking	4.3	E	E <sub>10</sub>	
Customers	13	Creating simple vision statements	34	Unclear scope or vision	4.9	E, S	E <sub>11</sub> , S <sub>3</sub>	
	14	Engaging customer participation	35	Lack of customer involvement	6.6	E	E <sub>12</sub>	
		Engaging customer participation	36	Poor Communication	6.0	E	E <sub>13</sub>	
Uncertainty	15	Applying iteration and incremental strategies	37	Distributed team	2.0	I	I <sub>7</sub>	
		Applying iteration and incremental strategies	38	Lack of product value to customers	7.0	E	E <sub>14</sub>	
		Applying iteration and incremental strategies	39	Poor quality	7.0	E	E <sub>15</sub>	
		Applying iteration and incremental strategies	40	Scheduling issues	5.3	E	A <sub>3</sub>	
		Applying iteration and incremental strategies	41	Scope Changes	6.6	E	A <sub>6</sub>	
	16	Observing and assessing practices	N/A	Risk management	N/A	N/A		
		Observing and assessing practices	42	Uncertain dependencies	7.0	E	E <sub>16</sub>	
		Observing and assessing practices	43	Technology issues	6.0	E	E <sub>17</sub>	
	17	Taking adaptive actions	44	Resistance to change to new process	5.8	E	E <sub>18</sub> , S <sub>4</sub>	
		Taking adaptive actions	45	Agile and non-Agile team (Deal with other team who has change management process)	6.0	E	A <sub>7</sub>	
Context	18	Keeping simple rules	46	Lack of proper process	5.3	E	A <sub>8</sub>	
		Keeping simple rules, Implement Change Control Board to deal with scope changes	47	Scope Changes	5.0	E	A <sub>6</sub>	
		Keeping simple rules, Implement Change Control Board to deal with scope changes	48	Agile with non-agile team	5.3	E	A <sub>7</sub>	
	19	Building customer-value organization	49	Different organizational environments	7.0	E	E <sub>19</sub>	
		Building customer-value organization	50	Lack of executive support	7.0	E	E <sub>20</sub>	
		Building customer-value organization	51	Lack of organizational support	6.3	E	E <sub>21</sub>	
		Building customer-value organization	52	Lack of proper process	6.0	E	E <sub>8</sub>	

## Appendix S

### Five Relationship Patterns between Agile Project Management Practices and Project Management Challenges

Five Relationship Patterns between Agile Project Management Practices and Project Management Challenges									
Challenges	Different		Same		Same		One		One
Practices	Particular		Alternative		Sequence		Ineffectiveness		Neutral (neither effective nor ineffective)
Patterns	P	A	S	N					
1	1-5 Hiring the right people (Project management incompetence)	18-45, 19-48 Keeping simple rules or Building customer-value organization (Agile with non-agile team)	2+7+11+12 => (8, 21, 30, 32)	15-37 Training and paired programming + Building self-organizing team + Sharing open information + Using right tools (Distributed team)	1-1 Applying iteration and incremental strategies (Distributed team)	1-1 Hiring the right people (Budgeting and cost)			
2	2-10 Training and paired programming (Lack of understanding of the tools)	2-8, 7-21, 11-30 Building self-organizing team or Sharing open information (Distributed team)	5+6=>18	7-22 Emphasizing commitment and mentoring (Insufficient team skills)	1-4 Building self-organizing team (Insufficient team skills)	Hiring the right people (Lack of proper processes)			
3	2-11 Training and paired programming (Scarce resource competition)	1-3, 2-9, 6-18 Hiring the right people, Training and mentoring, or Coaching and (Insufficient team skills)	1+17=>44	6-19 Hiring the right people + Taking adaptive actions (Resistance to change to new processes)	1-6 Coaching and mentoring (Lack of accountability)	Hiring the right people (Unable to provide good estimation)			
4	4-13 Decentralizing control (Organizational culture issues)	18-46, 19-52 Keeping simple rules or Building customer-value organization (Lack of proper processes)	13+14=>34	10-29 Creating simple vision statements + Engaging customer participation (Unclear scope or vision)	7-23 Eliminating waste (Poor quality)	Building self-organizing team (Lack of accountability)			
5	5-14 Emphasizing commitment and leadership (Lack of accountability or credibility)	5-16, 8-25 Emphasizing commitment and leadership or Prioritizing feature list for return on investment (Multitasking)		1-2	9-27 Hiring the right people (Cross functional team)	Creating innovative products (Lack of global product)			
6	5-17 Emphasizing commitment and leadership (Team resistance to new leaderships)	8-26, 11-31 Prioritizing feature list for return on investment or Sharing open information (Poor planning)		2-7	5-15 Training and paired programming (Customer incompetence)	Emphasizing commitment and leadership (Lack of good leaders)			
7	7-20 Building self-organizing team (Cross functional team)	2-12, 15-40 Training and paired programming or Applying iteration and incremental strategies (Scheduling issues)		12-32	Using right tools (Distributed team)				
8	8-24 Prioritizing feature list for return on investment (Lack of prioritization)	15-41, 18-47 Applying iteration and incremental strategies or Keeping simple rules (Scope Changes)							
9	10-28 Eliminating waste (High cost)								
10	12-33 Using right tools (Lack of tools)								
11	13-34 Creating simple vision statements (Unclear scope or vision)								
12	14-35 Engaging customer participation (Lack of customer involvement)								
13	14-36 Engaging customer participation (Poor Communication)								
14	15-38 Applying iteration and incremental strategies (Poor quality)								
15	15-39 Applying iteration and incremental strategies (Uncertain dependencies)								
16	17-42 Observing and assessing practices (Technology issues)								
17	16-43 Observing and assessing practices (Resistance to change to new processes)								
18	17-44 Taking adaptive actions (Different organizational environments)								
19	19-49 Building customer-value organization (Lack of executive support)								
20	19-50 Building customer-value organization (Lack of organizational support)								
21	19-51 Building customer-value organization (Lack of organizational support)								

## Appendix T

### Rating Template for the Conceptual Mapping Framework

Demographic Backgrounds	1	2	3	5	6	7
<b>Project Management Experiences</b>						
3-6 Years						
7-13 Years						
14-20 Years						
21-25 Years						
<b>Project Management Knowledge in</b>						
Agile (Certified ScrumMaster)						
Waterfall (PMP)						
Both						
Other						
<b>Organizational Environments</b>						
Agile						
Waterfall						
Mix						
Other						
<b>Project Types</b>						
Government						
Commercial						
Non-profit						
Mix						

### Usefulness Tendency

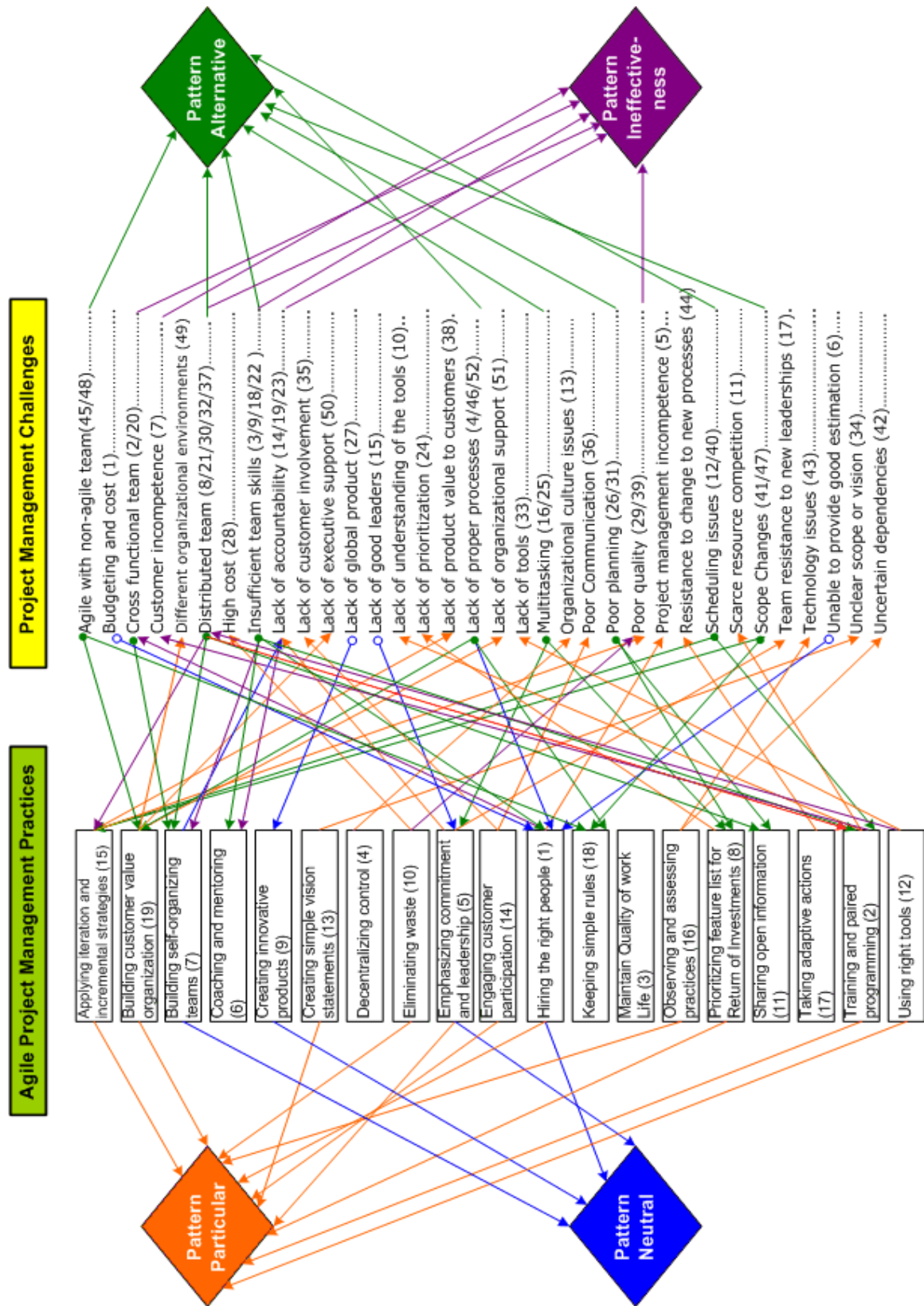
Strongly Disagree	1
Disagree	2
Somewhat Disagree	3
Neither Disagree or Agree	4
Somewhat Agree	5
Agree	6
Strongly Agree	7

## Appendix U

### The Expanded Mapping Framework



# The Expanded Mapping Framework of Agile Project Management Practices in Dealing with Project Management Challenges



## Appendix V

### Rating Results of the Agile Project Management Practices

Rating Results of the Agile Project Management Practices								
DOI	Themes	APM Major Practices (Project Management Challenges)	1	2	3	5	6	7
Individuals	1-1	Hiring the right people (Budgeting and cost)						
	1-2	Hiring the right people (Cross functional team)						
	1-3	Hiring the right people (Insufficient team skills)						
	1-4	Hiring the right people (Lack of proper processes)						
	1-5	Hiring the right people (Project management incompetence)						
	1-6	Hiring the right people (Unable to provide good estimation)						
	2-7	Training and pair programming (Customer incompetence)						
	2-8	Training and pair programming (Distributed team)						
	2-9	Training and pair programming (Insufficient team skills)						
	2-10	Training and pair programming (Lack of understanding of the tools)						
	2-11	Training and paired programming (Scarce resource competition)						
	2-12	Training and pair programming (Scheduling issues)						
Teams	4-13	Decentralizing control (Issues related to organizational culture)						
	5-14	Emphasizing commitment & leadership (Lack of accountability)				4.8		
	5-15	Emphasizing commitment and leadership (Lack of good leaders )						
	5-16	Emphasizing commitment and leadership (Multitasking)						
	5-17	Emphasizing commitment and leadership (Team resistance to new leaderships)						
	6-18	Coaching and mentoring (Insufficient team skills)						
	6-19	Coaching and mentoring (Cross functional team)						
	7-20	Building self-organizing team (Cross functional team )						
Value	7-21	Building self-organizing team (Distributed team )						
	7-22	Building self-organizing team (Insufficient team skills)						
	7-23	Building self-organizing team (Lack of accountability)						
	8-24	Prioritizing feature list for return on investment (Lack of prioritization)						
	8-25	Prioritizing feature list for return on investment (Multitasking)						
	8-26	Prioritizing feature list for return on investment (Poor planning)				7.3		
	9-27	Creating innovative products (Lack of global product)						
	10-28	Eliminating waste (High cost)						
	10-29	Eliminating waste (Poor quality)						
	11-30	Sharing open information (Distributed team)						
	11-31	Sharing open information (Poor planning)						
	12-32	Using right tools (Distributed team)						
Customers	12-33	Using right tools (Lack of tools)						
	13-34	Creating simple vision statements (Unclear scope or vision )						
	14-35	Engaging customer participation (Lack of customer involvement )				6.6		
Uncertainty	14-36	Engaging customer participation (Poor Communication)						
	15-37	Applying iteration and incremental strategies (Distributed team)						
	15-38	Applying iteration and incremental strategies (Lack of product value to customers)						
	15-39	Applying iteration and incremental strategies (Poor quality)						
	15-40	Applying iteration and incremental strategies (Scheduling issues)						
	15-41	Applying iteration and incremental strategies (Scope Changes)						
	16-42	Observing and assessing practices (Uncertain dependencies)						
	16-43	Observing and assessing practices (Technology issues)						
Context	17-44	Taking adaptive actions (Resistance to change to new processes)				5.8		
	18-45	Keeping simple rules (Agile with non-agile team)						
	18-46	Keeping simple rules (Lack of proper processes)						
	18-47	Keeping simple rules (Scope Changes)						
	19-48	Building customer-value organization (Agile with non-agile team)						
	19-49	Building customer-value organization (Different organizational environments)						
	19-50	Building customer-value organization (Lack of executive support)						
	19-51	Building customer-value organization (Lack of organizational support)						
19-52	Building customer-value organization (Lack of proper processes)							
Note: The highlighted themes are the original themes from the conceptual framework.								
		Usefulness Tendency						
	1	Strongly Disagree						
	2	Disagree						
	3	Somewhat Disagree						
	4	Neither Disagree nor Agree						
	4+	Slightly Agree						
	5	Somewhat Agree						
	6	Agree						
	7	Strongly Agree						

## Appendix W

### Rating Results of the Conceptual Mapping Framework

## Ratings Results of the Mapping Framework

Demographic Backgrounds	1	2	3	5	6	7
<b>Project Management Experiences</b>						
3-6 Years				5.5		
7-13 Years				5.6		
14-20 Years					6.4	
21-25 Years				5.3		
<b>Project Management Knowledge in</b>						
Agile (Certified ScrumMaster)					6	
Waterfall (PMP)				5.6		
Both						
Other				5.6		
<b>Organizational Environments</b>						
Agile					6	
Waterfall				5.3		
Mix				5.5		
Other				5		
<b>Project Types</b>						
Government				5.4		
Commercial				5.4		
Non-profit					6	
Mix						7

**Usefulness Tendency**

Strongly Disagree	1
Disagree	2
Somewhat Disagree	3
Neither Disagree or Agree	4
Somewhat Agree	5
Agree	6
Strongly Agree	7

## Appendix X

### Instruction for Using the Expanded Framework

### Instruction for Using the Expanded Framework

