Executive Summary

Team formation and development stand among the many challenges facing project managers within the field of software development. Typical teams experience five stages (forming, storming, norming, performing, and adjourning) according to Tuckman’s team development model. It is in the fourth stage that productivity surges; therefore, project managers within [Company], a big data analytics company, strive to have their teams reach this stage. To assist [Company] software development project managers maximize the factors within their control, this study sought to identify sets of actions and activities that could improve the likelihood of his or her project team experiencing Tuckman's performing stage. The first chapter provides background, details, purpose and posits the primary research question: What impact does a [Company] project manager's activities and actions have upon the ability of his or her software development project team to reach Tuckman's performing stage.

The literature review explored related literature and research with four areas of emphasis: understanding team development stages, examining popular team development models, applying team development to software development teams, and understanding the project manager's role within team development. The research showed that Tuckman's team development model was ideal for an academic research environment while being applicable to the target population. Studies also showed that a team's current development stage (dependent variable) and project manager actions (independent variable) can accurately be accessed via a questionnaire and that the two variables can be analyzed using descriptive statistics and the Analysis of Variance (ANOVA) statistical test.

To gather the required data to answer the primary research question, a quantitative program evaluation approach was selected as detailed in Chapter III. The target population was
[Company]'s software development teams, estimated at 250 employees. A cross-sectional descriptive survey questionnaire was distributed to [Company]'s [Division] division, a sample size of 127. Broken into sections, the questionnaire asked 27 questions to isolate project manager actions and activities as well as determine the current project team stage. The questionnaire received a 39% response rate, or 49 responses spanning 15 project teams.

Of the 13 [Division] division projects with more than a single team response, six were in the performing stage, six in non-performing stages, and one unable to be determined. Furthermore, three of the 17 project manager actions and activities had meaningful statistical significance when comparing [Company]'s performing stage and non-performing stage teams.

The researcher concluded that [Company]'s software development project managers could focus on three areas to improve the likelihood of his or her project team experiencing Tuckman's performing stage. During the project initiation phase and after contract award, the project manager should ensure a comprehensive external kick-off meeting is held and that his or her project team is aware of it and any outcomes. Once the project is kicked-off, the researcher concluded that a balance of the requisite technical hard skills and the soft skills is required to treat the staff equally and to find ways to relate to each of the project staff.

Based on these conclusions, the researcher recommended three actions to [Company]'s leadership. First, require software development project managers to hold a timely and well socialized kick-off meeting with their external clients and stakeholders and provide a suggested format and template. Second, provide project managers with soft skills training to enable them to better relate with their project teams and facilitate team development. Finally, provide project managers with team formation training in order to recognize the team stages of his or her team and appropriately direct resources during stage transitions.
IDENTIFICATION OF A PROJECT MANAGER'S IMPACT UPON
SOFTWARE DEVELOPMENT TEAM STAGES

MSA 699 Project Report
Central Michigan University

Submitted in Partial Fulfillment of Requirements for the
Degree of Master of Science in Administration
(Concentration in Information Resource Management)

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CHAPTER I: PROBLEM DEFINITION

Background

Across the business community, project managers are leading teams through the various project phases, from initiating and planning through execution, monitoring and controlling, and finally closing. It is during the project's execution phase that the work is completed and often consumes a large portion of the budget (Project Management Institute, 2013, p. 56). The project manager's goal is to ensure this execution phase is accomplished successfully to meet scope objectives, on time, and within budget (Pearlson & Saunders, 2013, p. 295). Information technology projects, specifically software development, pose unique project management challenges due to differences from traditional business projects and lack of interchangeable team members (Pearlson & Saunders, 2013, pp. 302-303). This research sought to examine further the latter of these challenges.

Software development teams are comprised of highly technical individuals with specific competencies such as software development and engineering, systems administration, database architects, security engineers, and quality control managers. These specialists, fulfilling a specific role, enter the project team when needed and depart when no longer required; this creates a chaotic environment and "makes the task of managing the coordination of a project team very (technically) complex and leading a project team to inspire them to deliver the project benefit is a very difficult (people-management) task" (Ng & Walker, 2008, p. 405). Furthermore, there are external factors beyond the software development team that the project manager must balance as "the actual performance of a team depends not only on the competence of the team itself in managing and executing its work, but also on the organizational context provided by management" (Moe, Dingsøyr, & Dybå, 2010, p. 481). The direction and culture provided by
management, and specifically the project manager, has a direct impact on the project team’s performance and its ability to become a high performing team.

The ability to successfully execute software development projects is critical for an information technology company. Failure to do so can have tremendous impact: In the 2000s, almost one quarter, or 25%, of software development projects were cancelled outright due to poor planning or management and cost nearly $67 billion (Pattit & Wilemon, 2005, p. 375). These poorly planned and managed projects can be attributed to several issues; however, one primary issue is team conflict. It is estimated that project managers spend more than 20% of their time responding to team conflicts (Pattit & Wilemon, 2005, p. 381).

During the lifecycle of a project, the team members go through a maturation process and experience several identifiable stages. Project managers have various tools and actions they can leverage throughout the stages to help ensure proper group development (Central Michigan University, 2012, pp. 228-231). One popular model of team development was initially proposed by Bruce W. Tuckman in 1965 with four stages, with a fifth stage being added in a revised model in 1977. The five stages that teams may experience according to Tuckman’s model include forming, storming, norming, performing, and adjourning.

The forming stage is the first stage of Tuckman's team development model. During this initial stage, individuals begin to come together and learn the team’s goals and boundaries. This is the “ice-breaking” stage, with members demonstrating uncertain and anxious behaviors and individual team members still working somewhat independently. Team interactions increase in the second stage, the storming stage. Conflict can arise as a result of these interactions. While conflict is critical for team growth, the project manager must handle it correctly to ensure the conflict is eventually resolved and is turned into a positive experience, such as personal or intra-
team growth. Also during this stage, the team members test policies and assumptions. If the team is able to work through the storming stage, they enter stage three: Tuckman's norming stage. Now that the team has worked through its struggles, there is an enhanced sense of team spirit and shared sense of achievement; trust begins to form. Next, the goal of every project team is to enter Tuckman's performing stage. During this stage, the team experiences open communications and strong cooperation. After having navigated the team into the performing stage, the project manager must be able to transition from a firm and directive leader to a productive teammate on a self-directing team. Finally, once the project work is complete, the team enters the adjourning stage and may experience a sense of loss after the effort needed to reach the norming and performing stages (Central Michigan University, 2012, pp. 228-230).

Each project team undergoes some progression through Tuckman's stages of team development. While the ideal project will go through the stages quickly and progressively, some project teams regress backwards, never reaching the targeted performing stage. Throughout these stages of team development, project managers have the ability to influence or impact team development transitions in order to improve team success; Anderson (2010) explains:

As a group moves through these stages, the leadership role of the project manager changes based on the evolving needs of the team. The project manager must encourage development along this path to attain the team's highest level of performance. Again, the research shows that interpersonal skills are critical to team development, increased task accomplishment, and team morale. (p. 61)

The ability to influence or impact project team development through specific and targeted actions is not something every software development project manager inherently knows. Often, software project managers are selected for their technical skills and knowledge; however,
software project success can depend on the project manager's soft skills (Pinkowska, Lent & Keretho, 2011, p. 343). If a project has poor leadership and suffers poor management techniques, the results may include the project team struggling to move beyond the inefficient storming phase of Tuckman's team model, causing low morale, poor customer satisfaction, and perhaps lost revenue.

**Research Problem**

For the project manager, the application of knowledge, skills, tools, and techniques within project activities are well defined by the Project Management Institute's Guide to the Project Management Body of Knowledge; however, the tools and practices for managing the interpersonal aspects such as team development are not as defined (Anderson, 2010, p. 59). These tools and techniques can be self-learned by project managers through trial and error; however, this method can be quite costly to the company, the project manager, the project team, and the customer with a negative impact on project deliverables. This is especially true in the software development environment where the trend towards heavily team-dependent agile software development methodologies is employed, a single team member can cause disruptions to both the team process and productivity (Largent & Lüer, 2010, p. 42). Assuming that project managers are able to influence and impact their project teams' performance and movement through the team development stages, it is not known if or to what extent specific project manager actions have upon a software development team's development.

To ground this project, the research focused on [Company], a big data analytics company headquartered in McLean, Virginia, with a staff of more than 600 professionals working worldwide providing interdisciplinary expertise that includes software solutions applied to help clients make data-driven decisions ([Company], n.d.). [Company] has many technical projects
PROJECT MANAGER IMPACTS ON TEAM STAGES

comprised of software development staff, each encountering a range of team development experiences, partially influenced by corporate leadership and the assigned project manager. Therefore, the primary research question of this research projects asked what impact does a [Company] project manager's activities and actions have upon the ability of his or her software development project team to reach Tuckman's performing stage?

Within this primary question, the project manager's activities and actions served as the independent variable while and the dependent variable is the project team's ability to attain Tuckman's performing stage. This overarching problem was examined through exploring a series of sub-problems that included:

- Which [Company] software development teams have reached Tuckman's performing stage?
- What are the common project management actions within [Company] software development teams?
- What is the relationship between common project management actions and the team development stages of [Company] software development teams?

Research Objective

The primary objective of this research study was to identify sets of actions and activities that a software development project manager at [Company] should employ to improve the likelihood of his or her project team experiencing Tuckman's performing stage. Additionally, it was the goal to identify any actions that [Company] software project managers should avoid. These identified leader-centric activities result in suggested methods for [Company] to employ at a corporate level to maximize the amount of time technical project teams spend in Tuckman's performing stage.
The results and recommendation of this research are targeted towards [Company]'s senior leaders and [Company]'s project managers. It is the researcher's intent that [Company] senior leaders can use these recommendations to properly assess project manager's performance and perhaps shape future workforce development programs. Miller (2003) agrees and notes that "Managers, human resource (HR) specialists, or other practitioners have a great deal of interest in assessing team development for the purposes of improving performance and attitudes" (p. 130). Additionally, [Company] project managers could use these recommendations to better assess and understand their teams’ performance levels and how to make improvements for current and future technical project teams.

[Company]'s technical staff want to be challenged and to participate in a performing team. Understanding any potential relationships between project manager actions and activities to improve this is vital to retaining [Company]'s top technical staff and keeping their morale high. Failing to do so could result in a higher staff turnover and lower staff morale.

Limitations and Delimitations

This research project sought to evaluate the impacts of project managers’ actions and activities upon their software development teams’ performance at [Company]. With over 600 employees supporting a variety of highly technical projects across the globe, [Company] has a wide scope of projects. However, this research included only recent [Company] software development projects which are either ongoing or have concluded within the past year.

[Company]'s software development projects are those projects that produce deliverables in the form of written software code, software engineering planning and design, or analysis of existing software. The technical staff on software development projects include project managers, software developers, systems engineers, software quality assurance testers, database
engineers, and information technology subject matter experts. Even though they may have similar staff composition, all other project types at [Company] were excluded due to limited time and resources for data collection.

[Company] was formed in 2012 with the merger of four firms ([Company], n.d.). Limiting this research project to recent software development projects provided a target population that embodies [Company]'s corporate culture and not that of the previous companies due to the majority of [Company]'s software development projects having periods of performance of one or two years. Additionally, only [Company] software development teams with an assigned project manager were included. Some project managers or staff from eligible [Company] software development projects were unavailable due to no longer being employed by [Company]. These team members were not included in the study's data collection.

When modeling team development stages, this study used Tuckman's theory of team development for modeling. The group development process is complex due to human nature and has resulted in several experts developing theories, many of which either influenced or were influenced by Tuckman's model, resulting in many similarities (Maples, 1988, p. 17). While Tuckman's team development model has some mixed results during empirical research, there is general agreement among theorists that group development processes do occur in identifiable stages. Therefore, it was used by this research study because it has "easy-to-remember labels and commonsense appeal" and is appropriate for the graduate level (Central Michigan University, 2012, p. 228; Maples, 1988, p. 17).

Definitions

For the purpose of this research, some terms are used in a more narrow context than may be generally understood. Therefore, the below are defined as used within this research study.
A one-way analysis of variance (ANOVA) is a statistical test "used to determine whether there are any significant differences between the means of two or more independent (unrelated) groups" (Laerd Statistics, n.d.). An ANOVA test results in two important values: The F-ratio and the p-value. The F-ratio is to test how different a sample's means are relative to sample variability, or in other words, "The larger this value, the greater the likelihood that the differences between the means are due to something other than chance alone, namely real effects" (Stockburger, n.d.). The other reported value from the ANOVA statistical test is the p-value, which indicates statistical significance and "implies that the means differ more than would be expected by chance alone" (Stockburger, n.d.). A common nomenclature for reporting ANOVA test results is seen in Figure 1: ANOVA reporting nomenclature below, were "df" is the degrees of freedom (Laerd Statistics, n.d.)

![Figure 1: ANOVA reporting nomenclature](Note. Reprinted from Laerd Statistics, n.d.)

The Group Development Assessment (GDA) is a group development model developed in the 1970s and it is applicable with work groups in which there is a designated leader. The GDA stages have shown to have parallel relations with the Tuckman model of team development (Ito & Brotheridge, 2008, p. 217).

High Performance Teams (HPTs) are teams which "frequently outperform other teams that produce similar products and services under similar conditions" (Castka, Bamber, Sharp, & Belohoubek, 2001, p.124).
[Division] is a division within [Company], "an advanced analytics company that extracts value from the increasing volume, variety and velocity of data" ([Company], n.d.), and the target sample of this research. At the time of this study, the [Division] division had 127 employees, or 51% of the estimated 250 [Company] software developers, which is the research population.

The project manager is "the person responsible for working with the project sponsor, the project team, and the other people involved in a project to meet projects goals" (Schwalbe, 2013, p. 493). Specifically for this research, this is the individual assigned by [Company] to lead the project team, represent them at customer meetings, and make decisions regarding the project activities.
CHAPTER II: REVIEW OF RELATED LITERATURE

Introduction to the Literature

The amount of literature and research available regarding team development is extensive and can become overwhelming if not narrowed down. Originating in the 1950s, group development research has been ongoing for over 65 years and remains a popular research topic (Chang, Duck, & Bordia, 2006, pp 327). The purpose of this chapter is to discover and analyze scholarly pieces pertaining to the primary research question of what impact does a [Company] project manager's activities and actions have upon the ability of his or her software development project team to reach Tuckman's performing stage. This chapter presents a review of related literature within four sections: 1) understanding team development stages, 2) examining popular team development models, 3) applying team development to software development teams, and 4) understanding the project manager's role within team development.

Presentation of the Literature

Understanding team development stages. Every individual must work as part of a team many times throughout his or her life. This practice begins in schools when forming breakout teams, is seen across multiple sports, and occurs in many team-centric professional workplaces. Each of these teams goes through a maturation process throughout the team's life-cycle and there are many scholarly resources available that discuss this. The team maturation process is critical for successful teams, as "many failed projects have been staffed by highly talented individuals; however it takes team work to complete projects successfully" (Schwalbe, 2013, p. 258).

Dynamic team processes. Acknowledging that teamwork is everywhere and that teams can provide corporations with a competitive advantage, Miller (2003) conducted a retrospective study of dynamic team processes to identify and understand the mechanisms that make
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teamwork more effective. The study suggests that teams are complex systems that have changing processes and interactions over time. Understanding the factors that influence changes is key to knowing how to guide teams towards a high level of performance and ultimately, success.

Noting that the overwhelming amount of group development research shares a similarity in describing the stages of development in a hierarchal form, Miller (2003), selects one of the most well recognized models to test in her study: Tuckman's five stages of team development model. The study recognizes that there are a variety of models to select; however, "Tuckman's stage model has been a standard for many years and activities carried out during stages are recognized to be key components of group development" (Miller, 2003, p. 122).

Miller (2003) used a questionnaire to collect data, which when analyzed, assesses in which stage of development is the team. The statistical test used by Miller (2003) was an analysis of variance (ANOVA) single factor test for order effects (p. 126). The method of question selection and validation is noteworthy as the research had 12 subject matter experts evaluating the questions and only selected those upon which all experts agreed upon. Once the questions were selected and distributed and data collected, the study found that "individuals can monitor and report the sequences of group development events with a respectable degree of accuracy" (Miller, 2003, p. 130). Moreover, the study confirmed that collected questionnaire data can be examined by project teams, noting that the "perceptions of team development were consistent within the team but differed between the teams. Therefore, it was acceptable to aggregate data into a group variable" (Miller, 2003, p. 129).

The significance of Miller's (2003) study upon this research study is in the team development model selected, the data collection method used, and the statistical test to establish statistical significance. Tuckman's model was chosen due to its simplicity and historical standard
within the team development field. Using the questionnaire method of data collection was proven to be effective in identifying team development stages, allowing for correlation through an ANOVA statistical test of other factors such as project manager actions and activities.

**Team results.** Another view of understanding team development and its impact upon team results is shared by Jessup (1992) in his team training guideline. Within this piece, Jessup (1992, p. 65) expresses that team's need to understand two basic concepts of team theory. The first is that of sharing, "sharing one mission, sharing tasks and experiences, and share consequences" (Jessup, 1992, p.65). This sharing of missions, tasks and experiences, and consequences are achieved through the daily bond of working together, tackling multi-team members, appreciating the talents and contributions of fellow team members, and facing the pressures of deadlines.

The second basic concept Jessup (1992, p. 65) shares is that of team development stages. Jessup also selects Tuckman's model of stage development. Jessup (1992) walks through the stages described in Chapter I above; however, notes that, "[team development] progression, while predictable, is seldom steady or rapid" (p. 65). This relates to this research study as it indicates that team stages can be captured effectively through a cross-sectional descriptive survey encompassing a single period of time.

**The paths of team development stages.** Ito and Brotheridge (2008) study the team maturation process and explore whether the stages experienced are path dependent. In their study, the authors analyze the responses of over 200 questionnaires by public servant professionals working within teams. Like many other research projects, and similar to Miller's (2003) study, this one begins by referring to Tuckman's model of team development to help one determine a team's current stage of development. Using Tuckman's model as a basis, the study
PROJECT MANAGER IMPACTS ON TEAM STAGES

compares a mapping of its stages against a measurable tool, the Group Development Assessment (GDA).

Ito and Brotheridge (2008) map out the GDA's task behaviors and process behaviors, which are measurable, aligned with Tuckman's model of stage development (Figure 2: Comparison of stages in the GDA and Tuckman models).

The study's methodology leveraged a questionnaire and found that the GDA was reliable, "with most stages having good to excellent reliability coefficients" (Ito & Brotheridge, 2008, p. 227), and that path dependency is partly supported. This suggests that while team development is linear, teams may regress backwards into a previous stage. Furthermore, the study revealed that actions and tasks "in an earlier stage can have significant effects on later stages" (Ito & Brotheridge, 2008, p.227). This indicates that a team leader, such as a project manager, may be able to positively impact a team reaching Tuckman's performing stage with actions during the preceding forming, storming, and norming stages. Similar to Miller's aforementioned research,
Ito and Brotheridge (2008) performed an ANOVA statistical test on each of the variables to determine statistical significance between the GDA's process and task behaviors and Tuckman's stages of group development (p. 222)

**Examining popular team development models.** This research project uses Tuckman's model of team development due to its simplicity, its proven ability to be measurable, and its popularity. Tuckman's model is not without criticisms, though. In this sub-section, alternative models of team development were examined for potential incorporation.

**Team development process in business.** Kormanski's (1988) article examining how popular team development models are incorporated into businesses provides valuable insight for a research project exploring the relationship between a project manager's actions and the ability for that team to become a high performing team, or reach Tuckman's performing stage.

Beginning in the 1950s, stages of team development were very task oriented and only had three identifiable stages; however, in the early 1960s, Schutz's Fundamental Interpersonal Relations Orientation theory recognized a conflict stage. This is similar to Tuckman's storming, or second, stage discussed in Chapter I. Many of these early stages are linear, and Tuckman's initial model in 1965 was a good summarization of the preceding models. Up until this point, none of the models had included a concluding stage. In the late 1960s, Mills introduced a separation stage. Many of the models agreed with this and incorporated some degree of the separation concept; Tuckman revised his model in 1977 to include the adjourning stage. These linear models form the basis of team development and the research by Kormanski suggests that most models contained three to five stages, all with similar labels. A summary of some of these popular models are listed in Table 1: Early models of group development and five stages below:
### Table 1: Early models of group development and five stages

<table>
<thead>
<tr>
<th>Models</th>
<th>One</th>
<th>Two</th>
<th>Three</th>
<th>Four</th>
<th>Five</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuckman (1965) and Tuckman and Jenson (1977)</td>
<td>Forming</td>
<td>Storming</td>
<td>Norming</td>
<td>Performing</td>
<td>Adjourning</td>
</tr>
<tr>
<td>Bales (1953)</td>
<td>Orientation</td>
<td></td>
<td>Evaluation</td>
<td>Emergence of solutions</td>
<td></td>
</tr>
<tr>
<td>Bennis and Shepard (1956)</td>
<td>Dependence</td>
<td>Counter dependence</td>
<td>Resolution</td>
<td>Interdependence</td>
<td></td>
</tr>
<tr>
<td>Schutz (1958, 1982)</td>
<td>Inclusion</td>
<td>Control</td>
<td>Openness or affection</td>
<td>Control</td>
<td>Inclusion</td>
</tr>
<tr>
<td>Bion (1961)</td>
<td>Dependency</td>
<td>Fight or Flight</td>
<td>Paring</td>
<td>Intimacy</td>
<td></td>
</tr>
<tr>
<td>Kaplan and Roman (1963)</td>
<td>Dependency</td>
<td>Power</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mills (1964)</td>
<td>Encounter</td>
<td>Testing boundaries and modeling roles</td>
<td>Negotiation</td>
<td>Production</td>
<td>Separation</td>
</tr>
<tr>
<td>Gibb (1964)</td>
<td>Acceptance</td>
<td>Data flow</td>
<td>Goals and norms</td>
<td>Control</td>
<td></td>
</tr>
<tr>
<td>Slater (1966)</td>
<td>Anxiety and frustration</td>
<td>Attack</td>
<td>Group morale</td>
<td>Conflict resolution</td>
<td></td>
</tr>
<tr>
<td>Mann (1967)</td>
<td>Initial complaining</td>
<td>Premature enactment</td>
<td>Confrontation</td>
<td>Internalization</td>
<td>Separation and terminal review</td>
</tr>
<tr>
<td>Dunphy (1968)</td>
<td>External standards</td>
<td>Rivalry, aggression, and negativism</td>
<td>Emotional concerns and affection</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. Adapted from Kormanski, 1988, p. 34*

It is easy to note how many of these models are similar in their composition of three to five stages, all with similar names and functions; Kormanski's (1988) research indicates that each of these stages is integrated with business concepts integral with management and supervision.

The research notes five trends, the first of which is directly relevant to this research: "[Trend] (a) The management style of the effective supervisor moves from a highly directive one to a more democratic style" (Kormanski, 1988, p. 36). This finding signifies that a project manager's actions do have some relationship with team stage development and that Tuckman's five-stage model is sufficient for this research.

**Extending Tuckman's theory.** Maples (1988) is a researcher and professor at the University of Nevada, Reno, who sought to "clarify Tuckman's five stages to increase graduate student's understanding of this valuable theory" (p. 17). Maples’ introduction to her research aligns with many other studies in that she acknowledges there are many models of team development; however, Tuckman's model has an attractive simplicity and appropriateness for
research and education. Maples observed that this simplicity, though, left many students feeling there was more to explore, more to understand other than merely the characteristics of forming, storming, norming, performing, and adjourning. These labels were "lacking in both descriptive depth and clear definition" (Maples, 1988, p. 18). Therefore, Maples conducted a five-year study encompassing approximately 230 graduate school students to better define these describe and define Tuckman's five stages. What Maples (1998) found was that there are four key descriptive words with contextual definitions for each of the five stages of Tuckman's model (Figure 3: Tuckman's theory extended).

Maples' (2003) research suggests that these 20 components extending out the definition of Tuckman's five stages can serve as a foundation when analyzing team development. She found that regardless of the complexities of human nature and the varying types of individual characteristics and personalities, team development progresses through the five stages (and the additional 20 components) with a great deal of consistency and regularly. The findings of
PROJECT MANAGER IMPACTS ON TEAM STAGES

Maples' research helped define characteristics and shape the approach of identifying the impacts of a project manager's action upon team development within this research.

**Applying team development to software development teams.** After exploring scholarly articles pertaining to team development and some of the popular models, the next step for this research was to seek out scholarly works specifically pertaining to software development teams. Software teams at [Company] are comprised of highly technical individuals working in a high paced professional environment to analyze, engineer, develop, and publish software code. Some recent research has indicated that team development within software development is unique and "understanding the factors that affect productivity could help determine where to concentrate management efforts" (Melo, Cruzes, Kon, & Conradi, 2012).

**Software development team factors.** Seeking to identify the factors that affect productivity in software development teams, Melo, Cruzes, Kon, and Conradi (2012) performed a multiple case study within the information technology industry. They found that software development teams were susceptible to team management issues such as team design choices and staff turnover as factors that impact productivity. Team design choices are regular decisions [Company]'s project managers make; therefore, the findings of Melo et al. (2012, p. 424) that team size, diversity, personality, skills, collocation, and time allocation all may serve as factors of team development and productivity provided potential data collection points for this research.

Another factor identified by Melo et al. (2012) is staff turnover. The turnover of a software development team can be a common occurrence due to external factors such as competition from other companies or due to internal issues (e.g., personal disagreements within the team). The study identified staff turnover "as critical for team production in the interviews
and retrospectives" (Melo et al., 2012, p. 422). These results provided helpful insights into the design of the research survey instrument.

*Communication in software development teams.* Brodbeck (2001) notes that a well established positive correlation exists between internal team communication and project performance; however, he was unsatisfied with the available research specific to software development. Furthermore, Brodbeck presents two conflicting notions of the importance of communication within software development teams: first, due to the customer service nature and highly iterative processes involved with software development, effective communication is required for project effectiveness, and second, several software engineering theoreticians view excess communication as unproductive to software development teams, as a developer is unable to write software code when sitting in a meeting or answering e-mail.

To explore the relationship between inter-team task related communication and software project teams, Brodbeck (2001) conducted a study of 21 software development teams composed of various professions including engineers, user representatives, and project managers. The study used a questionnaire and interviews to collect data such as organizational structure, software tasks and functions of the project members, and amount of task communication. Using this data against collected project performance data, the study found that as software development projects progressed from early to later stages, towards high performing teams, task communication increased. Interestingly, though, there was little correlation between communication levels in the early stages of the project; however, late stages showed a strong correlative relationship between communication and performance. This suggests that "in early stages of the project life-cycle, communication seems not to make any difference in [software development] performance. However...higher levels of communication seem to be of particular

Brodbeck's (2001) research was relevant to this research due to the research method used, research sample selected, as well as the significance of the results. Each of these three factors influenced the research design and data sought from study. Using a questionnaire for software development project teams appeared to be an effective tool to assess actions, in this case communications, with performance. Furthermore, understanding that teams may perform better with higher level of task-related communications in later stages was something to consider as a measurable action by [Company]'s software development project managers.

**Software project manager soft skills.**Introduced in Chapter I, software project managers have a challenging balance of technical and soft skills and Pinkowska, Lent, and Keretho (2011) conducted a study to identify project manager soft skills required for software development project managers. To frame their research, Pinkowska et al. (2011) first defined what the term "soft skills" has encompassed from past researches and ended up defining the term as "an aggregation of all interpersonal and personal learnable ability, which contribute to high efficiency of the execution of the human factor related processes of project management" (p. 343).

With this broad definition defined and using a popular project manager process model (L-Timer), Pinkowska et al. (2011) conducted a broad data review of journals, conference proceedings, and monographs strictly related to information technology project management and identified 74 required soft skills across seven process groups: human resource management, team management, conflict management, communication management, self-management, leadership, and elementary. Their findings of the most often repetitive soft skills across these domains for a
software project manager resulted in a declaration of feasibility to "execute an in depth analysis of human factor related processes of project management and deduce the skills relevant in performance of those activities" (Pinkowska et al., 2011, p. 347). The significance of their research gave input to this research for inclusion of soft skills for project manager actions and activities as well as the importance of soft skills to the software development project manager.

**Understanding the project manager's role within team development.** Leaders, specifically project managers, have a direct impact upon their team's performance. An important ingredient, and suggested focus area by Toofany (2007), is team building. To aide in team development, Toofany (2007) suggests that managers should execute specific actions, such as celebrating successes and achievements, to address potential problem areas, such as addressing low staff morale (p. 27). In this sub-section, scholarly research on the factors and actions of leaders and project managers was explored to further refine and assist in the development of the research of identifying what impact [Company] project managers' activities and actions have upon the ability of their software development project teams to reach Tuckman's performing stage.

**Factors affecting high performance teams.** Teamwork is used in the professional setting to improve organizational performance, and Castka et al. (2001) conducted research to seek out which factors are common among high performance teams (HPTs). Performance is defined in the study as an equation of three factors: ability, motivation, and environment. The ability of the team members is defined and unable to be directly influenced in a short time period by leaders and project managers. Motivation and environment, though, are factors that project managers directly influence through their actions and activities.
The study by Castka et al. (2001) further identified seven factors that impact the performance equation's variables. These seven factors fell into two categories: human and system and are displayed in Figure 4: Factors affecting successful implementation of HPTs.

**Figure 4: Factors affecting successful implementation of HPTs**

*Note. Reprinted from Castka et al., 2001, p. 128*

Human factors are knowledge and skills, need of the individual, and group culture. The first, knowledge and skills, directly ties to the ability variable of the performance equation, whereas need of the individual ties to motivation, and group culture ties to environment. Project managers can assess the needs of the individuals on their teams to improve motivation; additionally, they can set the right environment through supporting positive group culture environments.

Castka et al. (2001) define system factors as things such as organizational impact, defined focus, measures of performance, and alignment and interaction with external entities. Each of these, other than organization impact, is a lever able to be manipulated by project managers through specific actions and activities. To ensure that the project team is aware of the end-goal and has a defined focus, the project manager can hold a kick-off meeting with the project team.
and stakeholders. The same activity can positively influence alignment and interaction with external entities and "strongly points towards the importance of the dissemination of knowledge and the creation of understanding" (Castka et al., 2001, p. 127).

Understanding the factors of successful HPTs was helpful for targeted data collection. If one is aware of the factors present from other studies within successful teams, then being able to segregate and isolate those responses against project performance data, such as on [Company]'s software development teams, allowed for correlation analysis of the actions and activities of [Company]'s project managers.

*Software development project management practices.* Verner and Evanco (2005) understand the importance of the software development mission to business as well as appreciate the unique challenges software development teams face. To understand common factors of successful software development teams, Verner and Evanco conducted a questionnaire-based research study of over 100 team members covering over 120 projects. They found a strong correlation of project manager-based activities such as providing a clear vision of the final product, developing clear requirements, conducting active risk management, and executing postmortem reviews as clear factors to improve the success of software development teams.

The research methodology and question structure was noteworthy and relevant for this research study. Conducting a study of active software development team members using a questionnaire was shown to be effective when compared against project performance data. The common factors identified by Verner and Evanco (2005) are project manager actions, which served as inputs of potential data collection points for this research.
Summary of the Literature

The amount of scholarly research, studies, and literature available pertaining to a team development and leader's activities is immense. The initial area examined was that in the area of team development in general and the popular models. Tuckman's model is one of the longstanding team development models available; moreover, it provides a simple five stage framework to identify and classify team development progress. Several studies have demonstrated the ability to identify stages of project teams through questionnaire responses and noted team behaviors. The researcher identified the ANOVA statistical test as most commonly applied to questionnaire data. Additionally, the conducted research within team stages has shown to be valued by the corporate industry, "For managers and HR practitioners, understanding specific team processes and how the timing of such processes can make teams more or less effective would be most useful" (Miller, 2003, p. 130). This served as topic validation and an important baseline for this research design and execution.

Additionally, several researchers have looked into software development teams and unique factors. Software teams can be different than traditional professional environments and their teams may have unique "knowledge, attitudes, and beliefs regarding the projects and [project managers]" (Verner & Evanco, 2005, p. 92). Understanding what factors within the control of project managers of software development may lead to successful performance may lead to understanding the factors and actions of teams reaching Tuckman's performing stage.
CHAPTER III: RESEARCH METHODOLOGY

Research Approach

The contents of this chapter present the quantitative program evaluation approach used to assess the primary research question: What impact does a [Company] project manager's activities and actions have upon the ability of his or her software development project team to reach Tuckman's performing stage? The primary objective of this research was to identify what actions and activities a project manager at [Company] should employ to improve the likelihood of the software development project team reaching Tuckman's performing stage. This chapter is organized into three main sections and a summary. The first section is the data collection approach and procedures. This includes the type of data collected along with target population and sample details, and information about the research instrumentation. The second section details the method used to analyze the collected data from the first section. The third section discusses identified limitations and constraints of the research methodology and is followed by the final summary section.

Data Collection Approach and Procedures

Keeping the primary research objective in mind, several sub-questions attempt to break down the primary question. The aggregation of the answers to these sub-questions dictated the discussion, conclusion, and recommendations to the primary research problem. The sub-questions established in Chapter I include:

- Which [Company] software development teams have reached Tuckman's performing stage?
- What are the common project management actions within [Company] software development teams?
What is the relationship between common project management actions and the team development stages of [Company] software development teams?

**Data to be collected.** Beginning with the sub-questions, researchers should keep in mind one key question, "To resolve the problem, what data are mandatory?" (Central Michigan University, 2013, p. 80). This sub-section sought to identify what data were to be collected for this research. To do this, the researcher dissected the primary research question and sub-questions. The procedures used for collecting the identified data in this sub-section are discussed in subsequent sub-sections.

The first sub-question asked which [Company] software development teams have reached Tuckman's performing stage? The objective for this sub-question is to identify the development stage each [Company] software development project teams was in, specifically the fourth performing stage, and provided one half of the information need for sub-question three. Sub-question two asked what are the common project management actions within [Company] software development teams? This specifically investigated what common software development project manager actions and activities are present within the sample [Company]'s software development teams. Establishing the project manager actions and activities present provided the second half of inputs for sub-question three, exploring the relationship between project manager actions and activities and his or her project team's development stage.

The final sub-question introduces Tuckman's stages and asks what is the relationship between common project management actions and the team development stages of [Company] software development teams? Specifically, what project manager actions are found specific to particular team development stages? The data for this are in what stage, or stages, a project manager action occurred. The project manager's activities and actions served as the independent
variable while and the dependent variable is the project team's development stage. The data for all three sub-questions came from [Company]'s software development team members via a descriptive survey, discussed in the Data collection procedures section below.

**Data collection procedures.** Data collection for this research came from a descriptive survey in the form of a questionnaire sent electronically and designed to gather primarily quantitative data by leveraging the Likert scale for responses. This data source was cross-sectional in nature in that it only captured a single point in time. Research participants were not given multiple surveys over a span of time to measure changes due to the limited timeframe available to conduct research.

Additionally, this research kept the protection of all human subjects at the forefront of all data collection procedures. Pursuant to Collaborative Institutional Training Initiative (n.d.) guidelines, the researcher completed Social & Behavioral Research training and followed all regulations and guidelines.

**Target Population.** The target population for this research are [Company]'s software development teams. [Company] has more than 600 professionals working on a variety of projects ([Company], n.d.); the researcher estimated that roughly 250 employees support software development projects. In Chapter I, the researcher defined [Company]'s software development projects as those projects that produce deliverables in the form of written software code, software engineering planning and design, or analysis of existing software. Of these eligible team members on [Company]'s software development projects, only recent projects and those that had an assigned project manager were included.

**Sample Details.** Due to the target population for this research being geographically distributed across the globe, the researcher selected a hybrid method of cluster sampling and
convenience sampling. [Company] has several divisions aligned with mission type and mission customer. One of the divisions with many software development projects is the [Division] group. This group was selected for the target sample due to its convenience of access to the researcher as well as it housing 127 team members who support software development projects. This give a sample size of 51% of the estimated population of 250. This sample size meets the guidance provided by Central Michigan University (2013) of sampling 50% or more for population sizes greater than 100 and less than 1,500 (p. 216).

**Instrumentation.** The instrumentation for this research was a descriptive survey for software development team members, including project managers. The survey was accompanied by a consent form (Appendix B) and a link to an electronic survey in the form of a questionnaire (Appendix C). All survey questions were piloted to test for validity and reliability; this specific method is discussed in the subsequent "Validity and Reliability" section. Moreover, all of the survey questions are influenced from similar studies found during the literature review process in Chapter II. For example, some questions to collect data on project manager activities were influenced by Verner and Evanco's (2005, p. 88) research discussed in Chapter II. Another set of survey questions attempt to capture the stage of performance the team has achieved. These questions were influenced by Ito and Brotheridge's (2008) study mapping the Group Development Assessment's tool to Tuckman's five stages of team development as well as Miller's (2003) research of identifying a team's stage of team development. Additionally, the majority of the survey questions used the Likert scale, which allow for answer diversity while still limiting the within a controlled and defined range (Central Michigan University, 2013, p. 85). Finally, the survey contained one open-ended question at the end to capture any information.
the respondent felt compelled to share and which may have been missed by the more structured questions.

**Procedures.** The consent form (Appendix B) and the relevant survey (Appendix C) were e-mailed to the prospective participants through a corporate distribution list. This ensured that the appropriate audience received the correct survey link. Additionally, using a distribution list ensured that the recipients were unable to see who else was on the e-mail chain. Furthermore, by leveraging the blind courtesy copy (BCC:) feature, there were no "reply-all" e-mails sent to the survey group. To ensure anonymity, the researcher used Type Form, which provides an unlimited amount of survey questions and responses as well as supports mobile friendly browsing in a clean and simple user interface (Type Form, n.d.). An additional step taken to ensure the security of the responses and associated data, all files were exported from Type Form and stored on an encrypted external hard disk drive. This ensured that even if the hard drive is lost, misplaced, or stolen, the contents cannot be viewed by anyone without the decryption key.

Due to the researcher also being a software development team member at [Company], there was a risk of perceived coercion or potential retaliation by the participants. To alleviate these concerns, the consent letter clearly addressed these issues. The researcher did not view this to be a significant concern.

**Timing.** Approval was obtained on March 8, 2016 and the surveys were sent out on March 14, 2016 to [Company]'s [Division] software development teams with a suspense date of two weeks later, or March 28, 2016. The survey response rate was 39%, which met expectations and no extension was required.
Specific Approach for Data Analysis and Synthesis

With the collected data from the questionnaires and project performance analysis, the researcher used descriptive statistics of the various questions and correlated those answers and looked for trends among projects that did succeed to reach the performing stage and those that did not. Specifically, certain questions were grouped together to collect data on project manager's actions while others were grouped to gather data to capture the stage of team development. This method of analysis was able to isolate specific actions by [Company] software development team project managers and shaped the recommendations to management and conclusions of this study. An ANOVA statistical test was used on the collected data set to determine statistical significance of project manager actions and activities in performing stage teams and those teams in other stages. This method was selected based upon the Chapter II literature review. There was a risk that the data does not show any significant correlation; however, this did not end up being the case.

Methodological Limitations

This research study was designed to examine the relationship between a project manager's actions and a [Company] software development team's ability to experience Tuckman's performing stage. The limitations of this research include the selected sample and survey questionnaire.

The sample selected for this research was composed using a hybrid of convenience sampling and cluster sampling. By selecting the [Division] group within [Company], the sample is representative of [Company] as a whole; additionally, it was chosen based on the researcher's familiarity of the group.
The primary data collection method of this research was through a descriptive survey leveraging a questionnaire. The majority of survey questions used the Likert-scaled response. Even though a study found that some cultures may have certain tendencies such as selecting a central answer more often or writing in their own score, such as a zero on a scale of one to five (Lee, Jones, Mineyama, & Zhang, 2002), the researcher does not suspect any cultural issues factored into survey responses due to the selected sample being from the same general geographic region.

**Validity and Reliability**

The survey instrument used for this research study was tested to some degree for both validity and reliability. To test validity, the survey was piloted with four individuals from an Alexandria, Virginia based non-profit research organization. This group of four individuals was selected for their experience in research methodologies and survey design and are respected professionals known to the researcher. Each individual was provided a link to the electronic survey sequentially between February 29, 2016 and March 1, 2016. The individuals took the survey while the researcher was present to take notes and address any questions they had as they answered the questions as either a project member or a project manager; this method is as described by Walonick (2012). Each of the first three iterations identified survey question defects and resulted in wording choice changes to remove ambiguity and add clarity. The fourth survey taker had no identified defects and the researcher determined the survey pilot to have successfully established validity.

To test the survey for reliability, or repeatability, the researcher selected the test-retest measure (Walonick, 2012). Using the now valid version of the survey established by the pilot, the researcher provided the survey to three software developers outside the research population.
on March 1, 2016 and again on March 3, 2016. The results show a coefficient of stability of 1 as each of the three software developers answered each question identically. This may have been due to the relative short time period of approximately 48 hours between survey responses; however, it does point towards a comfortable level of reliability for the purpose of this research.

**Decision Criteria**

Of the 25 numbered questions on the survey for project team members in Appendix C, the first 17 are geared towards project manager actions and activities while the final eight to assess team formation stage and was based on the GDA questions. Specifically, the first eight questions are "No, Unsure, Yes" questions and responses were grouped by identified project. Project responses higher than a collective 66% of a single answer were coded as that respective answer and will be considered to be a confirmed action of a project manager for that particular project. Questions that failed to have a 66% or higher consensus were determined as unclear as to the project manager's activity and will be excluded from further consideration.

Questions 9 through 17 are project manager activity based questions with responses consisting of "strongly disagree," "disagree," "neutral," "agree," and "strongly agree." These responses correlated respectively to a number 1-5 and were again looked at together with answers from within the project team. Questions with a mean of less than 2.2 were considered as a negative response to that question for that project team, noting the project manager did not do that particular action. Questions with a mean of 3.8 or higher were considered as a positive response to that question for the project team, noting the project manager did that particular action.

Finally, questions 18 through 25 assess the project team stage. Based on the survey findings from Ito and Brotheridge (2008, p.219), project teams that display sets of task behaviors
and process behaviors can be mapped to the stages of Tuckman's model. Project team's responses were analyzed together and answers to questions with a mean of 3.8 or higher indicated that the particular task behavior or process behavior was present within the project team and can be correlated to forming, storming, norming, or performing stage.
CHAPTER IV: DATA ANALYSIS

This research project set out to identify [Company] project managers' actions or activities that have impact upon their software project teams reaching Tuckman's performing stage. The research population consisted of the approximately 250 [Company] team members supporting software development across two primary divisions. The researcher distributed the survey instrument to 127 [Company] software project team members, all part of the designated sample group, or [Company]'s [Division] division. The survey response rate was 39%, or 49 responses, encompassing 15 software development projects. The researcher used a quantitative program evaluation approach to analyze the survey responses, identify teams in the performing stages, isolate project manager actions and activities, and find correlations with project manager actions and activities.

Data Presentation and Analysis

The research survey instrument was designed to collect data in two primary categories: identification of team formation stage using Tuckman's model and software project manager actions and activities. Of the 49 responses received representing 15 projects, two projects only received a single response. These two survey responses and respective projects were discarded from data analysis due to the inability to determine project team formation stage from a single response.

Project team formation stages. The first step to analyzing the received data is to organize the responses by [Company] projects in order to identify those teams that have attained Tuckman's fourth stage of formation, performing, and those that have not. The research survey instrument included eight questions, 4a through 4h, to assess the project teams in relation to the aforementioned Group Development Assessment (GDA) model in Chapters II and III. Of the 47
responses representing 13 project teams to be analyzed, the researcher was able to identify the Tuckman stage of team formation for 12 project teams; one project, "Team_8," had seven responses with high volatility and no clear survey response consensus. The numerical values used for this research study's population, sample, and received responses is shown in Figure 5: Data results below.

Using the criteria established in the Research Methodology chapter, the researcher organized the responses to the survey questions by projects and identified consensus answers to each question. The summary of received survey data is depicted below in Table 2: Team formation stage assessment from survey responses. The projects that received survey responses
are listed in the leftmost column, followed by the number of responses, and then the average survey response score for the eight GDA behavior questions. The names of the six projects assessed by the researcher to be experiencing Tuckman's performing stage are bolded and highlighted green. The column sets of 4a through 4d represent GDA task behaviors and the column sets of 4e through 4h represent GDA process behaviors.

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<th># of Survey Responses:</th>
<th>Average of 4a</th>
<th>Average of 4b</th>
<th>Average of 4c</th>
<th>Average of 4d</th>
<th>Average of 4e</th>
<th>Average of 4f</th>
<th>Average of 4g</th>
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<td>3.40</td>
<td>2.20</td>
<td>4.00</td>
<td><strong>4.40</strong></td>
<td></td>
</tr>
<tr>
<td>Grand Total</td>
<td>49</td>
<td>2.29</td>
<td>3.43</td>
<td>3.65</td>
<td>3.94</td>
<td>3.55</td>
<td>2.31</td>
<td>4.02</td>
<td>4.10</td>
<td></td>
</tr>
</tbody>
</table>

* Received only one response
** No conclusive results based off received survey responses

**Group Development Assessment (GDA) task behaviors.** Group task behaviors are one half of the eight clusters of behavior within the GDA model consisting of orientation, organization, open data flow, and problem solving; each mapping to Tuckman's forming, storming, norming, and performing stages respectively (Scott & Byrd, 2012, p. 344). The first four questions in section four, questions 4a through 4d, of the research survey were manifestations of these GDA task behaviors. Project teams with an average response score lower than 2.2 for question 4a, or higher than 3.8 to the research survey questions 4b, 4c, and 4d were
deemed to exhibit the associated GDA task behavior. Of most interest to this research project are those project teams that scored positive for GDA's highest task behavior, problem solving, as those teams are potentially experiencing Tuckman's performing stage if paired with the highest GDA process stage, interdependence. There were eight such projects of the 13 analyzed deemed to exhibit the problem solving task behavior.

**Group Development Assessment (GDA) process behaviors.** The other half of the GDA behaviors are the process behaviors dependence, conflict, cohesion, and interdependence; similarly mapping to Tuckman's stages of forming, storming, norming, and performing stages respectively (Scott & Byrd, 2012, p. 344). Research survey questions 4e through 4h each represented a process behavior and any project with an average response score greater than 3.8 was deemed to be a consensus of that process being present. There were 10 projects scoring greater than 3.8 for the highest GDA process stage, interdependence.

**Tuckman's performing stage project teams.** Now knowing what task and process behaviors are present in each project team, the researcher was able to translate the project's GDA score to a team formation stage based on Tuckman's model. This mapping is reflected by Figure 2: Comparison of stages in the GDA and Tuckman models in Chapter II. Using the relationships established by Ito and Brotheridge (2008, p. 219), the research concluded that six [Company] project teams were in Tuckman's performing stage, while the remaining were in either the norming or storming stage. This is depicted below in Figure 6: GDA process and task behaviors of [Company] project teams.
**Project manager actions and activities.** The next step of data analysis was to determine what project manager actions and activities were present or absent within the various [Company] project teams. The researcher again consolidated survey responses by project and assessed each project manager based survey question as an action or activity as either present, not present, or unable to determine. Research survey questions 2a through 2g were yes / unsure / no questions. If a project's grouped responses had a 66% or greater yes or no response, then that question's action or activity was coded as such. If there was no 66% or greater consensus, then the researcher was unable to determine if that project manager action or activity was present. Actions and activities that were deemed as yes, they were present are color coded green in Table
3: [Company] project manager actions and activities by project; similarly, actions and activities not present are red and those unable to be determined left white.

Table 3: [Company] project manager actions and activities by project

<table>
<thead>
<tr>
<th>Project:</th>
<th>Assessed Tuckman Stage</th>
<th>Project Manager Action and Activity Survey Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team_1*</td>
<td>Unclear</td>
<td>2a 2b 2c 2d 2e 2f 3a 3b 3c 3d 3e 3f 3g 3h 3i 3j</td>
</tr>
<tr>
<td>Team_2</td>
<td>Performing</td>
<td>Y Y U N Y Y Y 4.0 3.0 5.0 5.0 5.0 3.0 4.0 4.0</td>
</tr>
<tr>
<td>Team_3</td>
<td>Forming / Storming</td>
<td>Y Y U N Y Y Y 4.3 3.7 4.0 3.7 4.7 4.3 4.3 4.3 4.0</td>
</tr>
<tr>
<td>Team_4</td>
<td>Performing</td>
<td>Y U Y Y Y Y Y 4.0 5.0 3.0 5.0 4.0 5.0 3.0 3.0 3.0 3.5</td>
</tr>
<tr>
<td>Team_5</td>
<td>Norming</td>
<td>Y N U Y Y Y U 3.0 5.0 4.0 3.8 4.5 4.5 3.0 3.5 1.8 3.0</td>
</tr>
<tr>
<td>Team_6</td>
<td>Storming</td>
<td>Y U Y Y Y U U 4.3 2.1 2.9 3.1 3.9 3.3 1.9 2.7 1.7 2.6</td>
</tr>
<tr>
<td>Team_7</td>
<td>Performing</td>
<td>Y U U N Y Y Y 4.3 2.5 3.7 4.0 4.0 4.0 3.7 2.5 3.3 3.7</td>
</tr>
<tr>
<td>Team_8**</td>
<td>Unclear</td>
<td>Y N U U U U U 3.3 3.2 3.1 3.3 2.9 2.9 2.1 2.6 2.1 2.7</td>
</tr>
<tr>
<td>Team_9</td>
<td>Performing</td>
<td>Y U Y Y Y Y Y 5.0 1.5 5.0 5.0 5.0 5.0 3.5 2.5 4.0 3.5</td>
</tr>
<tr>
<td>Team_10</td>
<td>Performing</td>
<td>Y Y Y Y Y Y Y 4.7 4.3 4.7 5.0 4.7 4.0 4.7 2.7 4.7</td>
</tr>
<tr>
<td>Team_11</td>
<td>Norming</td>
<td>Y Y U Y Y Y U 3.8 5.0 4.0 4.5 4.0 3.8 2.3 3.0 1.0 1.5</td>
</tr>
<tr>
<td>Team_12</td>
<td>Norming</td>
<td>Y N Y Y Y Y U 4.3 3.0 4.3 4.7 4.3 4.0 3.7 4.0 2.3 4.0</td>
</tr>
<tr>
<td>Team_13</td>
<td>Norming</td>
<td>Y Y U Y Y Y U 4.0 4.5 3.5 2.0 3.5 3.0 3.0 3.5 3.0 3.5</td>
</tr>
<tr>
<td>Team_14*</td>
<td>Unclear</td>
<td>Y N Y N U U U 5.0 3.0 5.0 5.0 5.0 5.0 5.0 5.0 1.0 5.0 3.0</td>
</tr>
<tr>
<td>Team_15</td>
<td>Performing</td>
<td>Y N U U U U U 3.8 3.2 4.0 4.6 4.8 4.4 2.6 2.6 2.0 2.6</td>
</tr>
</tbody>
</table>

Y=Yes        > 3.8 = Yes
N=No         < 2.2 = No
U=Unable to determine 2.2 < Unable to determine < 3.8

* Received only one response
** No conclusive results based off received survey responses

As seen in Table 3: [Company] project manager actions and activities by project, the survey responses reflect the varying leadership actions and activities of the respective [Company] project managers. The only question that is the same for all projects is question 2a, which was "Does the project have an assigned project manager?" This was a requirement established by the researcher to be included in the study; therefore, all responses from the 12 projects assigned Tuckman formation stage were analyzed.

**Isolation of variables.** With the above two sets of data analysis complete, the final step of analysis is to identify any statistically significant project manager actions and activities within performing stage teams versus those not yet in the performing stage. The analysis of the 17
project manager actions is shown in Table 4: Project manager actions and activities of [Company] project teams.

<table>
<thead>
<tr>
<th>Research Survey Question</th>
<th>Performing stage teams</th>
<th>Other stage teams</th>
<th>Absolute Delta</th>
<th>Percent ↑ / ↓</th>
<th>Statistical Test: One-way ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a</td>
<td>100%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>F(1,10) = 2.286, p = 0.16</td>
</tr>
<tr>
<td>2b</td>
<td>67%</td>
<td>50%</td>
<td>17%</td>
<td>33%</td>
<td>F(1,10) = 0.189, p = 0.67</td>
</tr>
<tr>
<td>2c</td>
<td>100%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>F(1,10) = 1.923, p = 0.2</td>
</tr>
<tr>
<td>2d</td>
<td>50%</td>
<td>83%</td>
<td>33%</td>
<td>-40%</td>
<td>F(1,10) = 2.426, p = 0.15</td>
</tr>
<tr>
<td>2e</td>
<td>100%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>F(1,10) = 0.049, p = 0.83</td>
</tr>
<tr>
<td>2f</td>
<td>100%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>F(1,10) = 1.092, p = 0.32</td>
</tr>
<tr>
<td>2g</td>
<td>100%</td>
<td>0%</td>
<td>100%</td>
<td>#DIV/0!</td>
<td>F(1,10) = 7.092, p = 0.02</td>
</tr>
<tr>
<td>3a</td>
<td>100%</td>
<td>67%</td>
<td>33%</td>
<td>50%</td>
<td>F(1,10) = 2.428, p = 0.15</td>
</tr>
<tr>
<td>3b</td>
<td>33%</td>
<td>50%</td>
<td>17%</td>
<td>-33%</td>
<td>F(1,10) = 0.811, p = 0.39</td>
</tr>
<tr>
<td>3c</td>
<td>67%</td>
<td>67%</td>
<td>0%</td>
<td>0%</td>
<td>F(1,10) = 0.94, p = 0.36</td>
</tr>
<tr>
<td>3d</td>
<td>100%</td>
<td>33%</td>
<td>67%</td>
<td>200%</td>
<td>F(1,10) = 5.599, p = 0.04</td>
</tr>
<tr>
<td>3e</td>
<td>100%</td>
<td>83%</td>
<td>17%</td>
<td>20%</td>
<td>F(1,10) = 1.376, p = 0.27</td>
</tr>
<tr>
<td>3f</td>
<td>100%</td>
<td>50%</td>
<td>50%</td>
<td>100%</td>
<td>F(1,10) = 7.491, p = 0.02</td>
</tr>
<tr>
<td>3g</td>
<td>17%</td>
<td>17%</td>
<td>0%</td>
<td>0%</td>
<td>F(1,10) = 0.728, p = 0.41</td>
</tr>
<tr>
<td>3h</td>
<td>33%</td>
<td>33%</td>
<td>0%</td>
<td>0%</td>
<td>F(1,10) = 0.196, p = 0.67</td>
</tr>
<tr>
<td>3i</td>
<td>17%</td>
<td>17%</td>
<td>0%</td>
<td>0%</td>
<td>F(1,10) = 1.009, p = 0.34</td>
</tr>
<tr>
<td>3j</td>
<td>17%</td>
<td>33%</td>
<td>17%</td>
<td>-50%</td>
<td>F(1,10) = 1.004, p = 0.34</td>
</tr>
</tbody>
</table>

The furthest left column is the survey question identifier, followed by the percentage of performing stage teams demonstrating this action or activity is present within. The third column is the percentage of teams in other than performing stages within which the action or activity is present. Columns four through six compare the two values for performing stage teams and teams in other stages. The fourth column is the absolute delta, which is simply the difference between performing stage and other than performing stage teams. A low value in the absolute delta column is indicative that the particular project manager action or activity is not unique to [Company] performing teams while a higher delta value could indicate that a potential influencing factor for performing stage teams is present. The fifth column is the percent increase
or decrease between performing stage teams and teams in other stages. This is important to include to show the magnitude of the difference between the two groups. For example, both questions 3e and 3j have an absolute delta of 17%. This metric alone would indicate they are equally disparate when comparing performing stage and non-performing stage teams. The two questions have quite different percent increase or decrease when comparing the two stages: Question 3e has only a 20% increase while question 3j a significant 50% decrease. The final column shows the ANOVA one-way statistical test to show statistical significance. The researcher computed both the F-ratio and the p-value for each question's ANOVA statistical test. The F-ratio is to test how different a sample's means are relative to sample variability, or in other words, "The larger this value, the greater the likelihood that the differences between the means are due to something other than chance alone, namely real effects" (Stockburger, n.d.). The other reported value from the ANOVA statistical test is the p-value, which indicates statistical significance and " implies that the means differ more than would be expected by chance alone" (Stockburger, n.d.).

There are three survey questions (highlighted dark green in Table 4: Project manager actions and activities of [Company] project teams) that show significant disparity between the two groups of teams while still being statistically significant. These three questions are: 2g, 3d, and 3f and are shown in Table 5: Significant project manager actions or activities.

Table 5: Significant project manager actions or activities

<table>
<thead>
<tr>
<th>Survey Question ID</th>
<th>Survey Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>2g</td>
<td>Did the project manager hold an external kick-off meeting?</td>
</tr>
<tr>
<td>3d</td>
<td>The project manager treats the staff equally</td>
</tr>
<tr>
<td>3f</td>
<td>The project manager relates to the staff</td>
</tr>
</tbody>
</table>
**External kick-off meeting.** The first factor identified with statistical deviation was question 2g, which indicated that all six (100%) of the performing stage teams definitely did hold an external kick-off meeting while none (0%) of the teams in other stages knew whether an external kick-off meeting was held. Due to the 0% rate of non-performing stage teams, the performing teams had an infinite percent increase, displayed as "#DIV/0!" in Table 4. The ANOVA test validates the large delta and percent increase with a large F-ratio (7.092) as well as a p-value of 0.02, which is statistically significant and can be viewed in Table 6: Survey question 2g ANOVA table below.

![Table 6: Survey question 2g ANOVA table](image)

**Treating the staff equally.** The second factor with data disparity between [Company]'s performing stage teams and teams in other stages pertains to the project manager treating the staff equally, survey question 3d. All six (100%) of the performing stage teams stated their project managers treat the project staff equally, while only 33% of the project teams in other stages felt that their project manager treated team staff equally. This equates to a 200% increase shown in performing teams when compared with teams in other stages along with an F-ratio of 5.599 and p-value of 0.04 from the ANOVA test. Both the large F-ratio and p-value less than
0.05 indicate statistical significance, as seen in Table 7: Survey question 3d ANOVA table below.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Count</th>
<th>Sum</th>
<th>Average</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>3d non-performing stage</td>
<td>6</td>
<td>21.72619048</td>
<td>3.621031746</td>
<td>0.948209562</td>
</tr>
<tr>
<td>3d performing stage</td>
<td>6</td>
<td>27.76666667</td>
<td>4.627777778</td>
<td>0.137962963</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P-value</th>
<th>F crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>3.040612717</td>
<td>1</td>
<td>3.040612717</td>
<td>5.598765663</td>
<td>0.039534745</td>
<td>4.964602701</td>
</tr>
<tr>
<td>Within Groups</td>
<td>5.430862623</td>
<td>10</td>
<td>0.543086262</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8.47147534</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Relating to the project staff.** The researcher found that the descriptive survey responses for question 3f, relating to the project staff, to vary consistently between performing stage teams and other stages. Every project manager (100%) of the six performing stage teams related to the project staff; however, only 50% of project managers on project teams in other stages did this. Performing stage teams showed a 100% increase in relating to the project staff when compared with non-performing stage teams. As seen in Table 8: Survey question 3d ANOVA table below, the ANOVA test validated these two results with a large F-ratio (7.491) and a statistically significant p-value of 0.02.
**Questionnaire qualitative data analysis.** The survey questionnaire also contained an open-ended question at the end to capture any information the respondent felt compelled to share and which may have been missed by the more structured questions. Fourteen questionnaire responses provided input to this question ranging across four general categories: observed project issues (seven), project team information (five), criticism of the survey questionnaire (one), and a recommendation to leadership (one).

The most common written-in response provided information of observed project issues. Six of the seven observed project issues indicated that the project client was providing unclear project requirements. This is outside of the project manager’s control and the researcher did not examine this further. The other observed project issue was a lack of accountability and competency. The researcher found that this observation came from a non-performing stage project team and therefore was not of significance to the scope of this research.

The second most frequent codified qualitative response contained project team information. The five responses included information such as the number of project employees, the type of project positions (software developers, system engineers, technical lead, etc.), and the

---

<table>
<thead>
<tr>
<th>SUMMARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>3f non-performing stage</td>
</tr>
<tr>
<td>3f performing stage</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source of Variation</td>
</tr>
<tr>
<td>Between Groups</td>
</tr>
<tr>
<td>Within Groups</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

---
project duration. All of this information was deemed beyond the scope of this study by the researcher.

Another written-in comment included a survey questionnaire criticism. The criticism was the non-applicability of the survey questions to that particular team; this was one of the project teams excluded from analysis by the researcher due to receiving a single project response.

The final qualitative response to the questionnaire include a recommendation to leadership. The respondent recommended that leadership "provide weekly personalized team member feedback and mentoring." The researcher found this comment useful, as it pertains to one of the isolated project manager actions: relating to the project staff. Unsurprisingly, this comment was received by a member of a non-performing stage team and the researcher incorporated this data point into the conclusions and recommendations in Chapter V.

Data Analysis Summary

This research project sent an electronically distributed descriptive survey instrument to a sample size of 127 [Company] software development team members and received 49 responses, which is a 39% response rate. These 49 responses represented 15 [Company] software development project teams; however, two projects only submitted a single response resulting in an inability to assess project team formation stage. Of the remaining 13 project teams and 47 responses, six project teams were assessed to have attained Tuckman's performing stage, six others in one of the other Tuckman stages, and one project team with inclusive survey responses. In addition to assessment of team formation stages, the researcher used the descriptive survey instrument to identify 17 common project manager actions and activities within each project. Of these 17 actions and activities, the researcher identified three actions to have statistically significant deltas when comparing [Company]'s performing stage teams against those in other
stages. These three factors include the project manager holding an external kick-off meeting, treating the project staff equally, and relating to the project staff. The researcher found that the remaining 14 project manager actions and activities did not deviate significantly enough to show a meaningful correlation.
CHAPTER V: SUMMARY, CONCLUSIONS & RECOMMENDATIONS

This final chapter provides a summary of the researcher's efforts to answer the research questions and draw conclusions from the data collected and the related studies and efforts discussed in Chapter II, the literature review. From these conclusions, the researcher presents several recommendations targeted towards [Company]'s senior leaders and [Company]'s project managers as well as suggested areas of future research for both [Company] specifically and the topic in general.

Summary

At the onset of this study, the researcher defined the primary research question as what impact does a [Company] project manager's activities and actions have upon the ability of his or her software development project team to reach Tuckman's performing stage? This question was formed by the researcher, a current project manager at [Company], while acknowledging the unique complexities of software development teams. Sawyer (2004) agrees and calls software development "an impressively complex socio-technical activity" (p. 95). The challenges that face project managers of software development teams are numerous; however, these teams share characteristics with all other project teams, such as transitioning through team formation stages as described in Tuckman's team development model. The pinnacle stage of Tuckman's team development model is the performing stage, where "role clarity has been established and genuine teamwork is taking place" (Sheard & Kakabadse, 2007, p. 548). The researcher aimed to identify any common project manager actions and activities present within [Company]'s software development teams that have correlative impact upon reaching Tuckman's performing stage through the use of three sub-questions:
• Which [Company] software development teams have reached Tuckman's performing stage?
• What are the common project management actions within [Company] software development teams?
• What is the relationship between common project management actions and the team development stages of [Company] software development teams?

In Chapter II, the researcher examined four areas of existing literature, which included 1) understanding team development stages, 2) examining popular team development models, 3) applying team development to software development teams, and 4) understanding the project manager's role within team development. The first result of the literature review process was the selection of Tuckman's group development model for team stage discussion. Moreover, the researcher concluded that an available and established tool to assess the current team stage of a project through task and process characteristics was the Group Development Assessment (GDA) tool (Ito & Brotheridge, 2008, p.215). The literature review process also narrowed down an established list of 17 common software development project manager actions and activities found by Verner and Evanco (2005, pp. 88-89). The review of related past research and literature provided the confidence for the researcher to move on to defining the research methodology.

The selected research methodology, discussed in Chapter III, was a quantitative program evaluation approach to answer the primary research question and sub-questions. The research population was [Company]'s software development teams, or about 250 individuals. [Company]'s [Division] division served as the target sample, selected by a hybrid method of cluster sampling and convenience sampling. The researcher developed and solicited a 27-
question descriptive survey questionnaire to the 127 [Division] software development team members and received a 39% response rate, or 49 responses representing 15 project teams.

The researcher presented an analysis of the data in Chapter IV. With the collected data, the GDA-based tool identified six of [Company]'s projects were currently in the performing stage of team development, four in the norming stage, one in between storming and forming, and another in the storming stage. Three teams were unable to be identified due to either receiving only a single questionnaire response or the responses showing no project team consensus.

Another section of the questionnaire enabled the researcher to isolate what project manager actions and activities were present or absent from each project team. The researcher then used descriptive statistics and an ANOVA test to analyze the data and found that three project manager actions and activities stood out when comparing [Company]'s performing stage and non-performing stage teams.

Conclusions

Based on the collected data and the information found in Chapter II (Literature Review), the researcher made three conclusions to resolve each of the study's three sub-questions. The aggregation of the sub-question's answers and conclusions enabled the researcher to conclude that some actions and activities have a positive correlative impact upon his or her software development team's ability to reach Tuckman's performing stage.

**Sub-question 1: [Company]'s performing stage teams.** The first research sub-questions asked which [Company] software development teams have reached Tuckman's performing stage? The researcher concluded that six teams, or 50%, of the twelve teams sampled with stages identified have reached Tuckman's performing stage.
The projects that reached Tuckman’s performing stage were namely Team_2; Team_4; Team_7; Team_9; Team_10; and Team_15. These teams were coded to the performing stage because they exhibited the appropriate GDA Task and Process Behaviors of Problem-Solving and Interdependence.

Sub-question 2: Project manager actions present within [Company]'s software development teams. The second sub-question asked what are the common project management actions within [Company] software development teams? Through quantitative analysis of the questionnaire data, the researcher identified which of the 17 surveyed project manager actions and activities were present within each project team. Each of the 17 project manager actions and activities were definitively present within at least three project teams.

The most common project manager action was letting the project staff know that he or she appreciates their efforts (survey question 3e). The project manager action least present on [Company]'s software development teams is gathering the project requirements in a specific method (survey question 3g). This is reflective of the pervasive use of the agile project methodology of software development by [Company]'s teams.

Sub-question 3: Relationship between project manager actions and activities and team stages. Sub-question three relied upon the answers to the first two sub-questions and asked what is the relationship between common project management actions and the team development stages of [Company] software development teams? The researcher found meaningful statistical deviation of three project manager actions and activities when comparing [Company]'s performing stage teams against the non-performing stage teams. These three factors include the project manager holding external kick-off meetings, treating the project staff equally, and relating to the project staff.
The first factor found that 100% of [Company]'s performing stage teams held an external kick-off meeting as part of their project execution while none of the teams in other stages definitively did. The external kick-off meeting "is a meeting held at the beginning of a project so that stakeholders can meet each other, review the goals of the project, and discuss further plans" (Schwalbe, 2013, p. 100). The researcher was not surprised to discover that all surveyed team members part of performing stage teams were aware of the external project kick-off meeting; however, there is some ambiguity in the data for the non-performing stage teams. The data shows that no non-performing stage teams conclusively held an external kick-off meeting; however, the response averages for all six teams were above the 2.2 threshold, indicating an unclear consensus. The researcher acknowledges that the data allows for the possibility that an external kick-off meetings was held by the project manager and that the surveyed team members were simply not aware of it. Even if this was the case, the project manager should practice good communication of project actions and ensure that all project members are aware of their external stakeholders and know that there was an external kick-off meeting held.

The second identified factor is the project manager treating the staff equally. Again, all six (100%) of the performing stage teams felt this was true while only 33% of the other stage teams agreed. This finding is intuitive on the surface; however, due to the complex dynamics present in software development teams, the researcher is not surprised that some project team members perceive unequal treatment across the team. Better understanding of the perceived unequal treatment is an area worthy of further research.

The final factor with meaningful deviation and statistical significance between [Company]'s performing stage and non-performing stage software development teams was the project manager relating to the staff. This project manager activity is a soft skill and several
studies agree that soft skills "are crucial to the success of project managers, especially during project execution" (Schwalbe, 2013, p. 232). Due to [Company]'s high-level of technology expertise, its software development project managers require higher level of technical competence when compared with many other fields. This finding suggests that the project managers must find time to maintain and improve both their technical, or hard, skills, but also their interpersonal, or soft skills in order to relate to their project teams.

Recommendations

Based on the findings of this study, the researcher's recommendations encompass three areas for [Company] management consideration. The first two directly correspond to the three activities found to affect a project manager’s team reaching the performing stage and the third is an overall recommendation relating to the value of training project managers to understand Tuckman’s stages of team performance.

**External kick-off meetings.** [Company]'s [Division] division engages primarily with government clients through formal contract agreements. Each of these project teams is bound to some degree by the contract statement of work or performance work statement to perform work for external stakeholders. Using the identified project teams in the performing stage of development, the researcher recommends [Company] leadership develop a company specific "best practices" for the timing, agenda topics, and audience for project managers to hold external kick-off meetings. This process would also include intra-team socialization which incorporates the project team in various aspects such as preparation, delivery, or follow-up from the external kick-off meeting. These actions would ensure that the external kick-off meeting is executed in a timely fashion and that project team members are aware of it and share a common understanding of the project's goals and expectations.
Soft skills training. The researcher notes that a highly technical company and project team requires a technical project manager to understand the scope and execution of the project. This researcher recommends, though, that these technical hard skills are augmented with in-house provided soft skills training to address the conclusion that treating the staff equally and relating to the staff can positively impact a software development's team development towards the performing stage. This type of training would help the project managers to understand the value of and need for soft skills even within the development of highly technical teams.

From Chapter II, the researcher found that there is a current recognition that "practice and science today agree that software project managers have to master soft skills in order to be successful" (Pinkowska et al., 2011, p. 343). One challenge to narrowing down the broad list of soft skills isolated to software project managers is that each project is different with unique project specific characteristics (Pinkowska et al., 2011, p. 347). These unique characteristics were narrowed in this research to a specific company, [Company], and found that two surveyed soft skills to be critical: treating the project staff equally and relating to the project staff.

Team formation training. Training project managers on Tuckman's stages of team performance provides project managers with the context they need to make proper management decisions. Understanding where they are on the team development continuum and how their actions affect the ability of their teams to reach the performing stage, will help project managers to connect their efforts with the performance of their teams. This type of training will encourage project managers to engage in stage-appropriate activities as they lead their teams.

Areas for Future Research and Study

While this research project's focus was to identify project manager actions and activities that impact team performance stages, future application and a secondary objective would be to
create a corporate training program for project managers to integrate those specific actions and activities into their project plans and daily leadership procedures. The question for this is what project team development course content and delivery system would be most impactful upon [Company] project managers’ activities and actions?

Due to the limited timeframe available to conduct research, data collation occurred at one time point. Further studies could overcome this study limitation by administering the surveys over a span of time to measure and better assess impact. This would account for the non-linear and dynamic team development path, as a team in the performing stage today may regress to the forming, storming, or norming stage if a team member departs or a team member is added.

Another area of interest is how does group development relate to group satisfaction? As mentioned in Chapter I, software development teams are comprised of several technical specialists which are difficult to identify, recruit, and retain. It could be useful to understand any relationship between the team’s development stage and team member satisfaction, assuming there is a correlation between satisfaction and team member retention rates. Tuckman’s stages of team performance is a valuable theory applicable to team development and warrants further study in both technical and non-technical teams.
References


PROJECT MANAGER IMPACTS ON TEAM STAGES


Largent, D. L. & Lüer, C. (2010). You mean we have to work together!?!: a study of the formation and interaction of programming teams in a college course setting. *Proceedings of the Sixth international workshop on Computing education research (ICER '10),* 41-49. DOI: 10.1145/1839594.1839603


PROJECT MANAGER IMPACTS ON TEAM STAGES


APPENDICES

Appendix A  Permission to Conduct Study
Appendix B  Survey Consent Form
Appendix C  Survey Questionnaire
Appendix A: Permission to Conduct Study

4/3/2016

Research Review Application approval/W. Dorr

Prout, Christina Leigh
Tue 3/8/2016 3:30 PM

To: Dorr, William Frederick <dorr1wf@cmich.edu>
Cc: Randall, Ench W <randa1ew@cmich.edu>; Zeh, Colleen Marie <zeh1cm@cmich.edu>

Dear William,

Your Research Review Application has been reviewed and approved. You may start your data collection. This approval will not expire as long as your topic and methodology remain unchanged. If your topic or methodology changes, please submit a new Research Review Application and supporting documents to your instructor by e-mail.

Please contact your instructor if you have any questions. Also, be sure to check with your instructor concerning the due dates for your project.

Good luck with your project. This is the only notification you will receive. Please keep a copy for your records.

Kim Gribben
Assistant Director, MSA Program

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https://outlook.office.com/owa/ViewMessageItem?ItemID=AAMIAJiZ2kYYhIe-5mI4NDwZiDAnQ2IWjLyMmlSnmE2Zm14MGBGAAA... 1'1
PROJECT MANAGER IMPACTS ON TEAM STAGES

[Company] Permission letter removed
Appendix B: Survey Consent Form

Study Title: Project Manager Impacts on Team Performance
Investigator: William Dorr, MSA Program, dorr1wf@cmich.edu
Faculty Monitor: Dr. Erich Randall, randalew@cmich.edu

Introductory Statement
My name is William Dorr and I am a graduate student at Central Michigan University. As part of my research, I am examining a project manager's impact on team performance at [BLANK].

As a part of the [BLANK] or [BLANK] division, you are receiving this survey invitation. I am inviting you to participate in this research study by completing a brief online survey. The data collected will provide useful information regarding project manager's impact on team performance. If you would like a summary copy of this study please send an email to me at dorr1wf@cmich.edu (it is not necessary to complete the survey in order to receive a copy of the results). Completion of the online survey will indicate your willingness to participate in this study.

What is the purpose of this study?
The purpose of this study is to gather data about the actions and activities a project manager at [BLANK] and their impacts upon team performance.

What will I do in this study?
If you consent to take this study, you will open the link to an online survey that is found at the end of this document. All answers will be anonymous because no names or job titles are asked for in the survey. Surveys will be completed and submitted online through the link at the end of this document. The researcher will compile the data and draw some conclusions that will be available to all participants.

How long will it take me to do this?
This survey will likely take you less than 10 minutes to complete. It can be taken any time until the survey deadline of March 18, 2016 at midnight. There is no advance preparation needed. The short time spent taking this survey should be completed during personal time.

Are there any risks of participating in the study?
Although the researcher supervises or works with some of the participants, this survey will in no way impact your position with the company as I will have no way of knowing who participated and who did not. Participants are assured that their responses are anonymous. Participation is voluntary and opting to participate or not will have no effect on your job or position with [BLANK]. For those who participate, no risk or discomfort is anticipated.

What are the benefits of participating in the study?
The benefits to participating in the study are that the participants will be assisting researchers in learning about [BLANK]'s project manager's and team performance. This will ultimately help [BLANK]'s leaders better meet the needs of all employees.

Will anyone know what I do or say in this study (Confidentiality)?
All surveys are anonymous. I will see each survey, but will not be able to identify who
completed it. The project will be shared with my faculty monitor. Data will be compiled and a
copy of this study will be provided to the leadership team at [redacted].

**Will I receive any compensation for participation?**
There is no compensation or fee to be paid to any participant in this study. Participation is
voluntary.

**Is there a different way for me to receive this compensation or the benefits of this study?**
No; there is no compensation for participating.

**Who can I contact for information about this study?**
For more information about the study, you can contact the researcher, William Dorr with the
following contact information:
  William Dorr, (redacted) - (redacted) or by e-mail at dorrw@cmich.edu
  Alternatively, you may e-mail my project advisor at randalw@cmich.edu

Please note that if you are not satisfied with the manner in which this study is being conducted,
you may report (anonymously if you so choose) any complaints to the MSA Program by calling
989-774-6525 or addressing a letter to the MSA Program, Rowe 222, Central Michigan
University, Mt. Pleasant, MI 48859.

**Additional Information**
You are free to refuse to participate in this research project or to withdraw your consent and
discontinue participation in the project at any time without penalty or loss of benefits to which
you are otherwise entitled. Your participation will not affect your relationship with the
institution(s) involved in this research project. This survey should be completed during personal
time and a copy of this study’s results will be shared with the [redacted] leadership team.

*Clicking on the survey link below implies my consent to participate in this research. This copy
of the form is for me to keep for my records.*

**CLICK THIS LINK TO BEGIN THE SURVEY:**
https://[redacted].typeform.com/[redacted]

*Thank you for your participation!*
Appendix C: Survey Questionnaire

Survey Questions for Software Development Project Team Members:

The survey URL is: https://surveyURL

Project Team Survey

Please spend 10 minutes sharing with me your observations and experiences as part of a [Company] Team

As a reminder, all survey responses are completely anonymous and this survey should be completed during personal time.

For the purpose of this survey, please identify one [Company] project for which you are/were a team member or manager: (1):

Please type in the project name/acronym. If you are a member of multiple projects, please select the project you spend the most time supporting. You are invited to complete this survey again if you are a member of more than one project team.

SD = Strongly Disagree // D = Disagree // N = Neutral // A = Agree // Strongly Agree

---

### Please answer these seven Yes / No questions.

<table>
<thead>
<tr>
<th>Question</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a. Does the project have an assigned project manager?</td>
<td>No</td>
<td>Unsure</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2b. Has the project had the same project manager since inception of the project?</td>
<td>No</td>
<td>Unsure</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2c. Has the current project manager previously led software development projects?</td>
<td>No</td>
<td>Unsure</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2d. Does the project have daily stand-up meetings?</td>
<td>No</td>
<td>Unsure</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2e. Did the project manager explain the project goals and vision to the team?</td>
<td>No</td>
<td>Unsure</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2f. Did the project manager hold an internal kick-off meeting?</td>
<td>No</td>
<td>Unsure</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2g. Did the project manager hold an external kick-off meeting?</td>
<td>No</td>
<td>Unsure</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### About the project: Please assess how much you agree or disagree with the following statements:

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a. You have a good sense of the project's goals and vision</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>(Please skip if the project does not have daily stand-up meetings)</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>3c. The project manager delegates authority</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>3d. The project manager treats the staff equally</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>3e. The project manager lets the staff know he/she appreciates their efforts</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>3f. The project manager relates to the staff</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>3g. The project requirements were gathered in a specific method</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>3h. The project manager directed the requirements gathering method</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>3i. The requirements were complete and accurate at the project's start</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>3j. If not complete at start, the requirements were completed later</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
</tbody>
</table>
About the project team: Please assess how much you agree or disagree with the following statements:

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>4a. The project team's expectations of me were unclear</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>4b. Criteria are established for fair evaluation of my project outcomes</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>4c. There are few, if any, 'hidden agendas' within this project team</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>4d. When problems arise, our project team often generates creative solutions</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>4e. Project team members frequently ask for direction of one another or the project manager</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>4f. Project team members tend to resist being led</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>4g. Project team members tend to have harmonious relationships with one another</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>4h. I am willing to risk expressing new ideas and trying new behaviors in this project group</td>
<td>SD</td>
<td>D</td>
<td>N</td>
<td>A</td>
<td>SA</td>
</tr>
</tbody>
</table>

Please list anything else that you feel may be important relating to the project team: