Journal of Engineering, Project, and Production Management
2019, 9(2), 56-65

A Correlational Study on Project Management Methodology and Project Success

Michael Pace
Executive Professor, Department of Management, Texas A&M University, 410 Wehner, 210 Olsen Blvd, College Station, TX, USA. E-mail: wpace@mays.tamu.edu

Project Management
Received November 3, 2018; revised December 22, 2018; accepted December 24, 2018
Available online January 17, 2019

Abstract: This non-experimental correlational study extends previous research investigating the relationship between project management methodology and reported project success, as well as the moderating variables of industry and project manager experience. The sample included North American project managers with five years' experience, 25 years of age or older, and experience with multiple project management methodologies. The survey instrument consisted of 58 questions, utilizing a 5-point Likert scale to record responses. The survey contained three sections, including demographic information, questions related to a successful project, and questions related to a less-than successful (failed / challenged) project. 367 usable responses were received. The examination of the constructs included Pearson's correlation coefficient as well as linear regression to determine the impact of moderating variables. Results indicated that project management methodology has a weak correlation with reported project success, and this correlation is not moderated by industry nor project manager experience. The results did not align with previously conducted studies, illustrating a need to continue the study of methods impacting success including investigating additional moderating variables.

Keywords: Project management methodologies, iterative, agile, traditional, waterfall, project success, complex adaptive system.

DOI 10.2478/jeppm-2019-0007

1. Introduction

A discrepancy exists between anecdotal evidence supporting one methodology in preference over another and the results of research studies investigating such claims. Despite a steadily increasing supply of resources available for and to project managers, project failure rates remain steady (Budzier and Flyvbjerg, 2013; Allen et al., 2014; Serrador and Pinto, 2015; Aga et al., 2016). Studies continue to show that on average, projects run over budget, over schedule, and that most of organizations have had at least one project failure in the previous year (Schachter, 2004; Gelbard and Carmeli, 2009; The Standish Group, 2013). Studies also have found that project failure can be so impactful that as many as 17% of projects can be so bad as to threaten the continued existence of the company (Bloch et al., 2012). Such failure rates leave scholars and practitioners in search of solutions to the challenge to producing *consistent* project success.

This outlines the underlying issue driving this study. Project success factors – those elements contributing to the successful completion of a project – are of critical importance to organizations seeking to deliver value via temporary initiatives. Frustratingly, projects continue to be met with failure despite new, updated resources, methods, procedures, and practices. Continued research is needed to examine the relationship between successful delivery and project management elements which could potentially be success factors.

The research gap targeted with this study is the discrepancy shown in the relationship between project management methodology and project success. Serrador and Pinto (2015) previously conducted a research study on the relationship between project management methodology and reported project success, and this study incorporated various recommendations for future research. The Serrador and Pinto (2015) findings furthered the work of Budzier and Flyvbjerg (2013), who found that agile project management positively impacted project schedule (e.g. project delivery time) but found no

impact on the other project constraints. Conversely, Suetin et al. (2016) found that the introduction of agile project management methods lessened project success. These conflicting results present a conundrum as to the nature of the relationship between project management methodology and reported project success. This study sought to re-evaluate the Serrador and Pinto (2015) findings, with introduction of the recommendations of repetitions with minimization of non-response errors, repetition to question rigor and relevance of the initial study, and an examination of the environment (i.e. industry) as a moderating variable.

This study investigated a single primary research question, supported by three sub-questions:

Research Question (RQ): To what extent does project management methodology influence reported project success among North American Project Managers and is this relationship influenced by industry (technology versus non-technology) or experience?

- Sub-Question 1: To what extent does Project management methodology influence reported project success within non-technology industries?
- Sub-Question 2: To what extent does Project management methodology influence reported project success within technology industries?
- Sub-Question 3: To what extent does years of experience influence project outcomes?

Following this introduction, Section 2 contains the literature review. Section 3 describes the data and method. Section 4 presents the results and findings. Section 5 provides a discussion and limitations, as well as suggestions for further research.

2. Literature Review

2.1. Project Management Methodologies

Project management methodologies (PMM) are collections of different approaches, tools, templates, and techniques. The common definition of a project management methodology involves the organization and standardization of project management activities to consistently deliver project objectives (Zdanyte and Neverauskas, 2011). The intent behind any project management methodology is to increase the probability of project success (Vaskimo, 2011; Spundak, 2014; Joslin and Muller, 2015). This increased probability is facilitated through consistency and uniformity, while also focusing specifically on how to manage the budget, resource, and schedule constraints of any project (Felix and Harrison, 1984).

As no two projects are the same, it can be difficult to ascertain which methodology to employ. There is no single, generic project management methodology that is universally applicable, across all projects or all sectors (Charvat, 2003; Cockburn, 2004). The effectiveness of project management practice can vary depending on the organizational context (Fernandes, Ward, and Araújo, 2015). Further complicating the situation is that the project management discipline is one of the fastest growing for modern organizations, meaning that ideas and concepts in a state of constant evolution and change (Gauthier and Ika, 2012).

Previous studies (Fortune et al., 2011; Joslin and Muller, 2015) have shown that limitations in using a project management methodology were ultimately detrimental to project success. These limits can include methods, process, tools, or techniques (Joslin and Muller, 2015). Further, misalignment of a particular methodology and the organizational context can influence performance. For the basis of this study, traditional and agile project management are considered categories inclusive of specific methods. Under the main categories of traditional fall methods such as critical path, critical chain, PRINCE2; agile methods include Kanban, Scrum, Lean.

2.2. Traditional Project Management

The traditional/waterfall method is perhaps the earliest example of a formal project management methodology. At its core, the traditional approach involves the mechanistic division of work, with an underlying assumption of manageability and predictability (Saynisch, 2010a). The focus on planning helps with the delivery of project success (Laufer et al., 2015).

Winston Royce first introduced the waterfall approach in the 1970s as an example of a flawed development methodology, though it has roots as early as a 1950s presentation by Herbert Benington (Royce, 1970; Benington, 1983). This method is highly structured and is referred to as waterfall as the work of one phase continues downstream into the next stage. Ironically, Royce asserted that appropriate methods should allow forward and backward progress between phases, which contemporary waterfall methods do not include (Royce, 1970).

The initial phases of the project are intended to set the stage for all project work, including establishing project scope and requirements that are necessary to deliver that scope (Thomas and Fernandez, 2008). Execution follows this planning phase, as the work of developing the project goals begins and proceeds. The project ends with a formal closure. Scope control strictly manages changes to scope.

Proponents of this approach argue that the compartmentalization of work efforts contributes to better planning and estimation (Laufer et al., 2015). Also, the linear approach maximizes quality as errors can be detected early in the process and resolved before moving into the next phase (James, 2008). Through clearly defined boundaries, and assuming predictable and linear projects, optimization and efficiency occur by following the plan (Stare, 2014; Spundak, 2014). Finally, as it has been around since the 1950s, it is a familiar approach and easy to use (Laufer et al., 2015).

Critics argue that this tactic is not appropriate when the specifications and requirements cannot be correctly collected at the project onset or are in a state of flux (Saynisch, 2010b). Also, due to the linear nature of the work, changes to requirements can require large amounts of rework or wasted work, which can be detrimental to the project regarding schedule and cost (Haughey, 2009). Another element of criticism is the amount of control required. The traditional approach takes the perspective that a rigorous, hierarchical control best manages complexity (Saynisch, 2010b), but critics assert that project problems stem from this framework (rather than

from a lack of process or planning) (Parker et al., 2015). Finally, this traditional approach carries the perspective as bureaucratic in nature; the project completes large amounts of documentation throughout its lifecycle (Phatak, 2012).

As a point of clarification, there has been confusion and overlap between traditional project management and PMI's Project Management Body of Knowledge (PMBoK). Joslin and Muller (2015) explicitly pointed out that the Project Management Body of Knowledge is not a methodology and is, as the name states, a body of knowledge that serves to collect best practices which are useful across several methods.

2.3. Iterative Project Management

The development of agile project management as an iterative methodology came from perceived weaknesses of traditional project management (Spundak, 2014; Heeager and Schlichter, 2016). Leybourne (2009) commented agile project management dismantled traditional project management in favor of experimentation. The core concept of agile project management is that better up-front planning cannot be guaranteed, so a different approach needs to emphasize continuous planning (Nichols et al., 2015).

Agile has its roots in the 1990s as project team members began searching for methodologies with flexibility (Kruchten, 2004). The development of agile eventually culminated in the Agile Manifesto in 2001, a set of guidelines for software development (Lindstrom and Jeffries, 2004). These principles include valuing individuals and interactions over processes and tools, valuing working software over comprehensive documentation, customer collaboration over negotiation, and responding to change over blindly following a plan (Heeager and Schlichter, 2016).

The basis of agile project management methodology is a series of recurring iterations. Each iteration cycle includes planning, design, coding, and testing (Stettina and Horz, 2014; Stare, 2014). Each iteration consists of co-located teams working closely together to deliver something of demonstrable value to customers (Stettina and Horz, 2014). Agile de-emphasizes up-front planning and extensive documentation (Leybourne, 2009). Dingsøyr et al. (2012) noted that agile seeks to minimize unnecessary, non-value-add work, especially regarding documentation. The cycle of iterations continues until the delivery of a final product which meets customer requirements.

The advantages of the agile approach are cost savings and speed of delivery (Stettina and Horz, 2014). Further, it is a flexible method that embraces change (Stettina and Horz, 2014). Jackson (2012) asserted that agile is right for any project that involves uncertainty, volatility, or risk. Agile project management can also eliminate bureaucratic overhead common to the traditional approach (Stare, 2014). Alaa and Fitzgerald (2013) commented that the major benefit of this method is the ability to address changing scope and requirements.

The disadvantages of the methodology are related to the processes themselves. Proponents tout agile as lightweight due to lack of documentation requirements, but the approach is process intensive. One of the core criticisms of the approach is that adoption requires rigor and robustness in following the prescribed processes (Alaa and Fitzgerald, 2013). For example, a core tenet of agile is the self-organizing team that is 100% devoted to only a single project (Northern et al., 2010). Self-organization is challenging to implement, as managers are more familiar with the command and control style (Augustine and Cuellar, 2006). The dichotomy can hamper speed and efficiency. Indeed, attempting to utilize agile without fully implementing all the components can lead to chaos and stress (Thillaisthanam, 2013), and requires a certain, accepting organizational culture (Laufer et al., 2015). Also, changing requirements in the agile approach can generate cost overrun and failures due to rework (Conforto and Amaral, 2016).

2.4. Project Success

Kerzner (2004) noted that the definition of project success has evolved. The initial success criteria consisted of time, cost, and quality (or scope) (Pinto and Slevin, 1988; Kerzner, 2004; Williams et al., 2015; Parker et al., 2015). These have been evolved to represent project management success, however, as they do not factor in whether the project will benefit the organization managing the project (Pinto and Slevin, 1988; Lim and Mohamed, 1999). The lack of agreed-upon definition is a key point in the project management literature, attempting to define project success, to define project management success criteria, or to define critical success factors that lead to or impact project success of failure.

Pinto and Slevin's (1989) discussion of project success factors is perhaps the seminal paper in the field (Ofori, 2013; Kuen and Zailani, 2012). They present non-experimental correlational research that both validates previously stated success factors as well as present additional entries. The purpose of their research is to assert both a causal and predictive link between 14 success factors and project success (Pinto and Slevin, 1989). Additionally, the authors suggest that each of these factors has a different importance depending on the project life cycle (Pinto and Slevin, 1989). The authors limited their research to 159 research and development (RandD) projects across a variety of industries (Pinto and Slevin, 1989). Pinto and Slevin (1989) collated the responses from questionnaires distributed to 585 members of the Project Management Institute. Analysis of these responses indicated several implications, including identifying which factors most contributed to project success and at which stage. An example of this analysis, the authors found that during execution, management support was able to predict 54% of project success, where in planning, project mission and schedule accounted for 63% prediction of success. Project managers need to be aware of the project mission, consult and stay connected with "clients," instill a sense of urgency and make sure the right tools, methods, and project team are in place (Pinto and Slevin, 1989). On the word of Pinto and Slevin (1989), use of their Project Implementation Profile (PIP) can assist project managers with project monitoring and evaluation by helping prioritize influences throughout the lifecycle, allowing for "more informed estimates concerning the current status and likely success of their project" (p. 35).

Building upon Pinto and Slevin's (1989) success factors, Cooke-Davies (2002) used empirical research to support earlier assertions as well as redefine success.

Seeking to answer three questions – what factors lead to PM success, what factors lead to project success, and what factors contribute to consistently successful projects – Cooke-Davies (2002) employed a qualitative research design consisting of case studies of 70 global organizations. Cooke-Davies (2002) theorized that there is a causal link between 12 key factors and project success. Europe, Australasia, and North America were the geographic locations of the organizations selected for research and analysis, the organizations had conducted 136 projects between 1994 and 2000, with budgets up to $300 million and project schedules up to 10 years in duration (Cooke-Davies, 2002). The extensive variety of geographies, budgets, and schedules enhances the external validity of the study. The internal validity is harder to ascertain, as Cooke-Davies (2002) did not explain the methodology for collecting the data. The results of the analysis of these projects show the 12 factors are linked to project success (Cooke-Davies, 2002). These factors include strategic elements, like establishing project portfolio management, tactical elements like risk management, stakeholder management, and change control, and more human elements like establishing relationships between project and functional managers (Cooke-Davies, 2002).

Fortune et al. (2011) also examined projects methods and the link to success, specifically stating their purpose as capturing "real world experiences of people active in project management" (p. 553). The authors theorized that geography does not impact project methods used and that the use of project tools influences project success (Fortune et al., 2011). The authors created and delivered a questionnaire to active project managers in three countries (Canada, UK, and Australia) to examine this hypothesis about the geographic impact to project methods. A total of 150 responses, 50 from each country, were used in the data analysis. Selection of the respondents was from professional networks. The analysis of the answers shows similarities in PMM, regardless of country, as well as an increase in usage rates across all techniques compared to previous research (Fortune et al., 2011). Quoting a previous study, the authors conclude that "project managers are becoming more professional regarding use of tools and techniques" (Fortune et al., 2011, p. 571).

Oracle (2010) continued the research trend by conducting a survey of 213 respondents, representative of both senior managers and project managers worldwide, as well as interviews with nine executives and subject matter experts in project management, from various fields and industries. The findings reflected that meeting schedule and cost requirements were the minimum required for most organizations. Oracle's (2010) study also found that company success was more consistent with agencies that adhered to strong project management methods, including scope and budget administration and control, ongoing risk management, and benefits tracking and realization. Organizations with mature project management practices further connect project objectives to strategic and tactical business objectives. This research further illustrated the dichotomy between resources and continued project failure rates, as 90% of respondents found project management critical (47%) or somewhat important (43%) to the ability to deliver projects successfully. However, a little less than half (49%) follow formal project management methods on only large or complex initiatives (Oracle, 2010). Further, 80% of respondents felt project management is a core competency that has enabled organizations to remain competitive, but only 27% admit to doing a good job of managing projects (Oracle, 2010).

Allen et al. (2014) suggested that while project success may be the intent of every initiative, failure gets more attention. Indeed, failure, while discouraging, can present a learning opportunity (Mishra et al., 2014). These failures cost billions of dollars in waste each year, clearly suggesting the need for improving the way projects are managed (Nelson, 2005).

The Standish Group's CHAOS reports (InfoQ-Lynch, 2015) have been published since 1994 and provide snapshots of the state of project management success and failure. Even looking at just the last five years' worth of reports show minor changes in success, challenged, and failed rates of projects analyzed by the group (InfoQ-Lynch, 2015). Recent research outside the Standish Group has confirmed these findings, with Rasnacis and Berzisa (2015) commenting that only 2.5% of all organizations globally manage to deliver a project 100% successfully. The authors also asserted that a majority of managed projects are not able to meet initial cost or schedule goals, with some even remaining incomplete (Rasnacis and Berzisa, 2015). Laufer et al. (2015) subjectively qualified that a large percentage of projects are not able to deliver regarding budget, schedule or scope (as measured by delivery of requirements).

The definition used by Serrador and Pinto (2015) consisted of two elements: project efficiency and stakeholder success. The former focused on the traditional constraints of scope, schedule, and budget; the latter on satisfaction of stakeholder expectations.

Inconsistent success and continued failure can be financially costly for organizations (Nelson, 2005; Mishra et al., 2014). The use of project management to deliver unique results, while beneficial, does involve financial investment for organizations (Fisher, 2011). Projects can see efficiencies of scale and repetition, as well as the creation of increased or additional capacity (Bolman, 2012).

3. Research Methods

Project management research exhibits the characteristics of what Hanisch and Wald (2012) called a Mode 2 field of knowledge production. Within a Mode 2 field, the research generated deals with solving practical problems. Regarding project management, this has shown to be the case as many of the past research has addressed project success or project failure (Hanisch and Wald, 2012).

As stated by Serrador and Pinto (2015), the evidence in support of agile project management working better than traditional project management in achieving project success is largely anecdotal. This study focused solely on agile and traditional methodologies, including moderators industry and experience, as to the influence of project management methodology on reported project success. The study was limited to agile and traditional as these categories encompass the majority of specific approaches. Project management methodology was the independent variable in this research. Reported project success is the dependent variable in this study. Industry and experience are moderating variables.

Serrador and Pinto (2015) showed that project management methodology has an influence on reported project success. The present study extends their work by attempting to repeat their findings as well as introducing experience and industry as moderating variables. The participants were recruited through intermediary using a simple, random sample obtained from a double opt-in access panel, in attempts to reduce same source bias.

3.1. Population and Sample

The target population for this study was North American project managers. The research looked at project management methodology, Reported Process Success, industry, and experience. The sampling frame consisted of individuals who chose to opt-in for the online survey. The population met the inclusion criteria of: 25 years of age or older, five years of experience, and experience with multiple PMM. The following criteria eliminated participants from the study: the respondent did not have experience with multiple PMM, the respondent did not agree to the informed consent.

The research utilized an intermediary to deliver the surveys. The intermediary selected participants using a simple, random sample obtained from the sample frame. The use of simple random selection allows researchers to determine the appropriate sample size of participants, which can then be generalized to a larger population (Trochim, 2006). Communication with respondents was conducted by the intermediary, with no direct contact with the researcher. The researcher did provide to the intermediary the Serrador and Pinto (2015) survey as well as the informed consent form for the research, including the objectives of the study along with associated risks.

Using G*Power to calculate recommended sample size, a target of 176 completed surveys was established; 379 responses were received with 367 usable for analysis. Of these 367 completed responses, all participants self-identified as holding a PMP® certification. Additionally, construction was the best-represented industry (16.3%), followed by manufacturing (14.9%), professional services (13.9%) and high technology (13.8%). All respondents were from North America. Average years of experiences was 12.41.

3.2. Instrument

This research utilized SurveyMonkey, an Internet survey website, to deliver the questionnaire. The instrument utilized for this study was developed by Serrador and Pinto (2015). This research obtained permission from the lead author before reusing the survey instrument. In addition to certain demographic information, respondents were asked to answer questions describing outcomes, as characterized by successful and less-than-successful projects.

The Serrrador and Pinto (2015) instrument consists of 58 questions, utilizing a 5-point Likert scale to record responses. The survey contained three sections, including demographic information, questions related to a successful project, and questions related to a less-than successful (failed / challenged) project. Within each of these latter sections, the questions relate either to project efficiency or stakeholder success.

3.3. Data Collection

A single electronic survey instrument served as the primary measure for this study. A simple random sampling technique was the mode of data collection. Potential respondents reviewed the informed consent form for the study at the onset of the online survey. Participants were required to accept all terms of the informed consent before proceeding to the survey.

Participants who did not accept the terms of consent were not allowed to continue with the survey and instead were presented with a statement of gratitude and exited the questionnaire. Participants who met the inclusion criteria and who accepted the terms of consent proceeded into the survey. A copy of the consent form was made available to all participants. Data collection occurred using SurveyMonkey, as facilitated through an intermediary. Such usage of an Internet survey is a popular data collection method due to speed, efficiency, and cost (Goudy, 2015). However, such surveys also carry risks to validity as to the accuracy and reliability of responses.

3.4. Data Analysis

Analysis of the collected survey responses utilized Statistical Package for the Social Sciences (SPSS). The data was confirmed to have no missing data, which would prevent accurate analysis. Performance and analysis of summary statistics and normality of data were used to establish the quality of the data.

The first and second sets of hypotheses used descriptive statistics as well as Pearson's correlation coefficient to identify and measure differences in reported success between the PMM (Creswell, 2009). The third hypothesis was tested using multiple linear regression. Multiple linear regression is useful in identifying the strength of relationships between multiple predictor variables to a single outcome variable, especially when moderated by another set of variables (Nathans et al., 2012).

3.5. Validity and Reliability

The Serrador and Pinto (2015) instrument utilized 58 questions to measure methodology, including the percentage of planning effort in either the initiation or the initiation and execution phases, as well as reported project success. The instrument has been published and has established validity and reliability as measured by Cronbach's alpha. The Cronbach's alpha for the success factor questions is 0.945; the Cronbach's alpha for stakeholder satisfaction questions is 0.77.

4. Results

The results showed only a weak correlation between project management methodology and reported project success. Industry played a moderating role on this correlation, but project manager experience did not. These results indicated that, while project management methodology may play a role in reported project success, there could be different variables of greater importance to project success. Such variables could include the adoption of project management (PM) practices (Golini et al., 2015), maturation of PM practices (Crawford, 2006; Mullaly, 2006), or tailoring of PM practices (Turner and Ledwith, 2016).

Specific results are presented below. Pearson's correlation coefficient test was performed on data based

upon a selection of a hybrid method (based upon % of "agile" deployed, where 0% was fully waterfall and 100% was fully agile), divided into non-technology and technology industries. The results of Pearson's correlation coefficient test on the non-technology group showed a weak positive correlation between project management methodology and reported project success, $R(316) = 0.294$, $p < 0.01$. This indicates the variable of project management methodology positively correlates with reported project success within non-technology industries. Table 1 shows the statistical analysis of project management methodology and reported project success within non-technology industries.

Table 1. Correlation matrix, project management methodology, reported project success, within non-technology

		PM Methodology	
Non-Technology	Reported_ Success	Pearson Correlation	0.294
		Sig. (2-tailed)	0.000
		N	316

The data was then transformed to a binary, waterfall or not, result. Table 2 shows the results of an additional Pearson's correlation coefficient analysis. Using the transformed data showed no statistical correlation, $R(316) = 0.102$, $p > 0.05$.

Table 2. Correlation matrix, waterfall vs. agile, reported project success, within non-technology

		PM Methodology	
Non-Technology	Reported_ Success	Pearson Correlation	0.102
		Sig. (2-tailed)	0.071
		N	316

The results of Pearson's correlation coefficient test on the technology group showed a moderate positive correlation between project management methodology and reported project success, $R(51) = 0.369$, $p < 0.01$. The results indicate the variable of project management methodology positively correlates with reported project success within technology industries. Table 3 shows the statistical analysis of project management methodology and reported project success within technology industries.

Table 3. Correlation matrix, PM methodology, reported project success, within technology

Technology vs. Not		PM Methodology	
Technology	Reported _Success	Pearson Correlation	0.369**
		Sig. (2-tailed)	0.008
		N	51

The data was then transformed to a binary, waterfall or not, result. Table 4 shows the results of the Pearson's correlation coefficient test. Using the transformed data showed a moderate statistical correlation, $R(51) = 0.422$, $p < 0.01$.

Table 4. Correlation matrix, waterfall vs. agile, reported project success, within technology

Technology vs. Not		Waterfall vs. Agile	
Technology	Reported_ Success	Pearson Correlation	0.422**
		Sig. (2-tailed)	0.002
		N	51

Testing for the influence of experience on the above correlations was performed with multiple linear regression test, building models to examine correlation and moderation. Model 1 showed significant results, $p < 0.05$ [$F(1,365) = 32.45$, $p < 0.001$]. The adjusted R2 displays that the model predicts 7.9% of the variance in reported project success. Adding experience as a moderator did not significantly affect the results, as shown in Model 2, $\Delta R2 = 0.001$, $\Delta F(1,364) = 0.375$, $p = 0.001$, $b = 0.01$, $t(364) = 2.83$, $p = 0.28$. These results supported accepting the null hypothesis. The results indicated the variable project management experience does not moderate the correlation of project management methodology with reported project success. Table 5 displays the ANOVA analysis, Table 6 the Model Summary.

Table 5. ANOVA[a] analysis

Model		Sum of Squares	*df*	Mean Square	*F*	Sig.
1	Regression	33.954	1	33.954	32.446	0.000[b]
	Residual	381.959	365	1.046		
	Total	415.913	366			
2	Regression	34.347	2	17.173	16.383	0.000[c]
	Residual	381.566	364	1.048		
	Total	415.913	366			
3	Regression	16.348	1	16.348	14.933	0.000[d]
	Residual	399.565	365	1.095		
	Total	415.913	366			
4	Regression	16.351	2	8.175	7.448	0.001[e]
	Residual	399.562	364	1.098		
	Total	415.913	366			

a. Dependent Variable: Reported Project Success
b. Predictors: (Constant), PM Methodology
c. Predictors: (Constant), PM Methodology, PM Experience
d. Predictors: (Constant), Waterfall vs. Agile
e. Predictors: (Constant), Waterfall vs. Agile, PM Experience

In addition to running the multiple linear regression with project management methodology, the analysis also included the transformed variable of waterfall vs. agile. The variable was used to generate Models 3 and 4. Model 3 showed significant results, $p < 0.05$ [$F(1,365) = 14.93$, $p < 0.001$]. The adjusted R2 displayed that this model can predict 3.7% of the variance in reported project success. Adding experience as a moderator did not significantly affect the results, as shown in Model 4, $\Delta R2 = 0.000$, $\Delta F(1,364) = 0.003$, $p = 0.001$, $b = -0.03$, $t(364) = -0.26$, $p = 0.79$.

Table 6. Model summarye (reported project success, methodology, experience)

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R^2 Change	F Change	$df1$	$df2$	Sig. F Change	
1	0.286[a]	0.082	0.079	1.023	0.082	32.446	1	365	0.000	
2	0.287[b]	0.083	0.078	1.024	0.001	0.375	1	364	0.541	2.103
3	0.198[c]	0.039	0.037	1.046	0.039	14.933	1	365	0.000	
4	0.198[d]	0.039	0.034	1.048	0.000	0.039	1	364	0.956	2.007

a. Predictors: (Constant), PM Methodology
b. Predictors: (Constant), PM Methodology, PM Experience
c. Predictors: (Constant), Waterfall vs. Agile
d. Predictors: (Constant), Waterfall vs. Agile, PM Experience
e. Dependent Variable: Reported Project Success

In summary, the analysis showed a weak correlation between project management methodology and reported project success in non-technology industries, moderate correlation in technology industries, and experience does not moderate these correlation results. That project manager experience did not moderate the PMM correlation with reported project success is a surprising finding. While there is not extensive research, available literature (Easton and Rosenzweig, 2012) provides evidence that experience is associated with improvement. The assumption for project managers is experience helps to improve their ability to work with people, understand organization culture, and learn technical skills through increased experience implicitly carries the assumption of improvement to consistent project success (Darrell, Baccarini, and Love, 2010). This bears further investigation.

5. Conclusions and Discussion

Surprisingly, the results of this study do not fully align with any previous research. The lack of a singular project management methodology (Cockburn, 2004) carries complications that selecting an inappropriate method can detrimentally impact project success (Joslin and Muller, 2015). That the present study showed only a weak correlation between PMM and project success does not present a simple solution to this complication.

The present study, including the misalignment with previous research, can be important to practitioners and researchers. Consistent project success appears to be a wicked problem. Projects are often constrained by volatility, uncertainty, complexity, and ambiguity (VUCA). Their success defined by contradictory information from a network of stakeholders involved. As is common with wicked problems, no two projects are the same and the solution (often a project management methodology) deployed in one setting rarely is successful unilaterally. The resulting occurrence is what is currently seen – consistent project success remains just out of reach.

Both this research as well as the study by Serrador and Pinto (2015) focused on traditional and agile project management methodologies, as measured via iterative planning throughout the course of the project. One recommendation for future research is to target additional methods, such as PRINCE2, lean, or extreme/Emertxe, to explore the sustainability of the method-to-success correlation. Another recommendation for future research is to investigate the customization of project management methodology for a specific organization, to see if that correlates with project success. Finally, additional analysis on this data could reveal additional insight. This research focused on reported project success but captured data also included sponsor success and team success ratings. Budget, schedule, and scope responses were also recorded, which could differ from reported project success and reveal new insights.

One limitation of the present study was the utilization of an existing online survey. Using an online survey does not allow for additional clarification or deeper probing on responses. Attempting to define the questions fully as well as by using a Likert-like scale, minimized this limitation, but these cannot eliminate the limitation. Another limitation was the failure to capture certain demographic information, such as age or gender of the respondent. The inclusion criteria required that respondents must be 25 years of age or older, but the survey did not capture age. Additionally, the gender of the respondent could have been captured to allow additional analysis of the data. Finally, there was a lack of demographic representation in the respondents, including non-PMP certified project managers.

The importance of flexibility cannot be understated. Whereas methodologies exist upon a spectrum based upon clarity of objectives and clarity of processes, most of these methods are selected at the onset of a project and not changed as the project is executed. Shifting from a six-sigma method to critical chain, for example, represents a shift that is difficult to manage. Static decision-making works in absence of ambiguity or complexity but is inappropriate in modern circumstance of VUCA (Volatile, Uncertain, Complex, Ambiguous).

Additional research on consistent project success is warranted. Utilize qualitative methods, such as grounded theory methods, may allow for a more insightful investigation on methodology selection, implementation, and deployment. Such inductive inquiry emphasizes the systematic generation of theory via intensive interviews and thematic analysis of any emerging patterns (Walsh et al., 2015). Future research could also investigate links between methodology and adoption, (Golini et al., 2015), maturity (Crawford, 2006; Mullaly, 2006), or tailoring (Turner and Ledwith, 2016).

References

Aga, D. A., Noorderhaven, N., and Vallejo, B. (2016). Transformational leadership and project success: The mediating role of team-building. *International Journal of Project Management*, 34, 806-818. doi:10.1016/j.ijproman.2016.02.012

Alaa, G. and Fitzgerald, G. (2013). Re-conceptualizing agile information systems development using complex adaptive systems theory. *Emergence: Complexity and Organization*, 15(3), 1-23. Retrieved from https://www.semanticscholar.org/paper/Re-conceptualizing-Agile-Information-Systems-Devel-Alaa-Fitzgerald/d2cb7af5bd9889b27b3b294d6246ccd0d01fcdb9

Allen, M., Alleyne, D., Farmer, C., McRae, A., and Turner, C. (2014). A framework for project success. *Journal of Information Technology and Economic Development*, 5(2), 1-17. Retrieved from http://www.gsmi-ijgb.com/Documents/JITED%20V5%20N2%20P01%20Mark%20Allen%20-Framework%20for%20Project%20Success.pdf

Allen, W. (2016). *Complicated or complex- Knowing the difference is important*. Retrieved from http://learningforsustainability.net/post/complicated-complex/.

Augustine, S. and Cuellar, R. (2006). The lean-agile PMO: Using lean thinking to accelerate project delivery. *Cutter Consortium*, 7(10), 1-24. Retrieved from http://davidfrico.com/ augustine06.pdf

Bloch, M., Blumberg, S., and Laartz, J. (2012). *Delivering large-scale IT projects on time, on budget, and on value.* Insights and Publications. Retrieved from http://www.mckinsey.com/insights/business_technology/delivering_largescale_it_projects_on_time_on_budget_and_on_value

Bolman, D. B. (2012). *Examining the relationship between technology leadership behaviors and project success*. Doctoral thesis. Available from ProQuest Dissertations and Theses database. (UMI No. 1287814661)

Budzier, A. and Flyvbjerg, B. (2013). Making sense of the impact and importance of outliers in project management through the use of power laws. *Paper presented at International Research Network on Organizing by Projects, 11th*. Retrieved from http://eureka.sbs.ox.ac.uk/4745/1/Budzier_and_Flyvbjerg.pdf

Charvat, J. (2003). *Project management methodologies: Selecting, implementing and supporting methodologies and processes for projects*. New York:Wiley.

Cockburn, A. (2004). *Crystal clear: A human-powered methodology for small teams*. London: Pearson Education.

Conforto, E. C. and Amaral, D. C. (2016). Agile project management and stage-gate model - A hybrid framework for technology-based companies. *Journal of Engineering and Technology Management*, 40, 1-14. doi:10.1016/j.jengtecman.2016.02.003

Conforto, E. C., Amaral, D. C., da Silva, S. L., Di Felippo, A., and Kamikawachi, D. S. L. (2016). The agility construct on project management theory. *International Journal of Project Management*, 34(4), 660-674. doi:10.1016/j.ijproman.2016.01.007

Cooke-Davies, T. (2002). The real success factors on projects. *The International Journal of Project Management*, 20(3), 185-190. doi:10.1016/S0263-7863(01)00067-9

Crawford, L. (2006). Developing organizational project management capability: theory and practice. *Project Management Journal,* 37(3), 74-86.

Creswell, J. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches (3rd ed.).* Thousand Oaks, CA: Sage Publications.

Crotty, M. (2003). *The foundations of social research: Meaning and perspective in the research process.* London, England*:* Sage.

Darrell, V., Baccarini, D., and Love, P. E. D. (2010). Demystifying the folklore of the accidental project manager in the public sector. *Project Management Journal*, 41, 56-63. doi: http://dx.doi.org/10.1002/pmj.20164

Dingsøyr, T., Nerur, S., Balijepally, V., and Moe, N. B. (2012). A decade of agile methodologies: Towards explaining agile software development. *Journal of Systems and Software*, 85, 1213-1221. doi:10.1016/j.jss.2012.02.033

Easton, G. S. and Rosenzweig, E. D. (2012). The role of experience in six sigma project success: An empirical analysis of improvement projects. *Journal of Operations Management*, 30, 481-493. doi:10.1016/j.jom.2012.08.002

Felix, R. G. and Harrison, W. L. (1984). Project management considerations for distributed applications. *MIS Quarterly*, 8(3), 161-170. doi:10.2307/248663

Fernandes, G., Ward, S., and Araújo, M. (2015). Improving and embedding project management practice in organisations - A qualitative study. *International Journal of Project Management*, 33, 1052-1067. doi:10.1016/j.ijproman.2015.01.012

Fisher, E. (2011). What practitioners consider to be the skills and behaviors of an effective people project manager? *International Journal of Project Management*, 29, 994-1002. doi:10.1016/j.ijproman.2010.09.002

Fortune, J., White, D., Jugdev, K., and Walker, D. (2011). Looking again at current practice in project management. *International Journal of Managing Projects in Business*, 4, 553-572. doi:10.1108/17538371111164010

Gauthier, J. and Ika, L. A. (2012). Foundations of project management research: An explicit and six-facet ontological framework. *Project Management Journal*, 43(5), 5-23. doi:10.1002/pmj.21288

Gelbard R. and Carmeli, A. (2009). The interactive effect of team dynamics and organizational support on ICT project success. *International Journal of Project Management*, 27, 464-470. doi:10.1016/j.ijproman.2008.07.005

Golini, R., Kalchschmidt, M., and Landoni, P. (2015). Adoption of project management practices: The impact on international development development projects of non-governmental organizations. *International Journal of Project Management,* 33, 650-663. doi:10.1016/j.ijproman.2014.09.006

Hanisch, B., Lindner, F., Mueller, A. K., and Wald, A. (2008). Toward theoretical foundation of project management: a framework and research agenda. *PMI®Research Conference: Defining the Future of Project Management,* Warsaw, Poland. Newtown Square, PA: Project Management Institute. Retrieved from https://www.pmi.org/learning/library/theoretical-foundation-project-management-framework-7140

Hanisch, B. and Wald, A. (2012). A bibliometric view on the use of contingency theory in project management

research. *Project Management Journal*, 43(3), 4-23. doi:10.1002/pmj.2126

Haughey, D. (2009, September). *Waterfall v agile: How should I approach my software development project*? Retrieved from http://www.projectsmart.com/articles/waterfall-v-agile-how-should-i-approach-my-software-development-project.php

Heeager, L. T. and Schlichter, P. S. B. R. (2016). How agile methods conquers general project management- The project half double initiative. *Proceedings/Information Systems Research in Scandinavia (iris)*.

InfoQ-Lynch (2015). *Standish Group 2015 Chaos Report - QandA with Jennifer Lynch*. Retrieved from https://www.infoq.com/articles/standish-chaos-2015.

Jackson, M. B. (2012). *Agile: a decade in*. Drexel Hill: Project Management Institute.

James, K. L. (2008). *Software Engineering*. New Delhi, India: PHI Learning.

Joslin, R. and Müller, R. (2015). Relationships between a project management methodology and project success in different project governance contexts. *International Journal of Project Management*, 33, 1377-1392. doi:10.1016/j.ijproman.2015.03.005

Kerzner, H. (1982). *Project management for executives*. New York: Wiley.

Kerzner, H. (2004). *Project management: A systems approach to planning, scheduling, and controlling*. New York: Wiley.

Kruchten, P. (2004). *The rational unified process: An introduction to the rational unified process*. Boston, MA: Addison-Wesley.

Kuen, C. W. and Zailani, S. (2012). Critical factors in successful new product development: an empirical study of Malaysian Manufacturing Companies. *International Journal of Management*, 29(2), 429. Retrieved from https://www.questia.com/library/journal/1P3-2688611551/critical-factors-in-successful-new-product-development

LaPlant, L. (2013, January). Experts provide advice on the future of the PMO. *PMI Today*, 1-7. Retrieved from http://www.pmi.org/Knowledge-Center/Publications-PMI-Today.aspx

Laufer, A., Hoffman, E. J., Russell, J. S., and Cameron, W. S. (2015). What successful project managers do. *MIT Sloan Management Review*, 56(3), 43. Retrieved from http://sloanreview.mit.edu/article/what-successful-project-managers-do/

Leybourne, S. A. (2009). Improvisation and agile project management: A comparative consideration. *International Journal of Managing Projects in Business*, 2, 519-535. doi:10.1108/17538370910991124

Lindstrom, L. and Jeffries, R. (2004). Extreme programming and agile software development methodologies. *Information Systems Management*, 21(3), 41-52. doi:10.1201/1078/44432.21.3.20040601/82476.7

Mishra, T., Parra, R. G., and Abeel, T. (2014). The upside of failure: How regional student groups learn from their mistakes. *PLOS Comput Biol*, 10(8), e1003768. https://doi.org/10.1371/ journal.pcbi.1003768

Mullaly, M. (2006). Longitudinal analysis of project management maturity. *Paper presented at PMI® Research Conference: New Directions in Project Management*, Montreal, Quebec, Canada. Newtown Square, PA: Project Management Institute.

Müller, R. and Söderlund, J. (2015). Innovative approaches in project management research. *International Journal of Project Management*, 33(2), 251–253. doi:10.1016/j.ijproman. 2014.10.001

Nathans, L. L., Oswald, F. L., and Nimon, K. (2012). Interpreting multiple linear regression: A guidebook of variable importance. *Practical Assessment*, 17(9), 1-19. Retrieved from http://pareonline.net/getvn.asp?v=17andn=9

Nelson, R. (2005). Project retrospectives: Evaluating project success, failure, and everything in between. *MIS Quarterly Executive*, 4, 361–372. Retrieved from http://www2.commerce.virginia.edu/cmit/Research/MISQE%209-05.pdf

Nichols, G. M., Lewis, N. A., and Eschenbach, T. (2015). Determining when simplified agile project management is right for small teams. *Engineering Management Journal*, 27(1), 3-10. doi:10.1080/10429247.2015.11432031

Northern, C., Matfield, K., Benito, R., and Casagni, M. (2010, December 15). *Handbook of implementing agile in Department of Defense information technology acquisition*. Retrieved from http://www.mitre.org/sites/default/files/pdf/11_0401.pdf

Ofori, D. (2013). Project management practices and critical success factors- A developing country perspective. *International Journal of Business and Management*, 8, 14-30. doi:10.5539/ijbm.v8n21p14

Oracle. (2010). *Standardized Approach to Risk Improves Project Outcomes and Profitability*. Retrieved from http://www.oracle.com/us/a-standardized-approach-to-risk-wp-068132.pdf

Parker, D. W., Parsons, N., and Isharyanto, F. (2015). Inclusion of strategic management theories to project management. *International Journal of Managing Projects in Business*, 8, 552-573. doi:10.1108/IJMPB-11-2014-0079

Phatak, O. (2012). Waterfall vs. agile model comparison. Retrieved from http://www.buzzle.com/articles/waterfall-model-vs-agile.html

Pinto, J. K. and Slevin, D. P. (1989). Critical success factors in RandD projects. *Research technology management*, 32(1), 31-35. Retrieved from https://www.researchgate.net/profile/Jeffrey_Pinto/publication/279941237_Critical_Success_Factors_in_RD_Projects/links/55b0fa1008ae092e964fbd6f/Critical-Success-Factors-in-R-D-Projects.pdf

Rasnacis, A. and Berzisa, S. (2015). Adaptation of agile project management methodology for project team. *Information Technology and Management Science*, 18(1), 122-128. doi:10.1515/itms-2015-0019

Royce, W. (1970). Managing the development of large software systems. *Proceedings of IEEE WESCON*. Retrieved from http://www.cs.umd.edu/class/spring2003/cmsc838p/Process/waterfall.pdf

Saynisch, M. (2010a). Beyond frontiers of traditional project management: An approach to evolutionary, self-organizational principles and the complexity theory - Results of the research program. *Project Management Journal*, 41(2), 21-37. doi:10.1002/pmj.20159

Saynisch, M. (2010b). Mastering complexity and changes in projects, economy, and society via project management second order (PM-2). *Project Management Journal*, 41(5), 4-20. doi:10.1002/pmj.20167

Schachter, D. (2004). Managing your library's technology projects. *Information Outlook*, 8(12), 10-12. Retrieved from https://faculty.washington.edu/rmjost/Readings/managing_your_ librarys_technology_projects.pdf

Serrador, P. and Pinto, J. K. (2015). Does Agile work? - A quantitative analysis of agile project success. *International Journal of Project Management*, 33(5), 1040-1051. doi:10.1016/ j.ijproman.2015.01.006

Serrador, P. and Turner, R. (2015). The relationship between project success and project efficiency. *Project Management Journal*, 46(1), 30-39. doi:10.1002/pmj.21468

Špundak, M. (2014). Mixed agile/traditional project management methodology - Reality or illusion? *Procedia-Social and Behavioral Sciences*, 119, 939-948. doi:10.1016/ j.sbspro.2014.03.105

Standish Group International, Inc. (2013). Chaos Manifesto 2013. Retrieved from. http://www.versionone.com/assets/img/files/ChaosManifesto2013.pdf

Stare, A. (2014). Agile project management in product development projects. *Procedia-Social and Behavioral Sciences*, 119, 295-304. doi:10.1016/j.sbspro.2014.03.034

Stettina, C. J. and Hörz, J. (2015). Agile portfolio management: An empirical perspective on the practice in use. *International Journal of Project Management*, 33(1), 140-152. doi:10.1016/j.ijproman.2014.03.008

Suetin, S., Vikhodtseva, E., Nikitin, S., Lyalin, A., and Brikoshina, I. (2016). Results of agile project management implementation in software engineering companies. *ITM Web Of Conferences*, 6, P 03016 (2016), 03016. doi:10.1051/itmconf/20160603016

Thillaisthanam, N. (2013). Agile methodology: When processes clash with principles. Retrieved from http://www.siliconindia.com/

Thomas, G. and Fernandez, W. (2008). Success in IT projects: A matter of definition?. *International Journal of Project Management*, 26, 733–742. doi:10.1016/ j.ijproman.2008.06.003

Thomas, J. and Mengel, T. (2008). Preparing project managers to deal with complexity - Advanced project management education. *International Journal of Project Management*, 26, 304-315. doi:10.1109/EMR.2014.6758262

Trochim, W.M. (2006). Nonprobability sampling. Retrieved from http://www.socialresearchmethods.net/kb/sampnon.htm

Turner, R. and Ledwith, A. (2016). Project management in small to medium-sized enterprises: fitting the practices to the needs of the firm to deliver benefit. *Journal of Small Business Management,* 56(3), 475-493. doi:10.1111/jsbm.12265

Vaskimo, J. (2011). Project management methodologies: An invitation for research. *IPMA World Congress 2011*, in Brisbane, Queensland. International Project Management Association, Amsterdam, the Netherlands.

Walsh, I. H., Bailyn, J., Fernandez, L., Levina, W., and Glaser, N. B. (2015).“What Grounded theory is… a critically reflective conversation among scholars”. *Organizational Research Methods*, 18(4), 620-628.

Williams, P., Ashill, N. J., Naumann, E., and Jackson, E. (2015). Relationship quality and satisfaction: Customer-perceived success factors for on-time projects. *International Journal of Project Management*, 33(8), 1836-1850. doi:10.1016/j.ijproman.2015.07.009

Wysocki, R. K. (2014). *Effective project management: Traditional, agile, extreme (7th ed.)*. Indianapolis: John Wiley and Sons.

Zdanyte, K. and Neverauskas, B. (2011). The theoretical substation of project management challenges. *Economics and Management*, 16, 1013-1018. Retrieved from http://lib-ezproxy.tamu.edu:2048/login?url=http://search.ebscohost.com/login.aspx?direct=trueanddb=e5handAN=61822101andsite=eds-live

Dr. Michael Pace is an Executive Professor with Mays Business School at Texas A&M University. He is a member of the Project Management Institute and International Project Management Association - USA. His research interests are project management methodologies and projects as complex adaptive systems.