2023

Globally Distributed Teams: The Between-team Barriers That Impede The Successful Delivery Of Agile Software Development

Ben Park
University of Central Florida

GLOBALLY DISTRIBUTED TEAMS: THE BETWEEN-TEAM BARRIERS THAT IMPEDE THE SUCCESSFUL DELIVERY OF AGILE SOFTWARE DEVELOPMENT

by

BEN PARK
M.S.EM University of Central Florida, 2011
B.S. CpE University of Central Florida, 1991

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
In the Department of Industrial Engineering & Management Systems
in the College of Engineering and Computer Science
at the University of Central Florida
Orlando, Florida

Spring Term
2023

Major Professor: Timothy Kotnour

ABSTRACT

Software development projects fail far too often, costing companies billions in revenue, loss of the intended purpose and damage to both customers and suppliers in the process (A. Shenhar & V. Holzmann, 2017a). Understanding the challenge of ever-failing globally distributed software development projects is the goal and research conducted in this dissertation. The vision guiding the direction of this research is “What are the between-team barriers that impede the successful delivery of Agile software development in Globally Distributed Teams?” Through the literature review, a model was created and refined. A Mixed-Method Sequentially Replicated Case Study Research was performed to determine within-case and cross-case findings. The research covers five replicated cases from various industries, including Food & Beverage, Oil & Gas, Insurance, and Healthcare. Using a Thematic Analysis process, the project leadership was questioned and interviewed. The results of the qualitative research were compared and contrasted with Likert data collected from the team members. Analysis performed included significant qualitative findings, most impactful factors, and alignment between the leaders and team members. The research found that all factors can be vital enough to cause a project to fail. The research found that the process factor is significantly less impactful than initially thought, and the people (the team) factor are clear success criterion. The research provides value to current and future project owners by providing them with criteria to evaluate their projects. The evaluation against criteria allows a project owner to adjust or create the conditions for success. Future research should be capable of expanding on this research by creating practical guides and specific tools for project creation where the projects have a greater success rate.

This work is dedicated to my wife, Lynn, and son Bradley. Without Lynn, I would not have made this journey. Without Lynn, I would not have completed the journey. Without Lynn, I would not have developed into the person I am today. College started for me with Lynn marking up my papers and reading my English reading assignments to me. As my tutor, coach, friend, and partner for life, I am truly blessed that God brought her into my life.

Bradley has challenged me to be better than I could ever be throughout my life. From soccer coaching, where I needed to learn how to teach little ones to play as a team; to Boy Scouts, where I needed to learn how to teach boys to become men as a scout leader; to Law School, where I had to learn to let my son grow up and accelerate right past me. The challenges along the way have been formative to my life, forcing me to become a better version each time. Without Bradley, this journey would not have started, let alone completed.

ACKNOWLEDGEMENTS

I want to thank several people for their help and support during the production of this dissertation.

Words cannot express my gratitude to Dr. Kotnour, Committee Chair, for his patience, advice, and guidance through this process and life. Dr. Kotnour has been instrumental in my development from the beginning of my master's degree through completing my Ph.D., always encouraging and leading me to the right path. Without Dr. Kotnour, this journey would not have been possible.

The Doctoral Advisory Committee has been advising me for many years during this journey. Through retirements and even COVID, this team provided excellent guidance, suggestions, and critical feedback that this dissertation would not have been possible without them.

Computer Task Group and especially the management team have made the dissertation project possible by supporting the study efforts that made the Pilot Study and many of the case studies feasible. Brent Laycock's support has been encouraging and supportive in anything I needed to complete the project and dissertation. The Pilot Study team was very encouraging and supportive during the pilot process and provided the feedback necessary to make the dissertation project successful.

Finally, I would like to acknowledge my family's hard work and suffering during the lengthy process. Without their love and support, this journey would have ended much differently and certainly would not have been successful. Thank you all for the strength you gave me through it all.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER ONE: INTRODUCTION

The Challenge

Every project is governed by cost, schedule, and technical constraints, commonly known as the Iron Triangle, Project Management Triangle, or Triple Constraint Theory. Given this, every project is a compromise. Spend more money or less, make the project more technically sophisticated or straightforward, shorten or lengthen the time to deliver the desired features the customer is paying to receive. Businesses continuously evaluate productivity methods, identifying barriers to success to deliver more in less time for less cost.

Software development projects fail far too often, costing companies billions in revenue, loss of the intended purpose and damage to both customers and suppliers in the process (A. Shenhar & V. Holzmann, 2017a). NASA's Mars Climate Orbiter was famously lost due to the failure to use metric units in the software (Sauser, Reilly, & Shenhar, 2009). The cost to the Jet Propulsion Laboratory (JPL) and the prime contractor, Lockheed-Martin, was immense in both dollars and reputation. In 1986, NASA's Challenger Space Shuttle exploded shortly after takeoff, the failure blamed on an O-Ring seal failing. The Hubble Space Telescope (HST) was slated to be launched in this period of time but was delayed. NASA put the space telescope in orbit in 1990 and soon discovered the optics were off; in essence, the telescope needed spectacles (A. Shenhar & V. Holzmann, 2017b). The reputation hit and cost to NASA were significant. These visible examples, whether due to technical failure, massive cost overruns, or schedule delays, impact the government, the developing company, and every person that worked on the project.

While the above project failures are not software-specific failures, software failures can have the same reputational impact. Recently, Boeing launched a rocket to test for the return to human-crewed flight. The rocket shut down prematurely, not reaching the desired altitude. Newspapers reported the reason for the failure as a software error. Specifically, it was reported that the software was reading the wrong clock. This was just one of the 35 identified software issues (Harwood, 2020). Combine the Boeing Starliner issues with the previous Boeing 737-Max aircraft software issues, and the company will reportedly lay off about 12,000 employees due to the negative business impacts. Understanding the causes, structures, and key factors impacting software development projects is challenging.

The Research Scope

An immense number of conditions can cause a project to fail. External factors such as contractual misalignment with execution, lack of managerial support, and misalignment of developers with customer expectations are just a few that can quickly scuttle a project. Numerous internal factors exist as well, which can cause projects to fail. Success in a locally organized small agile team using DevOps (continuous integration, continuous delivery, and automated testing) has proven it can be successful when well run. As teams scale up, communication, interpersonal dynamics, and several other factors have been shown to impact team effectiveness (Boehm & Turner, 2005). Globally Distributed Teams (GDT) at scale have the same challenges as locally scaled teams, plus the additional challenges of time and distance.

Experience gained from more than 30 years of software development and management by the researcher has demonstrated that many factors control and influence the success

or failure of a software development project. External influences**,** such as unmanaged change to current work, poorly written contract vehicles, and misaligned customer expectations, are regular and significant influences impacting a team, software development, and the success or failure of the project. Internal factors can also contribute to project failure, from the lack of process adherence to making poor technical choices to poor team management and leadership (Shenhar, 2004). While this paper will focus on the unique challenges of GDT, the data, knowledge gained, tools applied, and results identified should apply to most software development projects.

With software development projects becoming more complex than ever, many businesses are looking to reduce their labor costs while creating products faster. Some companies are looking to build the product using cheaper labor, while others go global to find an available and qualified workforce. Regardless of the initial reason, labor, or workforce, and what is being created, businesses need their teams to succeed. Too often, these teams fail over a short period of time. The successful usage of globally distributed software development teams has proven difficult for many companies in many parts of the world. With an idyllic goal of reducing labor costs and developing software on a continuous cycle, the panacea of GDT has proven to be elusive (Ghafoor, Shah, & Rashid, 2017). The image that comes to mind for a Globally Distributed Team is typically an image with pockets of teams spread across the globe. While this is the idyllic desire, GDT, for the context of this paper, refers to any distributed development team that is separated by space, buildings, locations, or time zones.

The idyllic goals of cheap labor and continuous development are elusive primarily because team performance is multi-dimensional. It is based on unique people and

therefore results in unique teams. The dimensions that make up the team's ability to perform are directly tied to each team member's personality. The person-fit to the team impacts the cohesiveness of the team and the overall team performance (Driskell, Salas, Goodwin, & O'Shea, 2006). Significant variables such as trust, knowledge of business, skillset knowledge, development process, continuous integration/continuous deployment, automated testing, and other essential factors influence team culture and performance. An agile scrum team's (a sub-team to the whole development team) individual performance impacts the other teams in a similar but aggregate way as each individual impacts the scrum team. The scaled development team (the set of scrum teams), working together or distributed, contributes to the quality, on-time, on-budget delivery to meet the customer's needs. The degree of alignment of the team of teams governs the overall project performance or success.

We have all seen teams that cannot get anything done, and we wonder where the problem lies. If you have ever seen high-performance teams, they can be amazing. Regardless of the team's current performance, understanding what governs performance is key to identifying, monitoring, and correcting issues. As a research question, the work herein asks, "What are the between team barriers that impede the successful delivery of agile software development in globally distributed teams?"

Sink and Smith define performance as consisting of seven interrelated and interdependent criteria, which are 1-effectivity, 2-efficiency, 3-productivity, 4-quality, 5-quality of work-life, 6-innovation, and 7-profitability. Based on Sink's definitions, this work mainly focuses on the effectiveness of the interactions between globally distributed teams, which is the measure of actual output versus expected output (Sink & Smith Jr,

1994). However, other research defines other measures for success. Measuring value to the customer provides a definitive factor of interest to measure the performance or output of a GDT.

When considering what can and does affect the effectiveness within or between teams, one must analyze which factors are impacting just the local team and how these teams interact when brought together. The "With-in" team or individual local team factors can be categorized into Process, People, Organization, Technical/Project, and Team Leadership groups, as shown in Figure 1 below. These local team factors combine to constitute the Team Practices for delivering value to the overall global team.

Figure 1: Factors to Characterize Team Effectiveness

Which factors impact the combined globally distributed team? How do the teams align when brought together? When analyzing teams separated over time and distance, what are the differences in the teams? Studies regarding how to fix an individual Agile Scrum team are widely available, as well as coaches and consultants to fix any local team issue imaginable. However, there is no one fix to the issues exaggerated by time and distance. The barriers to success can collapse the team, delay product delivery, and break the organization. These between-team barriers are the combination or alignment of the individual teams plus the between-team barriers, as depicted in the figure below, "Barriers to Success."

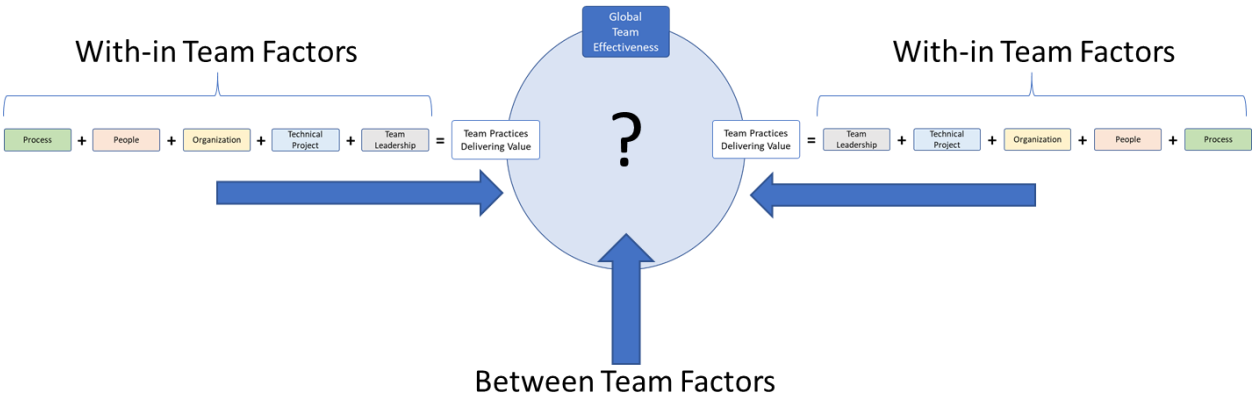


Figure 2: Barriers to Success

Regardless of the team size, the structure of the team, the varying capabilities of the team, and the distance between the teams, the barriers to building and running a successful team have to take the “with-in” and “between” team factors into account for success.

Conceptual Model

The factors that make up the categories must be bounded to define a conceptual model. These bounded categories are then applied to the specifics of the agile software development team. With each team modeled into the team practices delivering value, the team's interaction creates either alignment or a barrier between the team. The barriers can be identified by category and factor. The hypothesis is that by eliminating these barriers on a factor-by-factor basis, the distributed teams become aligned such that they create a potentially successful distributed team, as shown in the conceptual model below (Figure 3). If and when the teams are not aligned, the adjustment and control mechanisms of the degree of dispersion, media richness, architectural modularity, and leadership are

the tools for mitigation used to bring the global team back into alignment, creating an effective running team that delivers value to the customer.

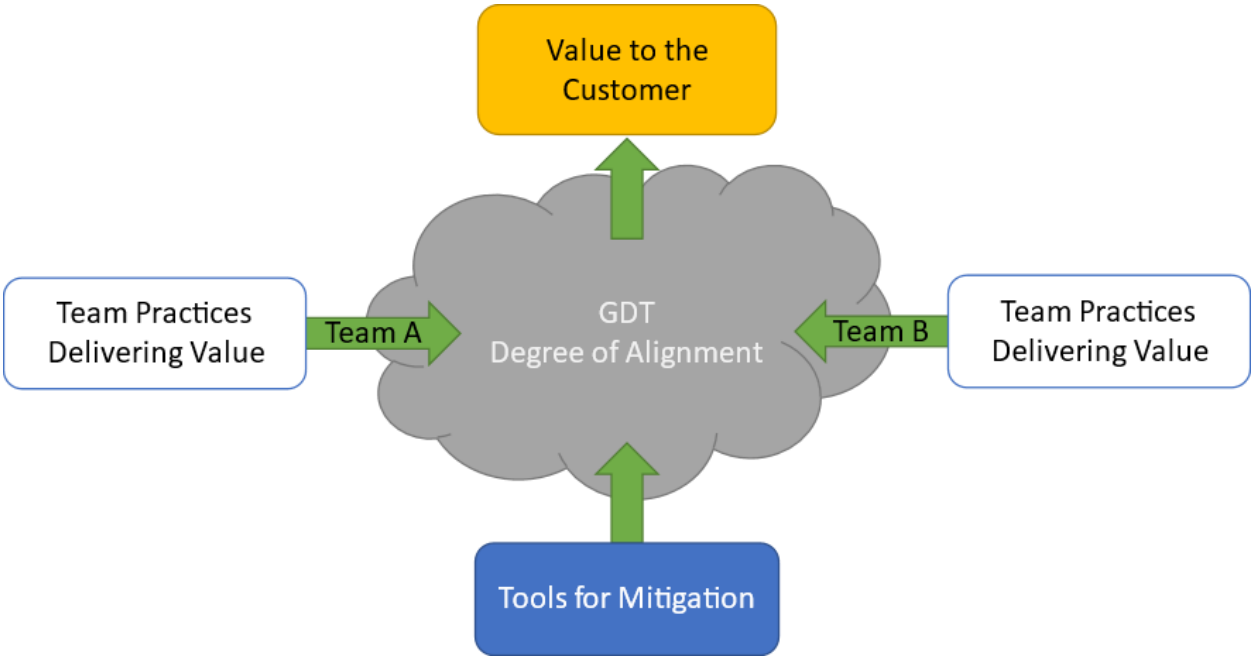


Figure 3: Distributed Team Conceptual Model for Delivering Value to the Customer

Research Questions

1. What are the between-team barriers that impede the successful delivery of Agile software development in Globally Distributed Teams?
    a. What are the controlling factors that impact the performance, productivity, or effectiveness of globally distributed agile software development teams?”
    b. What are the between-team barriers that impede successful delivery?
    c. Which key factors control the impact on a project?
    d. Why do these factors impact the project?

Hypothesis for the Conceptual Model

1. Given effective individual teams, eliminating the between-team barriers to success will align the distributed teams allowing them to deliver more value to the customer.
2. Using the tools for mitigation as adjustment mechanisms, acting on the global team, can increase the degree of alignment, thereby producing more value to the customer in a given period of time.
3. Any individual sub-factor of the team practices for delivering value significantly different from another team's value will impact the GDT Degree of Alignment.

Assumptions

1. Success occurs when the variance of internal team performance is not significant enough to impact the between-team barriers, and the between-team barriers are managed within acceptable parameters.
2. Minor or non-major factors can be mitigated and maintained locally within the smaller team, thus eliminating a barrier to the globally distributed team.
3. Anyone individual team factor taken to an extreme can cause a between-team barrier.
4. Architectural Modularity, Degree of Dispersion, Media Richness, and overall team-to-team alignment are the leading factors in developing a productive and successful operation of globally distributed teams.
5. Architectural Modularity is much more significant than the Degree of Dispersion or Media Richness on any given project such that the adverse effects of low Architectural Modularity cannot be overcome.

6. As the Degree of Dispersion increases, Media Richness must also increase for a constant Architectural Modularity.
7. For a static Degree of Dispersion, an increase in Media Richness can be used to mitigate limitations in Architectural Modularity.

The Context for the research

The globally distributed software development team comprises a set of scrum teams working as distributed teams to contribute to the quality, on-time, on-budget delivery to meet the customer's needs. The degree of alignment and effectiveness of the set of teams governs the overall project performance (Sink & Smith JR, 1994). When the barriers to success are significant, they can collapse the team, delay product delivery, and break the organization. Understanding which factors impact the combined globally distributed team and how the teams align when brought together is key to success. Issues are also exaggerated by time and distance. These between-team barriers are the combination or alignment of the individual teams plus the “between-team” factors.

Between Teams Factors

The “with-in” team factors focus on the execution of segments or parts of the whole. The "between" team factors concentrate more on the interaction and alignment of the sections or parts. These factors ensure a smooth integration, parallel operation, and quick resolution to issues for these complex projects. The authors, Shenhar and Holzmann, distilled managing complex projects into three key factors, “clear strategic vision, total alignment, and adapting to complexity” (A. Shenhar & Holzmann, 2017). The implications for projects from this research are significant. Shenhar and Holzmann’s key factors take

a leadership perspective on what is needed for success. The between-team factors are a leader's implementation measures to view the complex project's execution state. Architectural Modularity, Degree of Dispersion, and Media Richness are proposed to fulfill the similar role of smooth integration, parallel operation, and quick resolution for complex projects.

Architectural Modularity

Architectural modularity can significantly impact the between-teams' relationship, capabilities, and success. A monolithic application can work with a small individual team because the team can work together to accomplish the goal of adding features. As the team grows, the modularity needs to increase proportionally to allow each sub-team to operate in a semi-independent mode where they can test their features in total. Modularity promotes independence and parallelism without cross-coupling impacts. The computer science principles of tight cohesion and loose coupling are taught in computer science curriculums. A loosely coupled system with cohesively designed modules provides the core principle of architectural modularity. The more cross-coupling between modules, the more communication between teams is required, and the more the chances for miscommunication and errors. “Architectural Modularity occurs neither automatically nor by management decree. It is an all-encompassing project management practice requiring vision and leadership; synergy is gained from a systematic application of tools and practices by everyone involved” (Blackburn, Hoedemaker, & Van Wassenhove, 1996).

Degree of Dispersion

The geographical dispersion of teams plays a significant role in the physical ability to communicate over time and distance (O'Leary & Cummings, 2007). While they can be overcome, these factors impede an effective development team. Figure 4 - Overlapping Work Hours Shows the Degree of Dispersion and visually demonstrates the impact of working East to West across time zones.

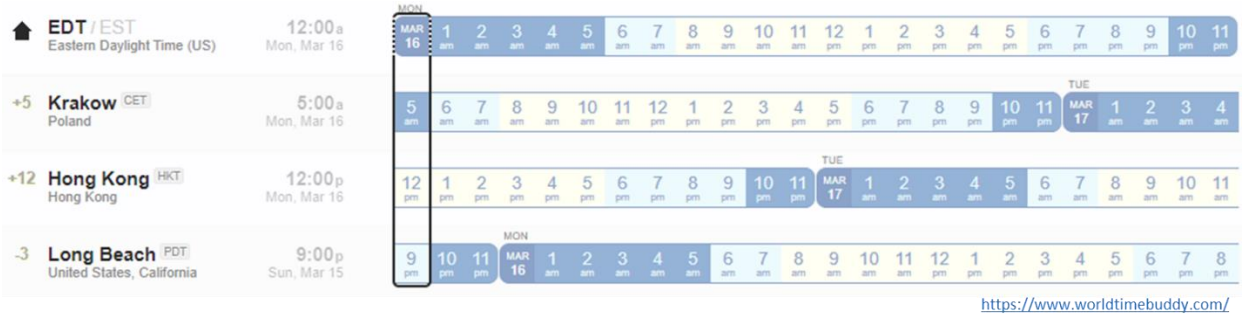


Figure 4: Overlapping Work Hours Shows the Degree of Dispersion

The degree of dispersion is a crucial concept for globally distributed teams. In the figure above, the yellow highlighted time is "work hours." Work hour overlap makes communication much more manageable. In the picture above, it is simple to discern that the Hong Kong and Poland teams do not significantly overlap with the leading East Coast US (EDT) team.

Media Richness

Various studies show that communication drops significantly over distances as short as 50 meters (Carmel & Agarwal, 2001). This is even true when they have ubiquitous communication tools such as Skype, Hipchat, Discord, or Slack. What hinders a teammate on Team A from talking with a teammate on Team B or C? Communication

media richness is one of the critical factors that can help overcome the impact of time and distance (Daft & Lengel, 1986). Richness differences in media include the medium's capacity for immediate feedback; chat is richer than email, video is richer than chat, and face-to-face reigns supreme. Media richness increases in its usability, as shown in Figure 5 - Media Richness Over Infrastructure; this can lessen the impact of the distance. However, there are limitations to what technology and infrastructure can do to overcome time differences.

Figure 5: Media Richness Over Infrastructure

Communication media richness is directly dependent on an ever-present infrastructure. Without high-speed connectivity, the Richness of the media is significantly impaired (Daft & Lengel, 1986). Within a team, there could be excellent communication capabilities and ubiquitous infrastructure, but without standard tools and datasets indicating what work should be performed, the teams could struggle to identify, communicate, and execute the right work at the right time. For example, how are the tools populated with a backlog of work if one team uses Rally to identify and manage work and another uses Atlassian's Jira product? How is the work coordinated? How are the tools synchronized? Even when the tools are the same, say Jira, in both locations, if the working dataset is not coordinated

between the sites, the work is not coordinated. From this, miss-communications will likely occur.

Team Practices Delivering Value

When considering what can and does affect the team-to-team or between-team effectiveness, one must analyze which factors are impacting just the local team and how these teams interact when brought together. Team Practices Delivering Value summarized the local team factors that impact the overall effectiveness of a team. These “With-in” team factors relate to those factors that are prevalent within a localized team. The elements or characteristics are summarized into factors. The “With-in” team factors can be categorized into the process, people, organization, technical/project, and leadership factors, as shown in Figure 6 below. The following sections provide a breakdown and definition of the sub-factors that comprise each "With-in" team factor.

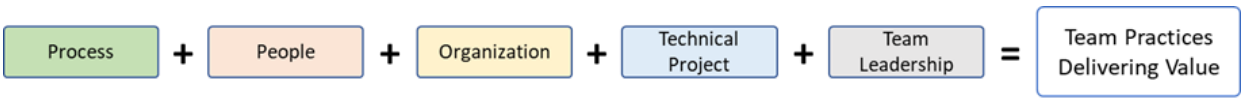


Figure 6: Factors to Characterize Team Effectiveness

As the factors are defined, examples for many are provided to demonstrate the impact within and between teams. While these “With-in” team factors impact the individual team's effectiveness, in many cases, the particular factor can cross into the between-team space, causing a reduction in the overall effectiveness.

Process

Traditional software development is classically known as waterfall development. The waterfall style is coined from the typical picture of the process model, which shows work flowing from stage to stage as each body of work completes. Modern software standards deem the process slow and cumbersome (Cohn, 2019). In 1995, Ken Schwaber, Jeff Sutherland, and several others created the Agile Scrum Framework to address the perceived shortcomings of waterfall development.

The methodology prescribes short iterations of work with frequent checkpoint reviews to ensure the development is in the right direction. Agile Scrum attempts to maximize the verbal communication skills and quick decision-making of small groups to move fast as a team. The methodology outlines several time-boxed elements for easy control of a process, depicted in the figure below, Figure 7 - The Agile Scrum Framework.

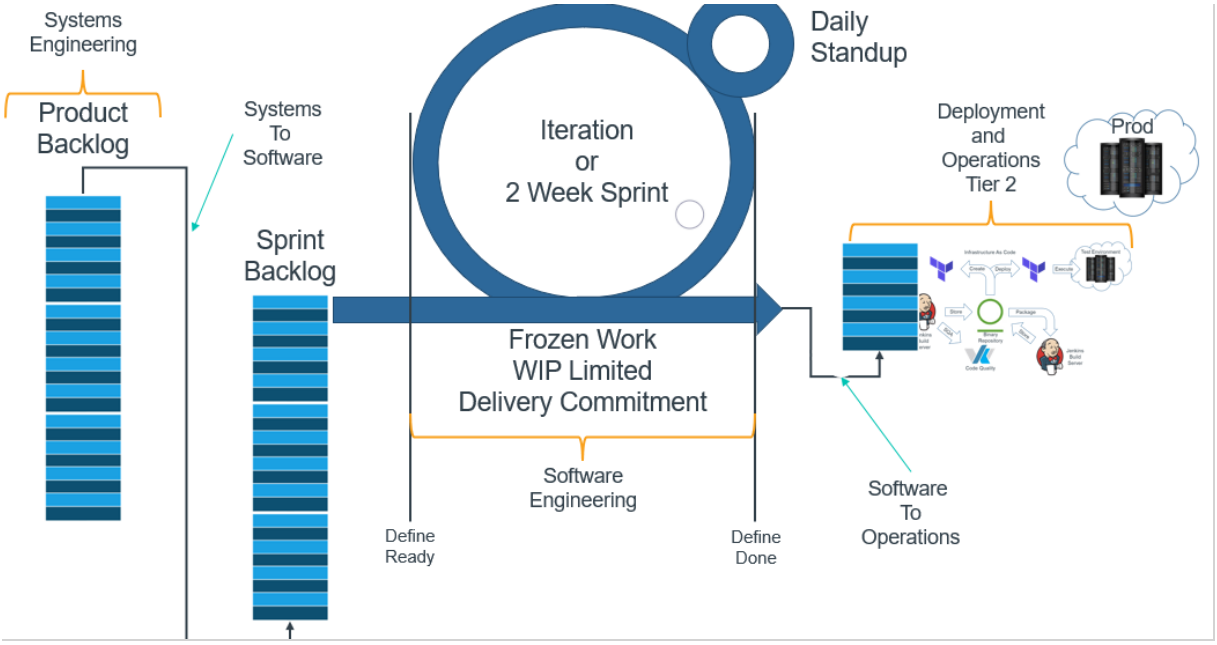


Figure 7: The Agile Scrum Framework (Schwaber, 2004)

The Agile Scrum process has been shown to work well for small teams, where the Agile Manifesto fits best (Schwaber, 2004). The Agile Manifesto is a 12-point treatise that embodies the Agile Scrum Tenant outlined in Table 1 below. The creators of Agile did not articulate nor include test and production methodologies. Partially, this could have been due to the state of production equipment at the time. Regardless of the reasons, Agile only defines the creative aspects of software development.

Table 1: Agile Scrum Tenants

Individuals and interactions	Over	Processes and tools
Working software	Over	Comprehensive documentation
Customer collaboration	Over	Contract negotiation
Responding to change	Over	Following a plan

In several books, Gene Kim proposed an automated test and delivery solution that includes the software development and operations teams called DevOps as an extension of the Agile Scrum process. DevOps applies lean principles to the development process and includes the operational environment consideration throughout the process (Kim, Behr, & Spafford, 2014b). DevOps is being adopted throughout the industry and shows tremendous value for delivering improved quality in shorter periods. DevOps, as defined by Gen Kim, comes directly from the concepts explained by Dr. Eliyahu Goldratt's Theory of Constraints. Teams using Agile and applying DevOps, as shown in Figure 8, are significantly more effective than any software development team that works in a development-only environment.

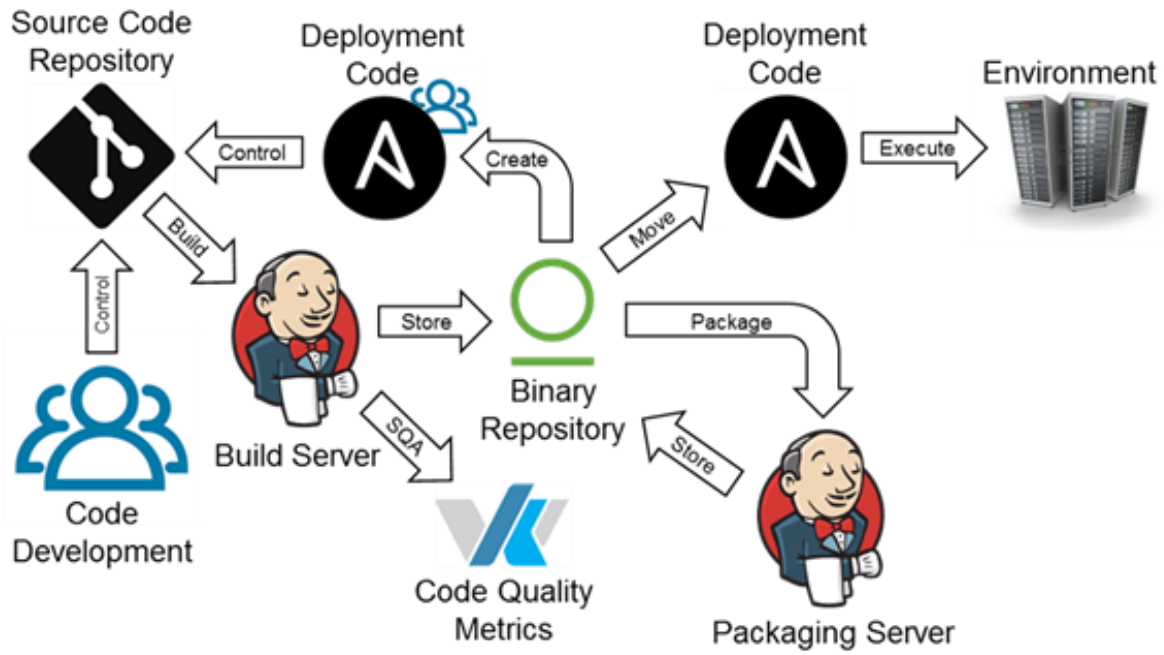


Figure 8: Example DevOps Pipeline Flow

Agile Scrum teams are generally made of five to nine team members. When developing large-scale products, there may need to be five to nine teams or more. Effecting scaling, managing, and keeping all the teams on track is a significant issue even when all teams are co-located. There are many Agile scaling processes from SAFe, LeSS, DAD, Scrum of Scrums (SoS), and more (Dolman & Spearman 2017). Now, spread the team(s) over time and distance. Experience shows that many teams fail in short order without a better understanding of the success and failure factors and better models, processes, and tools to manage these conditions. Many scaled teams fall behind schedule and never recover, or they never have the efficiency of their smaller selves. Scaling Agile over distance, time, and culture has unique challenges that add to the challenges of scaling locally (Carmel & Agarwal, 2001). Based on the teams' relative velocities, what agile and lean principles can be applied to correct the team performance to cross the barrier to success?

People

The People factor includes all the sub-factors that define a person and their interaction with others. Social and cultural factors (language, customs, idioms, religion, etc.) impact how we react and interact with others inside and outside our group (Hofstede & Hofstede, 2005). Knowledge and understanding of these factors are critical in building bonds between teams in different locations. "Cultural differences often exacerbate communication problems, and because software development requires rich communication, the lack of this can lead to misalignment and rework" (Holmström, Fitzgerald, Ågerfalk, & Conchúir, 2006). The barrier is encountered when one team member or team attempts to communicate effectively with another team member or team and does not consider their teammates' social and cultural factors. In his book, “The Five Dysfunctions of a Team,” Lencioni describes trust as a foundational need. Figure 9 shows Trust as a Foundational Need as the base layer, where each layer builds to better performance results for the organization.

Figure 9: Trust as a Foundational Need (Lencioni, 2002)

Regardless of the team size, structure, varying capabilities, and distance between the teams, the barriers to building a successful operational model can be broken down, as shown in the graphic above. As defined by Lencioni, trust is the foundation of all working relationships. Google's Project Aristotle defines the condition described by Lencioni as physiological safety (Schneider, 2017) and states that it is the dominating factor that allows a team to be successful. Newell, David, and Chand also found that social and cultural factors other than national culture influenced the level of trust in the relationship (Newell, David, & Chand, 2007). Amy Edmonson of Harvard University defines team physiological safety as going beyond interpersonal trust, stating that "it describes a team climate characterized by interpersonal trust and mutual respect in which people are comfortable being themselves" (Edmondson, 1999).

To punch through this barrier, and create effective communication, developing an understanding of the social and cultural factors that drive the team(s) is required. Developing this understanding enables more appropriate responses and elicits more appropriate questions, which in turn builds trust between the teams (Patterson, 2012). Just as a team must overcome individual social and cultural differences, so does the team of teams to overcome the barrier between teams. What social and cultural factors impact the project, and how can these factors improve the team's performance to overcome the barrier to success?

Organization

The organizational factor is categorized by sub-factors, such as management's ability to provide facilities and support for the team. Support includes the availability and reliability of power and the internet, the availability of the physical hardware and software tools to

execute the work and collaborate within the team and between teams, and the labor laws and regulations controlling work. Power is not nearly as reliable in some countries as in North America and Europe. Commodity computing equipment that North America takes for granted is not prevalent in all countries. Anecdotally, from a past project, a standard Dell workstation or laptop that we could order over the internet in the United States was unavailable in São Paulo, Brazil. Additionally, the internet to São Paulo, Brazil's work facility, was inadequately slow and occasionally dropped out. In some authoritarian countries, China, for example, the internet can be cut off at any given time, preventing communication with other global teammates.

Ubiquitous infrastructure is defined as the availability and reliability of power and internet systems. With a co-located local team, the internet's impact on providing inadequate speed or reliability may be minimized. In contrast, this same level of service may have a more considerable effect on the between team's ability to communicate. The ubiquitous infrastructure extends beyond internet capabilities to things such as mass transit to get to work reliably, roads to support traffic demands, consistent lighting and power, availability of assets such as computers, and even quality of life issues such as air quality supporting a healthy life. Without the ability to get to work, work in a healthy environment, and consistently get work accomplished, the team will not be able to keep pace with their partnered teams worldwide.

Tooling is the hardware and software needed to execute the work and collaborate with teammates. In general, commodity computing equipment and associated software is readily available in areas where one would establish a team or the location would not be considered for use. However, other tools are less obvious and just as necessary. When

the system being designed and built requires specialized hardware such as FPGAs, algorithms defined in the United States, or other specialized software, there may have to be significant consideration given to the location of the teams that work to build the system. Many hardware components and associated software algorithms are controlled by the United States Department of Commerce Export Administration Regulations (EAR) and or by International Traffic in Arms Regulations (ITAR). Many software and hardware technologies commonly used to keep information private are controlled under ITAR and EAR regulations as dual-use technology (Commerce, 2020). Following these regulations means that while it is used in the United States, it may not be exported to other countries without an analysis of whether an export license is required. Following a review of the system being developed by an export control compliance expert, architectural modularity and location decisions could be adjusted so that it is easy to comply with the regulations. Immediate and significant barriers can arise due to ITAR and EAR changes by the US Department of Commerce. They watch the current world situation and adjust the regulations for licenses accordingly.

Workforce unionization, as defined here, encompasses the government regulations, labor laws, and contractual obligations that impact or control work conditions and time. This factor encompasses several minor factors that, when combined, can create significant issues for teams to stay on schedule. At times, workforce unionization has been seen to impact between-team effectiveness. This factor includes sub-factors such as overtime work, hiring, and firing policies, compensation, and after-hours contact policies. For example, Polish labor law limits the overtime permitted to work to 8 hours per week and 150 hours per year for typical software development-type employees (Dudkowiak, 2020).

Imagine a team on the US East Coast trying to get a quick answer to a roadblocked issue from the team in Krakow, Poland, later in the US Day. The issue requires the Poland team member to log in, make a fix or change, and re-check-in his/her source code. Later in the US Day, the Krakow team member has gone home. The example occurred on a recent project. The Poland team's HR/Legal work policies did not permit requesting an employee to come into work after hours or work late to support a deadline except under stringent conditions (Dudkowiak, 2020). Issues such as this example will occur. Accounting for HR/Legal type issues helps to elevate the barriers from growing or even forming.

Factors in this space should be reasonably predictive and constant. Once they have been considered, issues worked through, and the negative factors are fully accounted for or mitigated, the impacts on the team and overall system of teams should be understood. Aligning the physical and infrastructural factors will not eliminate the barriers within or between teams. However, not accounting for these factors will likely create a barrier between teams that will significantly decrease the overall performance of the set of teams. What physical and infrastructural issues are impeding the team’s performance? What steps are needed to break down the impediment? How can the available infrastructure be used to cross the barrier to success?

Technical/Project

Technical/Project includes such items as skillset knowledge, concept of operations (ConOps) knowledge, process alignment, and directional or project alignment. Experience shows that unequal technical factors force a superior-subordinate relationship between the groups. This uneven footing for independently operating teams creates

barriers to success in many cases. Until all teams are on relatively equal footing, the operation as a team of teams will be hindered.

The concept of operation knowledge is the domain knowledge relative to how the customer will use or interact with the product or service. It is the understanding of the customer, their needs, their desires, and their goals and how that applies to the product or service being created.

Technical expertise encompasses the knowledge to execute the technical aspects of the project at hand. For example, a great C++ embedded developer does not always function well on a web development project written in JavaScript. The technical expertise factor is focused on an individual, the team, and as a comparative measure for between-team barriers.

Technical factors such as development process maturity, DevOps maturity, and automated testing can significantly impact the effectiveness of a team. In "The Phoenix Project," Gene Kim depicts the roadblocks, impediments, and many of the possible failures that impact individual teams from a process, DevOps, and test perspective (Kim, Behr, & Spafford, 2014a). When these factors cause delivery faults, failures, and incomplete deliveries, it becomes a between-teams factor for success. How do the teams align to cross the barrier to success from vision to code to tested features?

Leadership

Leadership is required at all levels, from the smallest team up through and including management. Each leadership level must develop and communicate the appropriate vision and value, both up to their management and down to the team. Each leader must

accomplish this in a manner that is clear to each constituent (A. Shenhar & V. Holzmann, 2017a). They must also recognize when the individual factors affecting a team are not in total alignment, not understanding or following the vision, or working as a unit to adapt to the issues encountered.

The leadership factors start with mission clarity and vision. For each team, mission clarity, or "Start with Why," as described by Simon Sinek, sets the vision and purpose for the team (Sinek, 2009). It is intrinsic motivation that one feels when achieving the project goals. When the team members do not see the same "Why," they do not have the same purpose. Shenhar couples the “Why” described by Simon Sinek with the concept of operation when he describes what he termed “Strategic Project Leadership” (Shenhar, 2004).

The Strategic Project Leadership (SPL) framework, as defined by Shenhar, consists of standard project leadership characteristics such as process, tools, organization, and the inclusion of spirit and strategy, which are vital. SPL fills in the gaps between traditional project management and the direction of the larger organization. Spirit can be defined as having a vision of the project with the ability to articulate it up and down the organizational chain. Tying in strategy is the key that is often missed. In this sense, strategy is connecting the corporate objectives with the project objectives, using the vision to articulate, and driving the project via these mechanisms (Shenhar, 2004).

Introduction Summary

The team practices for delivering value to the customer consist of the factor categories described in Figure 10 – Factors To Characterize Team Effectiveness. While these

factors impact the local team, what factors make up the between-team effectiveness for a globally distributed agile software development team?

Figure 10: Factors to Characterize Team Effectiveness

What mechanisms mitigate the impact on the productivity of globally distributed agile software development teams? That is, which factors impact the combined globally distributed team? How do the teams align when brought together? The barriers to success are the combination or alignment of the individual teams plus the between-team barriers. The barriers can be identified by category and factor. If and when the teams are not aligned, the adjustment and control mechanisms of the degree of dispersion, media richness, architectural modularity, and leadership are used to bring the global team back into alignment, creating an effective running team. This is shown in Figure 11 – Conceptual Model for Globally Distributed Team Success. The hypothesis is that by eliminating these barriers on a factor-by-factor basis, the distributed teams become aligned such that they create a potentially successful distributed team, as shown in the conceptual model diagram below.

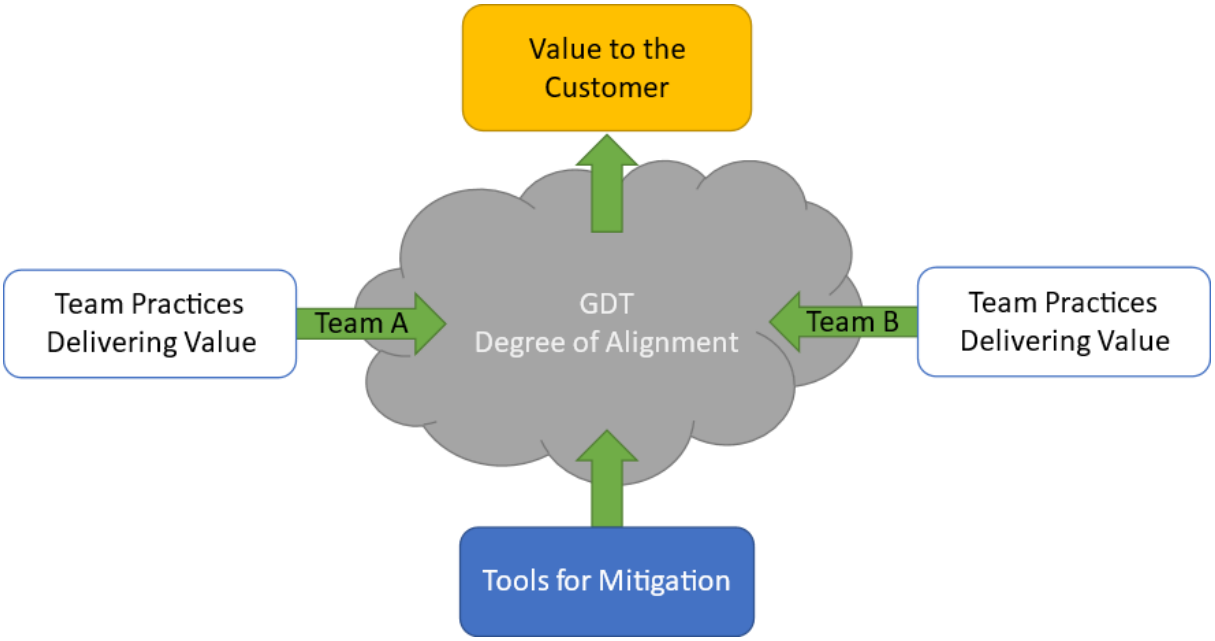


Figure 11: Conceptual Model for Globally Distributed Team Success

The next chapter will explore the literature, the literature gathering methods, and literature results that apply to the conceptual model in an effort to validate the operational research question, which is defined as follows. If I were a development leader guiding a globally distributed agile software development team, what factors do I need to be aware of and manage so that the global team performs as effectively as a local team?

CHAPTER TWO: LITERATURE REVIEW

Literature Introduction

In pursuit of identifying the key literature research factors involved in delivering value to the customer using distributed software teams, a literature research process based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) process was first utilized. The initial research process, as shown in Figure 12, is used in many systematic literature reviews and is a process required in many healthcare journals (Liberati et al., 2009). While not required, this approach, research process, and methodology provided a mechanism to perform research in-depth. This approach may not be wholly appropriate for the broad subject of all research. It did, however, provide a significant starting point and base set of broad referenced work.

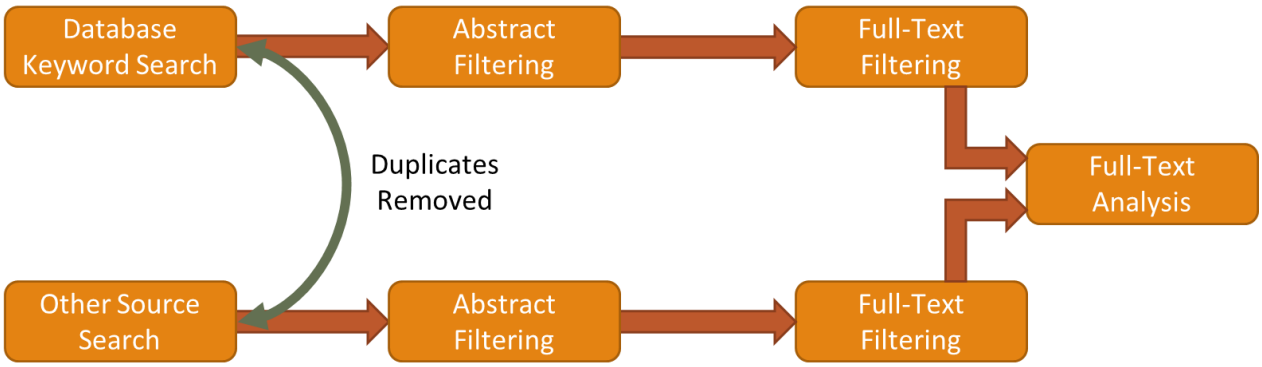


Figure 12: PRISMA Research Flow

The research was subdivided into four primary factors: Value to the Customer, GDT Degree of Alignment, Individual Team Practices, and Tools for Mitigation, as shown in Figure 11 - Conceptual Model for Globally Distributed Team Success. The Individual Team Practices are then subdivided into five within team factors, including Process,

People, Organization, Technical/Project, and Leadership, factor categories, as shown in Figure 10 – Factors to Characterize Team Effectiveness.

Literature Methods

The desire to determine a complete answer to the research question iteratively led to a new literature research process, as shown in Figure 13. Each article was naturally placed in a reference database for logging, future referencing, and tracking. Each article was scanned for success factors, which, when found, were clipped, quoted, and referenced in the data set table of factors. For each article, quotes and notes were also collected for usage in future work. While this pulls data out of the article, it does not move the research forward from a systematic literature perspective. One may, as I did, manually scan the references for additional articles to review. Manual scanning is a laborious task that only yields limited positive results. Another method is to use references in the article that relate to the research topic to hone in on additional articles. This latter method, while still laborious, expands the iterative flow as it identifies additional research articles.

The research methods described above are slow, require extensive reading and re-reading of each article, and do not yield overall results quickly. While the targeted results are valuable, a broader research technique was explored during this research process. This effort resulted from the Feedback Research Process, as shown in Figure 13.

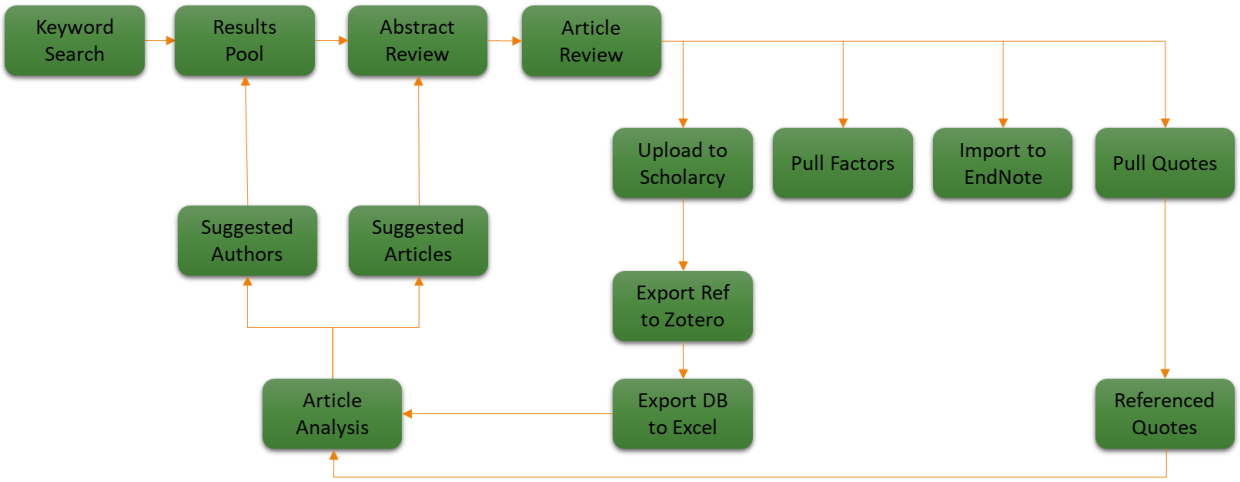


Figure 13: Feedback Research Process

While utilizing the standard approaches articulated by the PRISMA research method of tracking keywords, abstracts, and articles, the Feedback Research Process incorporates some basic analytical techniques to identify suggested authors and suggested articles to incorporate into the research. The Feedback Research Process produces rapid article identification expanding to second and third-order connections among articles very quickly.

The Feedback Research Process works by parsing the reference section of all articles in a given dataset. These references are combined into a single reference database and exported to Excel. Within Excel, basic analytics are conducted to identify authors and articles of interest. These suggested authors and articles are fed into the results pool and appropriately processed or discarded. Continuing this feedback process results in rapid identification and clarification of the research.

While this specialized technique is an enhanced extension of the manual process, automating portions of the process significantly sped up appropriate article identification.

The maturation of this process and software to improve it is left to a future effort. Two additional analytical results from the combined collective reference database are the top authors and the top journals for this topic. The Feedback Research Process was used to identify the key factors for distributed team performance.

The literature review consisted of peer-reviewed journal articles and related books. Articles of a technical nature, such as those covering Agile Scrum Methodology, will be time-limited to the last ten years. Significant works by the creators of Agile Methodology, Mike Beedle and Ken Schwaber, along with several systematic literature reviews regarding success factors for distributed agile software development projects, were found and used as significant parts of the analysis.

The eligibility criteria were primarily based on article relevance to the research goals. In each of the four subtopic areas, preliminary searches were performed using a keyword-based derived from the focusing questions. The preliminary searches were used to develop and focus on the desired keywords used for inclusion. Unless the preliminary search revealed relevant information, they were not tracked for inclusion. The literature search was conducted over several database systems. These databases included IEEE Explore, Web of Science, EBSCOhost, ProQuest, JSTOR, and Google Scholar.

Literature Results

Utilizing the Feedback Research Process described above resulted in more than one hundred and fifty articles identifying success factors for this research topic. The articles were focused on agile software development, GDTs, distributed teams, teams, and teamwork in general. Many articles used in the research were systematic literature

reviews specifically focused on the success factors of agile software development teams. As shown in Figure 14, based on the literature review, four primary factors have been identified: Value to the Customer, GDT Degree of Alignment, Individual Team Practices, and Tools for Mitigation. The remainder of this paper describes these four primary factors, the sub-factors that make up the primary factors, and their associated variables.

The Feedback Research Process directly contributed several of the most valuable insights into the complete literature research. This includes the key authors of Hinds and Bailey, Bent Flyvbjerg, and Hersleb & Mockus. It also identifies top journals influential in this research as Organizational Science and the Academy of Management Journal.

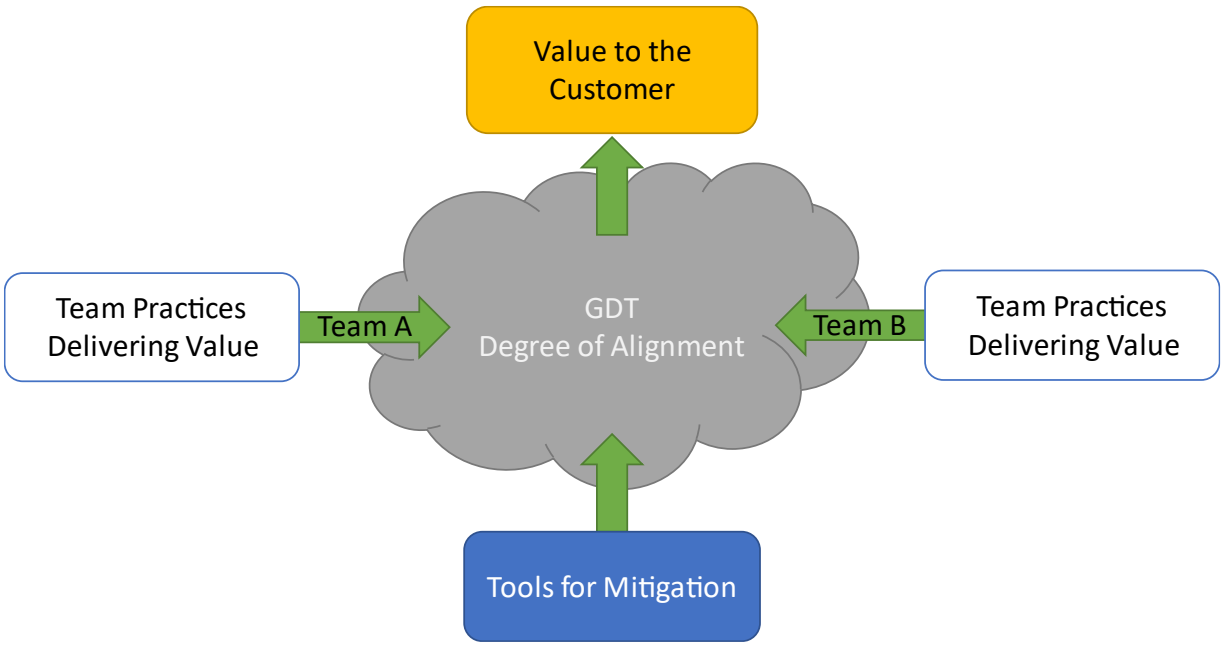


Figure 14: Distributed Team Conceptual Model for Delivering Value to the Customer

In addition to peer-reviewed journal articles, several notable books have been included. In several cases, these books are more significant bodies of work than the articles which

cover a similar subtopic. Reports abound for the Agile at scale subtopic, but there is no more authoritative source than one of the creators of the methodology. Given this, “Agile project management with Scrum” by Ken Schwaber (2004) was included and used as part of the research. Other books used as authoritative sources include “The Goal” and associated work regarding Theory of Constraints by Dr. Eliyahu Goldratt and Dr. Kerry Patterson’s work regarding social-emotional intelligence. These authors provide innovative and original contributions to the work herein. Wherever possible, derivative works in relevant journals have been sought to corroborate or validate commercial research.

Literature Discussion

Value to the Customer

The real-world question for our research attempts to determine ***how*** to deliver value to the customer faster. One may attempt to measure and improve a project's overall effectiveness, performance, or success to achieve these results. Sink and Smith defines performance as consisting of seven interrelated and interdependent criteria, which are 1-effectivity, 2-efficiency, 3-productivity, 4-quality, 5-quality of work-life, 6-innovation, and 7-profitability (Sink & Smith Jr, 1994). Shenhar and Holzmann utilized a project success model consisting of a Clear Strategic Vision, Total Alignment, and Adapting to Complexity (A. J. Shenhar & V. Holzmann, 2017). Garousi et al. combine process success, product-related factors, and stakeholder satisfaction to define project success (Garousi, Tarhan, Pfahl, Coskuncay, & Demirors, 2019a). Other research varies in form but may be summarized as combining effectiveness and efficiency in some form to determine team performance. Whether measuring effectiveness, efficiency, performance, or project

success, the objective measure of a team's success is delivering value to the customer, which can be quantitatively measured in terms of dollars the customer is willing to pay for the requirement. The researched literature does not agree on a consistent definition regarding efficiency, effectiveness, or productivity as a measure of the overall GDT's ability to perform. As shown in Table 2, the consolidated variables summarize the value to the customer. Measuring value to the customer provides a definitive factor of interest to measure the performance or output of a GDT.

Table 2: Variables for Value to the Customer

Factor	Value to Customer
Variable	• Project Success • Actual Success • Customer Factors • Team Performance

Globally Distributed Teams Degree of Alignment

GDTs are formed by bringing two or more teams together to right-size the development and delivery. Many, if not all, of the GDT factors may be seen when even two local teams are brought together, albeit in a microcosm. All local team factors contribute to the overall team's ability to deliver value to the customer. For GDTs, there are factors that research shows stand out more when teams are combined. The degree of alignment, conflict, or lack thereof may be the primary factor impeding value delivery to the customer.

A cloud obfuscates the team's actions when value is delivered to the customer, as shown in Figure 14. This veil of obfuscation has to be lifted when storm clouds of conflict impede the delivery of value to the customer. The cloud of GDT Degree of Alignment can be

better understood using Hinds and Bailey's research on the conflict between teams. When cohesive teams are brought together, conflict is generated by combining distinct units. This conflict may be categorized into Task Conflict, Affective Conflict, and Process Conflict. As defined by Hinds and Bailey, task conflict refers to the alternatives to implementing a particular feature (Hinds & Bailey, 2003).

For this reason, this type of conflict is focused more within a team rather than between teams. As a between-team source of conflict, this sub-factor would be most visible at a concept of operation level known as ConOps. Other research captures task conflict in the technical/project or process practices as understanding the tasks at hand or understanding the business (Abdalhamid & Mishra, 2017).

Affective Conflict is anxiety or hostility along with the time and energy associated with emotional disagreements (Hinds & Bailey, 2003). This type of conflict occurs both within a team and between teams. The people dynamic of teams draws this type of conflict to the forefront of visibility and research. Cross-Understanding and Shared Mental Models are people-related sub-factors that attempt to capture or mitigate affective (emotional) conflict (Huber & Lewis, 2010).

Process Conflict focuses on each team member's resources, roles, and responsibilities (Hinds & Bailey, 2003). Process conflict is quickly resolved as a within-team sub-factor when leadership identifies and addresses visible issues. Between-team, process conflict may be more difficult to make visible due to the distinct differences between the teams. Dynamism and uncertainty (Misra, Kumar, & Kumar, 2006), degree of adoption (van Kelle, van der Wijst, Plaat, & Visser, 2015), and process variability (Boehm & Turner, 2005) are similar sub-factors relating to conditions caused by process conflict.

The degree of alignment can be described and measured. A diagnostic framework known as SPACE considers issues from all aspects of the team: **S**atisfaction and well-being, **P**erformance, **A**ctivity, **C**ommunication and collaboration, and **E**fficiency and flow (Forsgren et al., 2021). SPACE is one of several identification tools revealed through the literature research. SPACE may be utilized to discover issues within and between teams (Forsgren et al., 2021). At the end of each iteration, the survey approach determines the areas where the team may improve. The multi-dimensional information obtained from the survey tool may be used to identify factors that are in less-than-optimal operation. Utilizing SPACE to find conflict areas may make mitigating or preventing conflict easier with a resulting increase in more value delivered to the customer in a shorter period of time.

Tools for Mitigation

The tools for mitigation sub-factors are themselves measurable. These sub-factors, shown in Table 3 - Variables for Tools for Mitigation, are also tools for mitigating or enhancing the degree of alignment. Using the tools for mitigation, as shown in Figure 14, may lessen conflict, thus improving the degree of alignment and overall delivery of value to the customer. Media Richness and Degree of Dispersion are widely used and discussed in the literature with mixed conclusions. Architectural Modularity seems to be ignored or not addressed in the literature researched to date, perhaps due to the project-specific nature of this sub-factor. Cross-Team Leadership is a key sub-factor in much of the project management literature.

Mitigating conflict between teams may be achieved by enhancing Media Richness to increase the effectiveness of communications (Daft & Lengel, 1986). Using Media Richness to increase communication effectiveness is not a cure-all. Understanding the

root cause of the conflict and applying corrective actions based on these root causes will solve the issue more thoroughly. A related method to increase communication between teams is to decrease the Degree of Dispersion (O'Leary & Cummings, 2007). Shifting the workday of one or both teams may decrease the degree of dispersion, leading to better communication opportunities. Maximizing the overlap between teams provides an opportunity to utilize richer media technology such as voice, video, and instant messaging instead of just email communications.

Architectural Modularity is a crucial technological approach that begins early in the architecture phase and must be maintained as features and capabilities are added to the system. Architectural Modularity affects the degree to which one team can operate without interacting with another. Higher degrees of Architectural Modularity decrease the need for communication and decrease the types and impacts of task, affective, and process conflict. Having well-defined application programming interfaces (API) and thorough continuous integration/continuous deployment automated testing (DevOps) infrastructures help to mitigate conflicts raised by the interactions.

Cross-Team Leadership identifies the level of leadership and distinguishes it from leadership as part of team practices. The leadership skills, traits, and variables are similar and inclusive of team practice leadership but focused on the cross-team aspects rather than the individual team.

Table 3: Variables for Tools for Mitigation

Factor	Media Richness	Degree of Dispersion	Architectural Modularity	Cross-Team Leadership
Variable	Type of media Bandwidth Utilization	Mileage Index Time Zone Index Site Index Isolation Index Distribution Index Team Distribution	Task Interdependence	Collaborative identification of the global virtual team mission Effective leadership of the global virtual team Team practice leadership

Team Practices Delivering Value

Do customers care how a team produces something? Experience answers, “not really.” It is critical that the customer receives value delivered on time and on budget. Often with today’s complex projects, this is considered a win. Achieving the desired results requires exploring sub-factors governing team practices and contributing to barriers between and within teams. Gaining a deeper understanding of the team practice sub-factors that contribute to issues is of significant value to development companies.

Based on early research, the within or local team sub-factors were categorized into practices of agile methodology, social and cultural, physical and infrastructure, technical and business knowledge, and leadership groups. The summation of these governing team practices results in what the team can produce and can be measured by a rating for the value they deliver. Further research has culminated in the individual practice sub-factors of Organization, People, Process, Technical/Project, and Team Leadership which

characterize a local team's ability to deliver value to the customer or GDT, as shown in Figure 15.

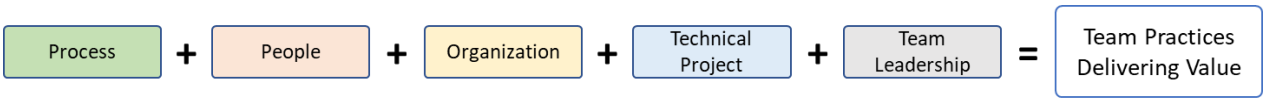


Figure 15: Identified Key Factors for Team Practices Delivering Value

It is essential to fully understand the individual practices as each consolidates a wide array of variables. A detailed breakdown of the consolidated variables for team practice sub-factors is shown in the tables following each individual team practice section.

Process

The focus for this practice sub-factor is on agile process variables such as the say/do ratio, the stability of the team's velocity, and the DevOps maturity. These are essential variables, and they govern a large portion of the success or failure of a project from a process perspective. From the literature, research shows that many more significant variables are at play in this practice. These are shown in Table 4 – Variables for Process Practices Delivering Value.

In Boehm and Turner's article, "Management Challenges to Implementing Agile Processes in Traditional Development Organizations," planning and control, dynamism and uncertainty, and testing were directly identified (Boehm & Turner, 2005). Planning and control refer to standard project management techniques such as scheduling, earned value, and other quantitative performance measures. Dynamism and uncertainty can be measured or visualized using team velocity. The velocity stability shows the dynamic

nature and uncertainty or lack of control in a team's process. Testing by today's development standards is an outdated variable to measure individually. DevOps maturity encompasses not only the testing measures but also the frequency and completeness of the testing. The degree of adoption is the relative measure of how well teams agree on the process framework. While this is similar to dynamism and uncertainty, these measures do not focus on the same aspects of the team. Dynamism and uncertainty relate to fluctuation in the backlog and are analogous to requirements volatility, while the degree of adoption relates more to the stability of the process framework (van Kelle et al., 2015).

Table 4: Variables for Process Practices Delivering Value

Factors	Process
Variable	• Planning and Control • Dynamism • Uncertainty • Testing • Performance Expectancy • Decree of Adoption • Teamwork Quality • Process Variability • Business Process conflicts
Variable	• Multidisciplinary and collaborative definition of the technical approach to be implemented • Distributed and multidisciplinary management of the development strategy • Activity • Efficiency and flow • Coordination • Redundancy • Team Learning • Monitoring • Feedback

People

People variables include social norms, cultural idioms, and cross-understanding, as shown in Table 5. Other variables found in the research include emotional intelligence components such as openness, agreeableness, emotional stability, conscientiousness, and extraversion. These traits create trust and psychological safety in a team (Driskell, Salas, Goodwin, & O'Shea, 2006). Team psychological safety goes beyond individual characteristics describing how these people-based variables mold together (Edmondson, 1999). As teams come together from far and wide, increased cultural diversity requires an enhanced cross-understanding (Huber & Lewis, 2010). Localized teams utilize the team's bond of trust as a basis for their psychological safety. Team members using emotional intelligence may lead to a shared mental model of one another, increasing effectiveness as a team (Cohen & Bailey, 1997).

Table 5: Variables for People Practices Delivering Value

Factors	People
Variable	• Cross-Understanding • Emotional Stability • Extraversion • Openness • Agreeableness • Conscientiousness • Trust • Psychological Safety • Team Psychological Safety • Personal Characteristics • Team Composition • Societal Culture • Training • Learning • Value Convergence • Anti-People • Team Factors • Cultural Team Diversity • Dependability • Psychological Safety • People Conflicts • Satisfaction and well-being • Cohesion • Trust • Collaboration • Value Diversity • Team Orientation • Culture • Personality • Effort • Motivation

Organization

The Organization practice sub-factor includes infrastructure variables such as internet stability and availability, tools, buildings, and workspace, as shown in Table 6 – Variables for Organization Practices Delivering Value. Research reveals additional variables of identifying appropriate team members, the ubiquity of standard tools throughout the team,

effective knowledge sharing, and team autonomy (Guzmán, Ramos, Seco, & Esteban, 2011). Other standard organizational variables include the alignment and support of management. This includes project alignment to the organization's management style, vision, mission, alignment to project monitor and control practices, and alignment to change and risk management techniques (Garousi, Tarhan, Pfahl, Coskuncay, & Demirors, 2019b).

Table 6: Variables for Organization Practices Delivering Value

Factor	Organization
Variable	• Customer Commitment • Hierarchical Status Distance • Chain of Command Distance • Exposure • Corporate Culture • Management Support • Alignment to Process • Alignment to Project • Alignment to vision • Infrastructure • Tools • Anti-Organization • Organizational Factors • Identification of appropriate team members for specific role or responsibility • Selection and adaptation of the appropriate technology to enable interaction between the global virtual team members • Effective sharing of knowledge generated by the global virtual team • Team Autonomy Balance of Member's Contribution

Technical/Project

The Technical/Project practice sub-factor includes customer knowledge and technical ability to execute the work. Misra et al., 2006, define this variable as Competency. Variables such as skillset knowledge, ConOps knowledge, and directional or project

alignment also drive the Technical/Project practice. These variables are shown in Table 7 – Variables for Technical/Project Practices Delivering Value. Experience has shown that unequal technical factors between teams force a superior-subordinate relationship. This uneven footing for independently operating teams creates barriers to success in many cases. Until all teams are on relatively equal footing, the operation as a GDT will be hindered. The concept of operation knowledge is the domain knowledge relative to how the customer will use or interact with the product or service. As a key variable, this ConOps understanding of the customer, their needs, desires, and goals will help deliver value to the customer quickly.

Technical expertise encompasses knowledge to execute technical aspects of the project at hand. For example, a great C++ embedded developer does not always function well on a web development project written in JavaScript. The technical expertise variable focuses on an individual, the team, and as a comparative measure for between-teams. Additional variables found through research include project size, type of project, technological uncertainty, technical complexity, project criticality, and urgency (Garousi et al., 2019b).

Table 7: Variables for Technical/Project Practices Delivering Value

Factors	Technical/Project
Variable	• Business/Safety Criticality • Competency • Requirements • Development • Understanding of vision (project) • Understanding of Tools • Understanding of Corp vision • Understanding of process • Understanding of project • Risk Management • Change Management • Project Management • Project Size • Anti-Technical • Contingency (project) Factors • Task Interdependence • Team Size • Provision of continuous training on required capabilities to work in a global virtual team • Completion of the software project • Performance • Risk Management • Change Management • Project Management • Project Size • Anti-Technical • Contingency (project) Factors • Task Interdependence • Team Size • Project Size • Provision of continuous training on required capabilities to work in a global virtual team • Completion of the software project • Performance • Provision of mechanisms for organizational and individual learning and improvement

Team Leadership

Leadership is required at all levels, from the smallest team up through and including the management team. Each leadership level must develop and communicate the appropriate vision and value both up to their management and down to the team. Each leader must straightforwardly accomplish this for each constituent (A. J. Shenhar & V. Holzmann, 2017). Leaders must also recognize when the individual variables affecting a team are not in total alignment, not understanding or following the vision, or not working as a unit to adapt to the issues encountered.

Leadership variables start with mission clarity and vision. For each team, mission clarity, or "Start with Why," as described by Simon Sinek, sets the vision and purpose for the team (Sinek, 2009). “Why” is the intrinsic motivation one feels toward achieving the project goals. When the team members share the same "Why,” they have the same motivational purpose. Shenhar couples the “Why” described by Simon Sinek with the concept of operation when he describes what he terms Strategic Project Leadership (SPL) (Shenhar, 2004).

As defined by Shenhar, the SPL framework consists of standard project leadership characteristics such as process, tools, organization, and the inclusion of spirit and strategy, which are vital. SPL fills in the gaps between traditional project management and the direction of the larger organization. Spirit can be defined as having a vision of the project with the ability to articulate it up and down the organizational chain. Tying in strategy is the key that is often missed. In this sense, strategy connects corporate objectives with the project objectives, thus creating harmony using the vision to articulate and drive the project (Shenhar, 2004). The numerous additional characteristics and

properties considered variables for the leadership sub-factor are shown in Table 8 – Variables for Team Leadership Practices Delivering Value.

Table 8: Variables for Team Leadership Practices Delivering Value

Factors	Team Leadership
Variable	• Clear Strategic Vision • Total Alignment • Adapting to Complexity • Decision Time • Communication • Negotiation • Leadership Style • Communication Style • Degree of Agility • Vision • Knowledge of team • Knowledge of management • Knowledge of customer • Transformation Leadership • Task Variety • Communication Effectiveness • Knowledge sharing • Structure and clarity • Meaning • Impact • Communication and Collaboration • Communication • Coordination Shared Leadership

Literature Summary

The question governing the literature researched is, “What are the between-team barriers that impede the successful delivery of agile software development in Globally Distributed Teams?” These factors have been categorized into the areas identified by the conceptual model shown in Figure 14 – Distributed Team Model For Delivering Value to the

Customer. The preponderance of the research is focused on Team Practices for Delivering Value. This is consistent and expected since this research is done for individual localized teams. While individual studies are inconsistent and vary in their conclusions, the GDT-specific research reinforces the conceptual model. The literature identifies the GDT degree of alignment factors as conflict. However, conflict is not a cause, source, or originating root cause impediment to the alignment of globally distributed teams. Conflict, in all its forms, is a dependent variable driven by other factors.

How does the research impact or change the research question, hypothesis, and assumptions? Referring to the research question(s) from Chapter 1 of this document, the main research question is “What are the between-team barriers that impede the successful delivery of agile software development in Globally Distributed Teams?”

a. **What are the controlling factors that impact the performance, productivity, or effectiveness of globally distributed agile software development teams?** The conceptual model identifies the controlling factors: Value to the Customer, Tools for mitigation, and Team Practices for Delivering Value. Each of the top-level factors is comprised of sub-factors validated through research. The top-level factors are hypothesized to be the controlling factors for GDT agile software development projects.
b. **What are the between-team barriers that impede successful delivery?** Based on the literature, the between-team barriers should be measurable as types of conflict. While these are not the root cause, they are the measurable impact on a project. From the measurements and root cause analysis, one should be able to

identify the specific factor impeding the team's degree of alignment. This is one of the focal points in the research outlined in the next chapter.

c. **Which key factors control the impact on a project?** The literature shows that the key factors are or should be the impacting factors for a project. They mitigate, moderate, and amplify the factors and subfactors to achieve the desired level of alignment is the primary function of team leadership. The research outlined in the remainder of this dissertation will delve deeper into validating the controlling factors that impact a project.

d. **Why do these factors impact the project?** The literature brought forward several potential root causes for each type of conflict. Understanding "Why" and "How" to address is the key desired finding of this dissertation.

Given the researched literature and understandings, the hypotheses and assumptions still hold. The next chapter presents details of the research methodology applied to this dissertation.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

Introduction

The literature review identified the key factors for Globally Distributed Teams and the barriers between the teams that impede the successful delivery of agile software development. This chapter discusses the research design and methodology, which is intended to further validate the conceptual model and the researched literature and provide better insights into operational models for success.

The Need for Research

The need for further research is clear. Project failure is a pervasive and complex problem throughout the software industry. Throughout the literature researched, many metrics measure factors and scoring methods exist. The preponderance of the factors identified through research tries to quantify issues with scoring metrics such as velocity or say/do ratio. While these metrics are valuable, they do not measure the intrinsic bonding of a team, nor can they measure the culture created. The one notable exception is a diagnostic framework known as SPACE. This framework considers issues from aspects of the individual team: **S**atisfaction and well-being, **P**erformance, **A**ctivity, **C**ommunication and collaboration, and **E**fficiency and flow (Forsgren et al., 2021). The SPACE framework, while highly useful for individual team feedback, does not identify the sources of conflict, nor does it address the barriers between teams. The between-team barriers are hypothesized to be qualitative forms of conflict, as identified by Hinds and Bailey's research on teams.

High-Level Research Methodology

The research methodology process that governs this research is shown in Figure 16 - Research Methodology below. With the scope of research defined and the Body of Knowledge reviewed completed in chapters one and two, this chapter focuses on developing the research proposal to test the defined and revised hypotheses.

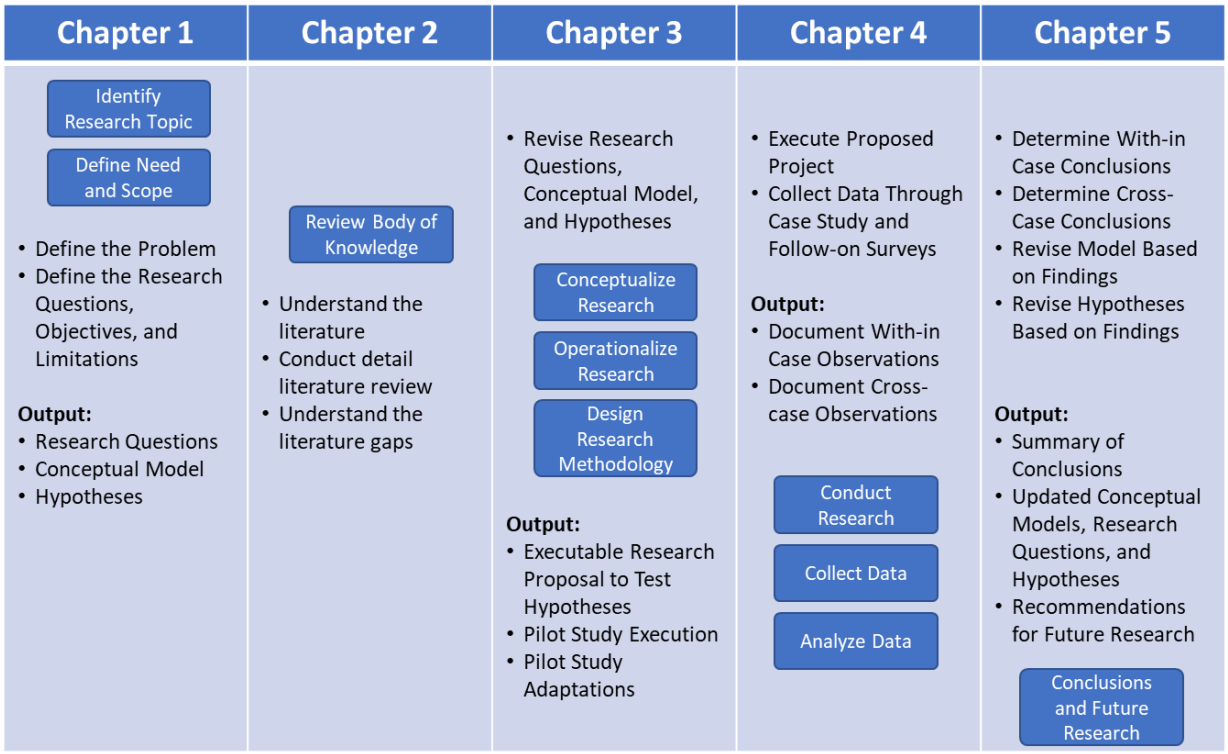


Figure 16: Research Methodology

Research Approach

Figure 17 – Inductive vs. Deductive investigation shows the inductive pattern starting from observation to developing a theory. Numerous observations have been made during the more than 30 years of inductive experience (fieldwork) in developing and managing software projects. The patterns seen in the observations of projects yield tentative hypotheses and theories. Deductive literature research into key factors has explored and

refined hypotheses. The literature research confirms key factors, added factors not yet considered, and informed the research to allow the development of the conceptual model. Numerous key factors turn out to be social/emotional factors requiring qualitative analysis to best understand.

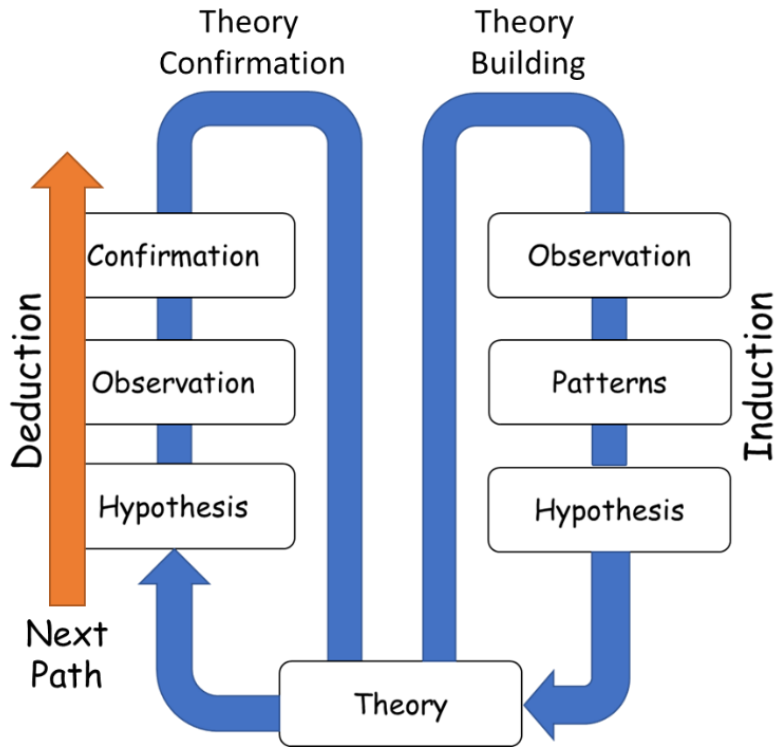


Figure 17: Inductive vs. Deductive Investigation

From the researched literature, it is clear that qualitative data are not being measured adequately or are missing. Whether using deductive or inductive research, drawing in qualitative data will help to uncover the how and why of these complex interactions. The qualitative approach would significantly assist in validating or contradicting the conceptual model, support the theoretical connections between model factors, and provide insights into the qualitative components that impact software development projects.

In many areas of research, qualitative research is thought of as “Grounded Theory.” Grounded Theory, by definition, is an inductive, iterative, interactive, and comparative method that provides systematic guidelines for gathering, synthesizing, analyzing, and conceptualizing qualitative data for theory construction” (Charmaz, 2015). Grounded Theory research also starts from zero, starting with no hypothesis. The research and data guide the researcher to the hypothesis.

Many case studies are thought of as executing a grounded theory approach. This assumption is challenged by McCaslin, Yin, and Eisenhardt in their respective works (Eisenhardt, 1989; McCaslin & Scott, 2003; Yin, 2018). Since this work starts with a hypothesis, validates, and refines it via the literature review, the work cannot be grounded theory. While this research is not a grounded theory approach, a data-driven approach is a valid and effective way to reach the desired how and why answers.

As Eisenhardt (1989) described, a building theory approach to the research using case studies may provide the platform to determine the within-case and cross-case patterns. Following an analysis of potential case studies through Yin’s “Case Study Research and Applications.” (Yin, 2018), an explanatory case study using multiple cases with multiple embedded cases within each case fits the GDT model. This approach affords the best opportunity to provide validity, reliability, and generalization to the overall research.

Research Methods

A series of questions must be explored to determine appropriate research methods. Questions include: What is the suitable research method for this research topic, survey, experiment, archival analysis, history, or case study? When considering current research,

experience, and availability of detailed data, various methods could be applied to the research. When is quantitative versus qualitative research more appropriate? Research shows it depends on the questions being asked. Types of questions regarding “How” and “Why” are most appropriately qualitative types of research (Yin, 2018). Of the qualitative research, what type of work is most appropriate? McCaslin created a five-question method for framing qualitative research (McCaslin & Scott, 2003). Utilizing the five questions to frame the research, the associated tradition points to case study research.

Method	(a) Form of Research Question	(b) Requires Control Over Behavioral Events?	(c) Focuses on Contemporary Events?
Experiment	how, why?	yes	yes
Survey	who, what, where, how many, how much?	no	yes
Archival Analysis	who, what, where, how many, how much?	no	yes/no
History	how, why?	no	no
Case Study	how, why?	no	yes

Figure 18: Relevant Situations for Research Methods (Yin, 2018)

Yin specifies three conditions to consider when choosing the research study type, shown in Figure 18 – Relevant situations for research methods. The first condition is the form of the question being posed. The questions in this research are “how” or “why” type questions. The second condition articulates that several research methods require control over behavioral events. Behavioral events are mainly the focus of this research, and they are certainly not under control in real life, nor in any experiment we can construct. The third condition refers to actively in progress or historical (Yin, 2018). Based on the

conditions postulated by Yin, survey, archival analysis, historical, and case study could be appropriate for this research.

Survey

Conducting a broad survey to collect quantitative data and analyzing the results is a natural choice. Working through the issues with conducting a survey has eliminated this approach. One issue with this approach is that the answers sought are typically much more in the qualitative approaches. The questions of how and why are prevalent due to the missing or misunderstood data. While a qualitative survey could be undertaken, identifying a broad range of qualified respondents would be difficult given the roles sought on the project. This is not easy because most agile projects do not follow a formulaic process. Agile is a process framework based on lean principles (Schwaber & Beedle, 2002). Thus, every project must apply the principles to their situation. Individuals in a particular project may or may not have consistent roles, responsibilities, and titles when compared to another project in another company. Identifying the proper respondents for each position in the global project, having them be committed to responding, and harmonizing their role variations make the qualitative survey challenging to provide the generalization or external validity typically sought in a survey.

Archival Analysis and Historical

In commercial software development, many things are not written down. A recently completed historical project would not be feasible due to the lack of knowledge of the available project details. The emotional context of the interactions between the teams will be challenging to determine from archived work. With people moving to their next project

quickly, it is believed that finding the right persons for archival or historical projects would be an undertaking unto itself.

Case Study

Case studies help to answer the how and why type questions. They can include multi-layer iterative approaches for in-depth analysis. Case Studies do not require control over behavioral events. Many of the items sought to understand are, in fact, behavioral. In the cases to be chosen for this research, the cases will be ongoing or near-term historical. When analyzing the given choices, case study research, according to Yin, Eisenhardt, and McCaslin, focuses on this research method. Selecting several cases for in-depth analysis should provide higher validity through replication and generalizability across the set of cases. This provides the potential for better results than a broad survey and is more practical than historical research, which would lack much of the emotional context needed.

Case Studies are somewhat notorious for their lack of rigor and internal scientific validity, reliability, and external validity. This research design attempts to apply every plausible mechanism to increase the validity and reliability of the overall case study. Wherever possible, multiple sources are used to triangulate an accurate answer for the given question. This includes replicating the study over multiple cases to increase the validity; reviewing the case data from three angles; using multiple methods to collect the data to review. Yin refers to this approach as “converging lines of inquiry” (Yin, 2018). Additionally, the research will follow a documented procedure and protocol to increase reliability. Each case study will be executed using the same procedure with the same process for data collection, storage, and analytics.

Conceptualization of the Research Model

This section discusses the refined conceptual model pertaining to Globally Distributed Teams and the between-team barriers that impede the successful delivery of agile software development. This section also defines the constructs and their underlying factors. Lastly, the hypotheses and their relationship to the constructs will be discussed.

The Refined Conceptual Model

As presented in Chapter 1, this research is intended to identify the between-team barriers that impede the successful delivery of agile software development when teams are separated by time or distance.

Figure 19 – Research Conceptual Model depicts the overall model showing the degree of alignment between teams. The Team Practices Delivering Value shows the sub-factors that sum up to make a complete team. When value is delivered to the customer, a cloud obfuscates the team's actions. This veil of obfuscation has to be lifted when storm clouds of conflict impede the delivery of value to the customer. The cloud of GDT Degree of Alignment can be better understood by utilizing Hinds and Bailey's research on conflict between teams. When cohesive teams are brought together, conflict is generated by combining distinct units. This conflict may be categorized into Task Conflict, Affective Conflict, and Process Conflict (Hinds & Bailey, 2003).

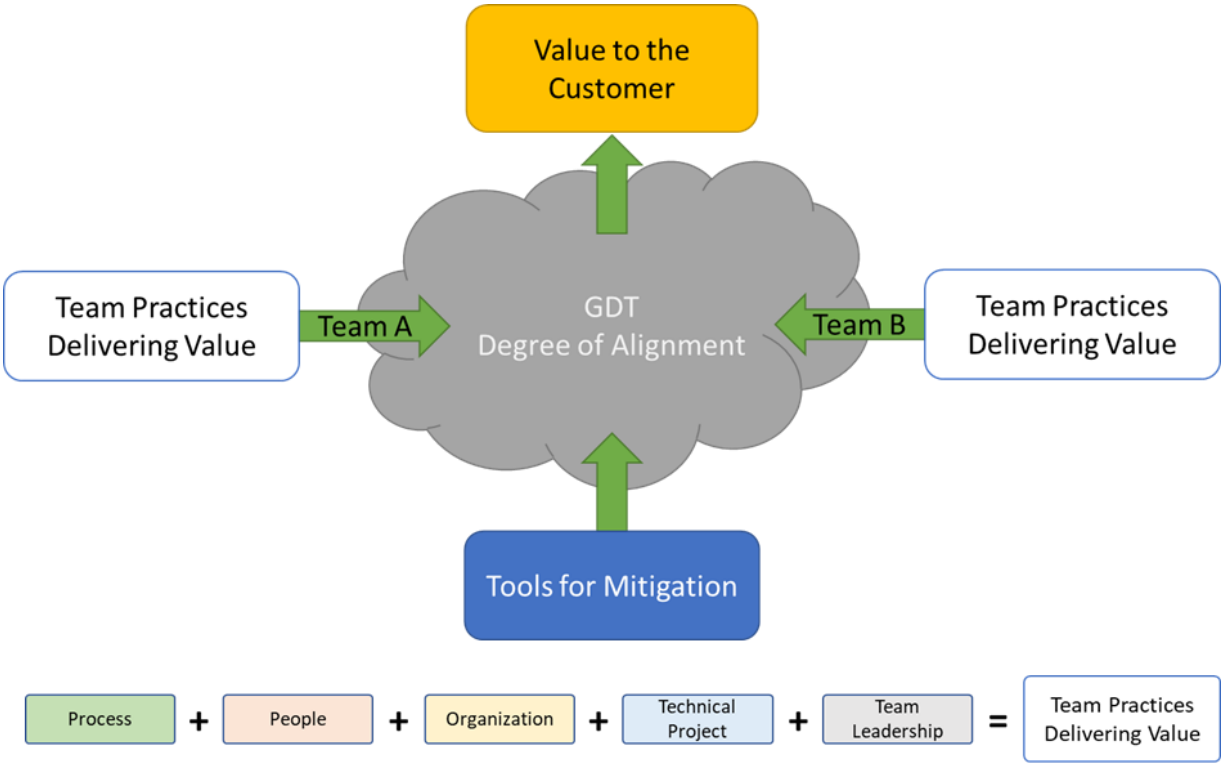


Figure 19: Research Conceptual Model

Factor and Sub-Factor Definitions

Table 9 - Definitions of Factors relating to the Conceptual Model provides definitions of each factor and the sub-factors that make up the Team Practices for Delivering Value.

Table 9: Definitions of Factors Relating to the Conceptual Model

Consolidated Factor	Definition	Why is this Important?
Value to the customer	Whether measuring effectiveness, efficiency, performance, or project success, the real measure of a team's success is delivering value to the customer, which can be quantitively measured in terms of dollars the	Understanding that delivering value is the measure of success for a project frames the conversation. Some developers may believe that if their portion succeeds, the project is viewed as a success. This is not true unless the project succeeds in the customer's eyes.

Consolidated Factor	Definition	Why is this Important?
	customer is willing to pay for the requirement.	
GDT Degree of Alignment	When cohesive teams are brought together, conflict is generated by combining distinct units. This conflict may be categorized into Task Conflict, Affective Conflict, and Process Conflict (Hinds & Bailey, 2003).	Understanding the types of conflict and the value they bring or hinder is essential for recognizing and adjusting project interactions.
Task Conflict	As defined by Hinds and Bailey, task conflict refers to the alternatives to implementing a particular feature (Hinds & Bailey, 2003).	Task conflict is essential as it shows the team members are safe to discuss alternatives to the current implementation or design. Task conflict also demonstrates that teams are relatively equal in their knowledge and ability to complete the work.
Process Conflict	Process Conflict focuses on each team and team member's resources, roles, and responsibilities (Hinds & Bailey, 2003)	Process conflict demonstrates a lack of continuity regarding the development process, including completeness of testing. When process conflict exists, the outcome or completeness of work will often significantly differ between teams. This can cause defects, rework, and issues in integration.
Affective Conflict	Affective Conflict is anxiety or hostility along with the time and energy associated with emotional disagreements (Hinds & Bailey, 2003).	Affective conflict shows the personality issues between team members.
Tools for Mitigation		
Architectural Modularity	Architectural Modularity promotes independence and parallelism without cross-coupling impacts. The computer science principles of tight cohesion and loose coupling applied at the system level provides	Architectural modularity reduces the required interactions between teams for technical reasons. This can change as design changes are required. Increased interaction when architectural modularity is low

Consolidated Factor	Definition	Why is this Important?
	modularity and reduce the interfaces between GDTs.	causes significant delays in closing issues.
Degree of Dispersion	Geographical dispersion of teams over time zones is the physical ability to communicate over time and distance (O'Leary & Cummings, 2007).	Research shows that any distance of 50 meters diminishes interaction. Distances of different buildings, states, and over time zones increase the difficulty of getting to a shared mental model for smooth communication.
Media Richness	Richness differences in media include the medium's capacity for immediate feedback; chat is richer than email, video is richer than chat, and face-to-face reigns supreme.	The amount of data one can communicate from the media is vital to clear communication and conveying or interpreting emotion. The less you know someone you need to communicate with, the richer or more capable the media format needs to be used.
Cross-Team Leadership	Cross-Team Leadership identifies the level of leadership and distinguishes it from leadership as part of team practices. The leadership skills, traits, and variables are similar and inclusive of team practice leadership but focused on the cross-team aspects rather than the individual team.	Good leadership is not about preventing issues but handling them immediately, entirely, and transparently. The leader acts as the binding glue that works to recognize and eliminate conflicts and issues between the teams.
Team Practices for Delivering Value		
Process	The Process sub-factor is the processes and metrics that govern software development. This includes user story creation through feature sell-off in a production-like environment.	The process used is less important than it being consistent with all other teams in the system. Inconsistent processes by teams can cause conflicts between teams.
People	The People sub-factor is the team's social and emotional aspects, including items such as trust, customs, idioms, norms, etc.	The most effective teams are ones that attain a shared mental model, which allows team members to know each other and make them better able to

Consolidated Factor	Definition	Why is this Important?
		anticipate team members' reactions.
Organization	The Organization sub-factor includes all the support provided by the organization. This includes items such as network, office space, training, people for the project, and management support.	Organizational support is important to provide the teams with the necessary support, training, and tools to get the job accomplished successfully.
Technical/Project	The Technical/Project sub-factor is the technical ability to develop the software needed for the project at hand, as well as the business domain knowledge regarding the project.	The lack of knowledge of the business domain causes adjustments to process or requires additional support to be needed by other teams. The knowledge of what to build and the ability to complete the work are vital to the performance of each team.
Team Leadership	Team Leadership is the strategic vision, communication skills, and emotional intelligence to know when issues arise and to act quickly to mitigate them.	Good leadership is not about preventing issues but handling them immediately, entirely, and transparently. The leader acts as the binding glue that works to recognize and eliminate conflicts and issues on the team.

Operationalization of the Research Model

The Operationalization of the Research Model section describes the practical steps to carry out this research. The research goal is to answer the postulated research questions and hypotheses from Chapter 1. This section will discuss the overall research approach, data collection, instructions, and validity in detail.

Research Questions

The main research question from Chapter 1 remains the same. That is, “What are the between-team barriers that impede the successful delivery of agile software development in Globally Distributed Teams?” To the engineering manager or the team leader, they are looking for “What do we have to measure to see the issues with our teams?” From the literature researched, the factors have been identified and combined into the conceptual model. Just as the sub-factors are essential to understand, so are the sub-research questions and their value to the engineering manager.

Sub-Research Question 1

What are the controlling factors that impact the performance, productivity, or effectiveness of globally distributed agile software development teams?

The first sub-question has been adapted from the literature research to the conceptual model. The conceptual model identifies the controlling factors: Value to the Customer, Tools for mitigation, and Team Practices for Delivering Value. Each of the top-level factors is comprised of sub-factors validated through research. The top-level factors are hypothesized to be the controlling factors for GDT agile software development projects. The research here-in will test this hypothesis through the replicated case study.

Sub-Research Question 2

What are the between-team barriers that impede successful delivery?

Based on the literature, the between-team barriers should be perceivable as types of conflict. While these are not the root cause, they are noticeable, visible, and actionable

to the engineering manager and significantly impact a project. Using root cause analysis, one should be able to identify the specific factor impeding the team's degree of alignment.

Sub-Research Question 3

Which key factors control the impact on a project?

The literature showed what key factors of other research are the impacting factors. The replicated case study approach is intended to show the engineering manager what impacts a project and why. From this data, the engineering manager can apply mitigating and moderating approaches to the situation to achieve the desired level of alignment.

Sub-Research Question 4

Why do these factors impact the project?

The literature brought forward several potential root causes for each type of conflict. Understanding "Why" and "How" will provide significant value to the engineering manager through this research.

Variable Relationship

Figure 20 – Relationship Between Variables shows the relationship between the independent, dependent, and mediating variables. The Team Practices for Delivering Value are independent of other variables when analyzed within the globally distributed team model. Tools for Mitigation mediates the Team Practices for Delivering Value. The degree of mediation is measurable by measuring the form and significance of the conflict.

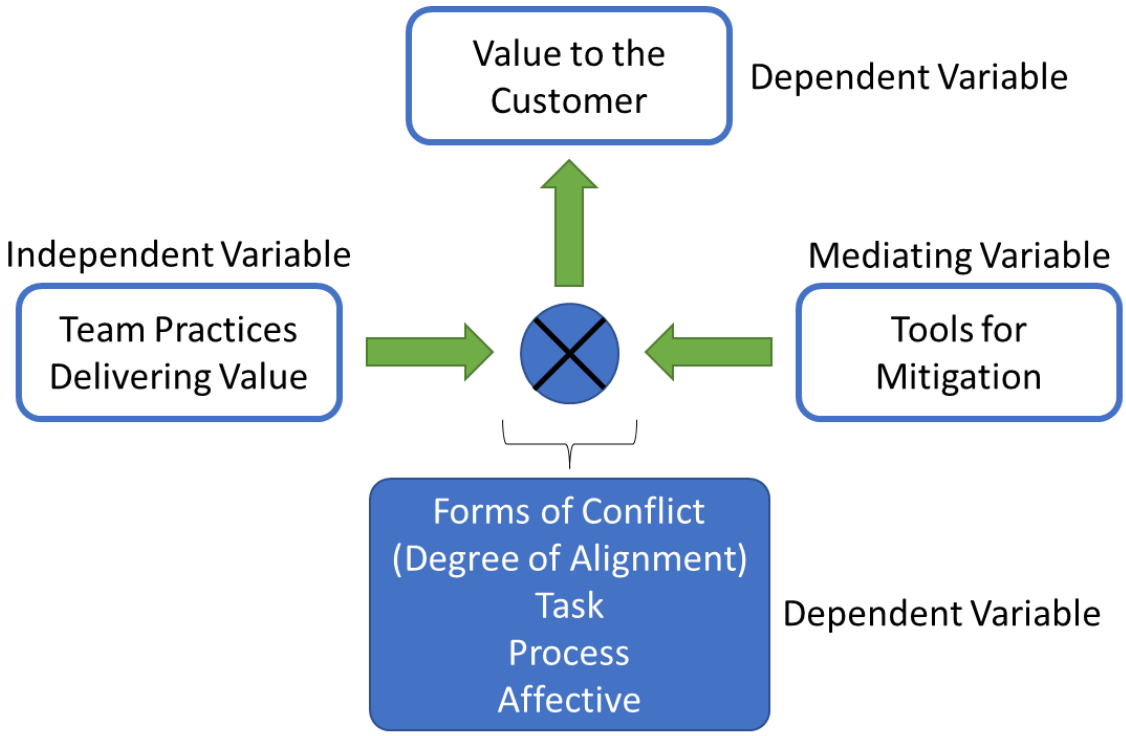


Figure 20: Relationship Between Variables

While task conflict can be both positive and negative, process and affective conflict are hypothesized to be inversely proportional, impacting the Value to the Customer.

Hypotheses

This research's core hypothesis stipulates that removing process and affective conflict will improve Value to the Customer. On the other hand, Task Conflict must not be in such significance that it negatively impacts the project, or it too will impede the Value to the Customer. The value of the core hypotheses and where they match up to the primary factors is shown in Figure 21 - Hypotheses and Importance.

Research Area	Why is this important?	#	Hypothesis
Value to the customer	Understand what that delivering value is the measure of success for at project frames the conversation. Some developers may believe that if they succeed, the project succeeds which is not true unless all of the project succeeds.	H1	Given effective individual teams, aligning the distributed teams allows them to deliver more value to the customer.
GDT Degree of Alignment	Understanding the types of conflict and the value they bring or hinder is important for recognition and adjustment of project interactions.	H2	Given effective individual teams, eliminating the between-team barriers to success will align the distributed teams.
Tools for Mitigation	Architectural modularity reduces the required interactions between teams for technical reasons. Distance increases the difficulty in getting to a shared mental model. The amount of data one can communicate over the media being used is vital to clear communication and conveying or interpreting emotion. Good leadership is not about preventing issue, rather handling them immediately, completely, and transparently.	H3	Using the tools for mitigation as adjustment mechanisms, acting on the global team, can increase the degree of alignment thereby producing more value to the customer in a given period of time
Team Practices for Delivering Value	The individual practice sub-factors of Organization, People, Process, Technical/Project, and Team Leadership characterize a local team's ability to deliver value to the customer or GDT	H4	Any individual sub-factor of the team practices for delivering value significantly different from another team's value will impact the GDT Degree of Alignment.

Figure 21: Hypotheses and Importance

Value to the Customer

H1: Given effective individual teams, aligning the distributed teams allows them to deliver more value to the customer.

Whether measuring effectiveness, efficiency, performance, or project success, the real measure of a team's success is delivering value to the customer, which can be quantitatively measured in terms of dollars the customer is willing to pay for the requirement. Some developers may believe that if their portion succeeds, the project is viewed as a success. This is not true unless the project succeeds in the customer's eyes.

GDT Degree of Alignment

H2: Given effective individual teams, eliminating the between-team barriers to success will align the distributed teams.

When cohesive teams are brought together, conflict is generated by combining distinct units. This conflict may be categorized into Task Conflict, Affective Conflict, and Process

Conflict. As defined by Hinds and Bailey, task conflict refers to the alternatives to implementing a particular feature (Hinds & Bailey, 2003). Understanding the types of conflict and the value they bring or hinder is essential for recognizing and adjusting project interactions.

Task Conflict

H2a: Task conflict at the systems level for a GDT is necessary and desirable, while task conflict at the individual team level indicates a lack of architectural modularity.

As defined by Hinds and Bailey, task conflict refers to the alternatives to implementing a particular feature (Hinds & Bailey, 2003). Task conflict is essential as it shows the team members are safe to discuss alternatives to the current implementation or design. Task conflict also demonstrates that teams are relatively equal in their knowledge and ability to complete the work.

Process Conflict

H2b: Process Conflict is a strong indicator of future issues on the project and can be sourced from many factors. The most common source of GDT process conflict comes directly from the team practices process sub-factor, but other team practice sub-factors can also create it.

Process Conflict focuses on each team member's resources, roles, and responsibilities (Hinds & Bailey, 2003). Process conflict demonstrates a lack of continuity regarding the development process, including completeness of testing. When process conflict exists, the outcome or completeness of work will often significantly differ between teams. This can cause defects, rework, and issues in integration.

Affective Conflict

H2c: Good GDT or Team Practice leadership can mitigate or eliminate affective conflict

Affective Conflict is anxiety or hostility along with the time and energy associated with emotional disagreements (Hinds & Bailey, 2003). Affective conflict shows the personality issues between team members. With a wide range of issues, the team leader must quickly figure out the issue and resolve it before it breaks down the overall team bonding, safety, and communication between the teams.

Tools for Mitigation

H3: Using the tools for mitigation as adjustment mechanisms, acting on the global team, can increase the degree of alignment, thereby producing more value to the customer in a given period of time

Architectural Modularity

H3a: Strong Architectural Modularity will eliminate a significant amount of communication between teams, thus reducing the task, affective, and process conflict visible in a GDT.

Architectural Modularity promotes independence and parallelism without cross-coupling impacts. The computer science principles of tight cohesion and loose coupling applied at the system level provides modularity and reduce the interfaces between GDTs. Architectural modularity reduces the required interactions between teams for technical reasons. This can change as design changes are required. Increased interaction when architectural modularity is low can lead to significant delays in closing issues.

Degree of Dispersion

H3b: Minimizing the Degree of Dispersion provides an opportunity to moderate process and negative task conflict.

Geographical dispersion of teams over time zones is the physical ability to communicate over time and distance (O'Leary & Cummings, 2007). Research shows that any distance of 50 meters diminishes interaction. Distances of different buildings, states, and time zones all increase the difficulty of reaching a shared mental model for smooth communication.

Media Richness

H3c: Maximizing Media Richness provides an opportunity to moderate all forms of negative conflict.

Richness differences in media include the medium's capacity for immediate feedback; chat is richer than email, video is richer than chat, and face-to-face reigns supreme. The amount of data one can communicate over the media is vital to clear communication and conveying or interpreting emotion. The less you know someone you need to communicate with, the richer or more capable the media format needs to be used.

Leadership

H3d: When Strong Cross-Team Leadership exists, it recognizes the conflicts hindering alignment and uses the other Tools for Mitigation and the Team Practices to mitigate or eliminate the conflict.

Cross-Team Leadership identifies the level of leadership and distinguishes it from leadership as part of team practices. The leadership skills, traits, and variables are similar and inclusive of team practice leadership but focused on the cross-team aspects rather than the individual team. Good leadership is not about preventing issues but handling

them immediately, entirely, and transparently. The leader acts as the binding glue that works to recognize and eliminate conflicts and issues between the teams.

Team Practices for Delivering Value

H4: Any individual sub-factor of the team practices for delivering value significantly different from another team's value will impact the GDT Degree of Alignment.

Process

H4a: Processes that do not align or provide for deliveries meeting other team's needs will cause process conflict in the GDT Degree of Alignment.

The Process sub-factor is the processes and metrics that govern software development. This includes user story creation through feature sell-off in a production-like environment. The process used is less important than it being consistent with all other teams in the system. Inconsistent processes by teams cause conflicts between teams.

People

H4b: The people on teams that interface with other teams directly impact the GDT Degree of Alignment regarding Task and Affective conflict.

The People sub-factor is the social and emotional aspects of the team, including items such as trust, customs, idioms, norms, etc. The most effective teams are ones that attain a shared mental model, which allows team members to know and be able to anticipate the reactions of team members.

Organization

H4c: When a team's organization sub-factor does not meet a minimum necessary level, the team's performance will cause conflict for the GDT Degree of Alignment.

The Organization sub-factor is all support provided by the organization, including network, office space, training, people for the project, and management support. Organizational support is important to provide the teams with the necessary support, training, and tools to successfully get the job accomplished.

Technical/Project

H4d: Teams not equal to other teams in domain and technical abilities develop into a superior/subordinate relationship with other teams.

The Technical/Project sub-factor is the technical ability to develop the software needed for the project at hand as well as the business domain knowledge regarding the project. The lack of knowledge of the business domain causes adjustments to process or requires additional support to be needed by other teams. The knowledge of what to build and the ability to complete the work are vital to the performance of each team.

Team Leadership

H4e: Local team leadership that does not provide the vision, communication, and emotional intelligence has a strong potential to allow other sub-factors to get out of control, impacting the GDT Degree of Alignment.

Team Leadership is the strategic vision, communication skills, and emotional intelligence to know when issues arise. Good leadership is not about preventing issues but handling them immediately, completely, and transparently. The leader acts as the binding glue that works to recognize and eliminate conflicts and issues between the teams.

Research Design

The goal of this research is to further the study of globally distributed agile software development teams to understand better the barriers to success that occur between the distributed teams.

- Validate the conceptual model through the case studies
- Validate the controlling factors for project success
- Establish and validate the relationship between the model variables.

To achieve the goals outlined above, the research will employ a replicated case study design to achieve the desired validity. Each case study will follow a Mixed-Method Sequentially Replicated based approach to understand the project factor impact from multiple points of view and data sources. Figure 22 – Case Study Flow depicts the overall flow of replicated cases with a high-level view of how each case will be executed. Sometimes in case studies, Validity is challenging to demonstrate and is a frequent criticism of case study research. To address this valid concern, this overall study consists of multiple cases replicated using multiple sources of evidence, maintaining a chain of evidence, and will have the draft report reviewed by key personnel in the study (Yin, 2018).

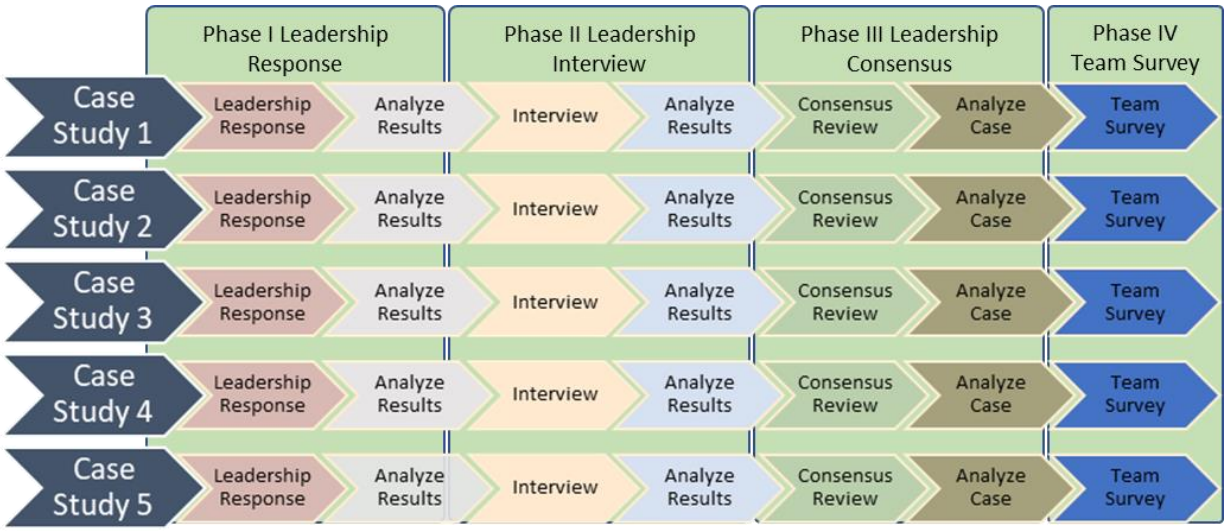


Figure 22: Case Study Flow

Each case in the study will be carefully selected to best gain insights into the research questions. According to Yin, selecting 2-3 cases to study would provide literal replication evidence. In a study of speed and communication, Herbsleb and Mockus used case study replication between two studies to show the impacts of having to wait for answers (Herbsleb & Mockus, 2003). Selecting 4-6 case studies showing replication makes a case for theoretical replication (Yin, 2018). With phases of the case study plan overlapping, i.e., in parallel, it is conjectured to be reasonable to execute up to five individual case studies with a minimum of three case studies being used to achieve the desired literal replication for validity and reliability purposes. The case study screening and selection criteria listed below describes the criteria needed to be a candidate for the case study.

1. Permission from the company to review documentation
2. Permission to publish, with company review, the results of the case study
3. Essential personnel must be available for the study (survey and interview)

4. The project selected as a case to study follows an agile scrum framework related process
5. The project consists of at least two scrum teams separated by distance
6. The product owner or scrum master for each scrum team participants
7. The project has concluded at least one major release to the customer

The overall case study approach will explore in-depth three to five historical cases of recently completed software development projects. Using the results of each case, the within-case findings will be determined. Analyzing all cases as a set will help determine the cross-case findings and cross-case generalizability compared to the conceptual model.

Data Collection Approach

The Mixed-Methods Sequentially Replicated Case Study is designed to gather data from multiple sources, validate this information through multiple exposures, and help to imply the intensity of impact on the overall project. The projects selected in this study are complex real-world projects. The research looks for details regarding the degree of alignment and the root causes for this level of alignment.

Using the Mixed-Methods Sequentially Replicated Case Study approach, the explanatory case study processing flow conducts an iterative detailed interview process to achieve a thorough analysis for each case study. Figure 23 – Individual Case Study Flow shows the overall flow of the process.

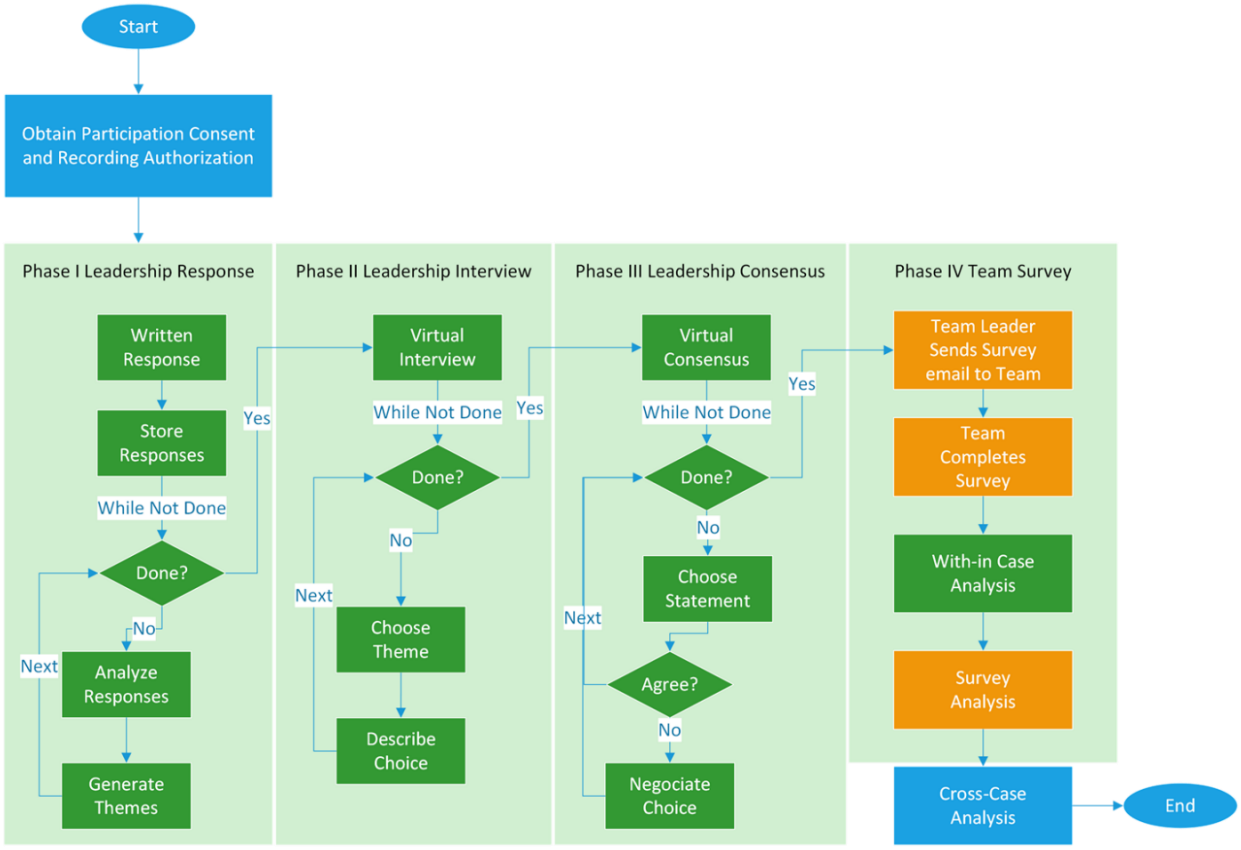


Figure 23: Individual Case Study Flow

Case Study Approach

For each explanatory case in the study, a three-round approach will characterize the project. Round one begins with the leadership team consisting of product owners and scrum masters. They will complete a written explanation (qualitative responses) of program issues and mitigations during the project execution. For convenience, this written explanation also includes the team survey questions (Likert multiple-choice responses). The researcher will analyze each response for themes and interview the leadership team leaders with returned written explanations. Round two of the study process is a short interview. The brief interview intends to narrow the responses driving to normalization of responses to understand best which factors impacted the project. Round three of the

study process reconciles findings and comes to a consensus in a group meeting. Additionally, the cases will be analyzed for themes to determine cross-case findings compared to the conceptual model. Conclusions will be drawn from the results to determine how well the individual case studies act as replicates for each other.

Selection of replicated cases to study and the targeting individuals on each case based on role significantly re-enforces Validity, Reliability, and Generalizability (Yin, 2018). The key personnel includes the overall team leader or product owner as well as the individual team product owners and scrum masters, as shown in Figure 24 - Identifying and Selecting the Key Personnel. The lead product owner and scrum master will be identified as key personnel where multiple scrum teams exist at a single location, depending upon the team's organizational structure. Due to variations in structure between Scrum of Scrums (SoS), Large Scale Scrum (LeSS), Disciplined Agile Delivery (DAD), and Scaled Agile Framework (SAFe) agile methodologies, key personnel are not required to have the product owner or scrum master title or role. Instead, they must be in the proper position of knowledge for the case study contribution. For the individual team key personnel, alternate scrum masters or product owners can be identified if the original persons are unavailable. This option is caveated with the following: they must have been a critical person and in a vital position during the period under evaluation.

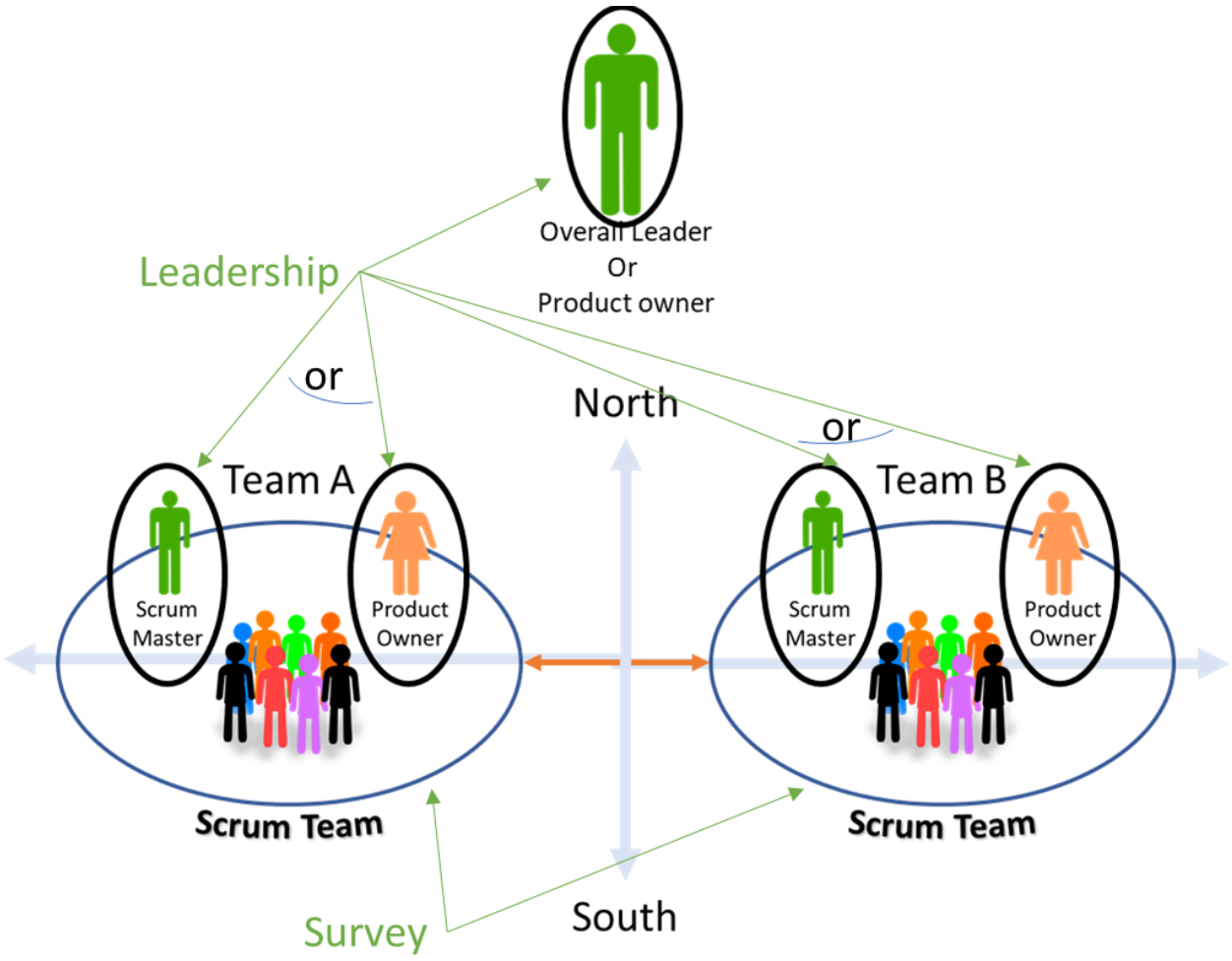


Figure 24: Identifying and Selecting the Key Personnel

Team Survey Approach

Following the leadership case study, a survey is distributed to the software development team. In Phase IV of the individual case flow, the team survey adds data set to analyze the case study themes. The survey flow parallels the flow of the case study questions. Due to the small population being surveyed, external validity is not a goal of the survey. Instead, the goal of the Team Survey instrument is to identify corroborating and contrasting trends between the leadership team and the software development team. The

survey instrument provides quantitative data gathered in the same manner and process as the Phase I Leadership Response.

Data Collection Instrument Description

For crucial personnel or leadership team, we asked them to fill out a detailed written response document. To put the bottom line up front, there are four parts to the research, as shown in Figure 25 – Individual Case Study Overview process. For convenience, as part of the phase I leadership written response, we have included the survey (part IV). There is significantly more value to this research in the qualitative responses. Respondents will be encouraged to make every effort to answer each qualitative response as completely as possible.

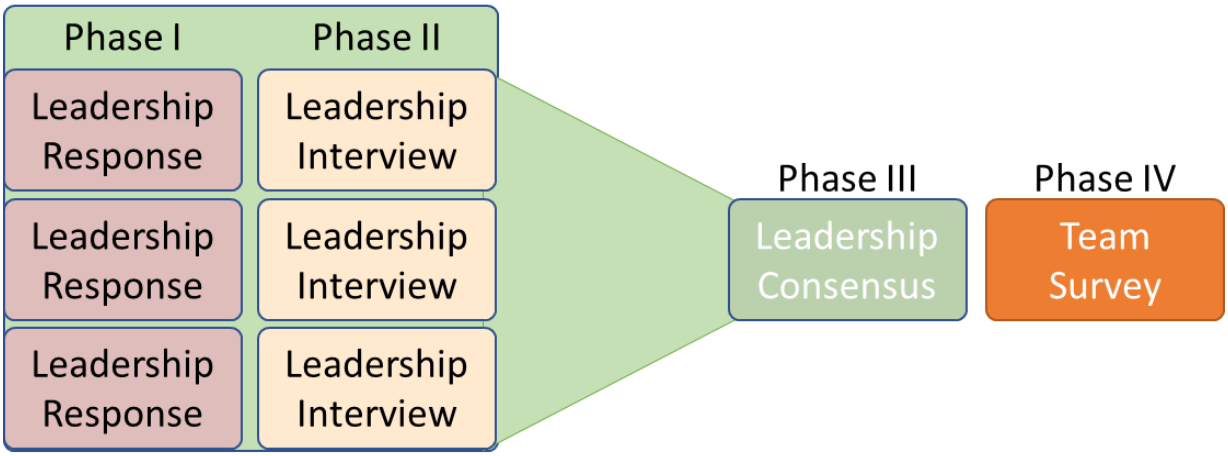


Figure 25: Individual Case Study Overview

The leadership response contains a series of questions to better understand the performance of distributed software development teams. Each question contains four parts: definition, survey question, survey answer choices, and a qualitative question. Each question begins with a definition to provide guidance and context for the questions being

asked. Parts two and three refer to the survey statement and Likert multiple-choice response. Respondents are to select the best response to the survey statement. Table 10 - Leadership Response Questionnaire shows the choices for all survey statements. The final part is the qualitative response. As a person in a leadership role, this is an essential section of the question. The respondents will be encouraged to be as complete as possible in their responses. The follow-up interview will provide an additional opportunity to clarify responses.

Table 10: Leadership Response Questionnaire

Definition:				
Survey Question:				
Answer Choices:				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Qualitative Question:				
Qualitative Answer:				

The Phase II Leadership Interview will be conducted via Zoom, recorded for transcription, and led by the researcher. The researcher will ask for verbal consent to record the interview. If consent is not provided recorded, the interviewee will not be able to participate in the study. The recording will only be maintained for the duration of the research. A transcript of the recording will be performed and stored in an encrypted file storage system.

The researcher will share the screen to verify the information collected by the interviewee. The leadership interview is round two of the study process. The short interview intends to narrow the responses driving to consensus.

The Phase III Leadership Consensus will be conducted via Zoom, recorded for transcription, and led by the researcher. The researcher will share the screen to verify the information collected by the leadership team (you and the others responding to the leadership response). The leadership consensus is round three of the study process, the final round. The short meeting intends to gain consensus from the leadership team regarding the project's properties.

The team survey contains a series of questions to better understand the performance of distributed software development teams. Each question contains three parts: definition, survey question, and answer choices. Each question begins with a definition to provide guidance and context for the questions being asked. Parts two and three refer to the survey statement and Likert multiple-choice response. Respondents are to select the best response to the survey statement. Table 11 - Team Survey Questionnaire shows the choices for all survey statements.

Table 11: Team Survey Questionnaire

Definition:				
Survey Question:				
Answer Choices:				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Case Studies and Surveys as Complementary Methods

The overall research study aims to provide the greatest validity possible for the research being undertaken. Overall, the research is a replicated case study with three to five individual cases being replicated. Each case study utilizes a three-phased approach to drive to consensus of impact. The goal is to eliminate individual bias and opinion so that experiential learning is highlighted. A team survey follows the individual case study to compare and contrast the results.

The survey has limited value due to the small question set and a small number of individuals surveyed. The survey's value is not generalizability. Instead, the value is comparatively analyzing the results against the leadership consensus. The survey is part of a consolidated approach to eliminate bias and provide as much validity to each case as possible with the replicated case studies. Yin refers to this approach as "converging lines of inquiry" (Yin, 2018). Using the team survey combined with the case study provides both breadth and depth in the individual case analysis. In this manner, the survey is complementary to the individual case study research and the overall research (Flyvbjerg, 2006).

Pilot Study Approach

A pilot study will be conducted before the general data collection is executed. There are two pilot study goals. The first goal of the pilot study is to ensure that the pilot case study process is executable. The second goal is to validate and refine the questions being asked during the study process and team survey. The pilot will be executed as similarly as possible to the project case study. A three-phased leadership Pilot Case Study Test will be undertaken to achieve the goals.

The Pilot Case Study Test will be conducted using the procedure with the intent to test every aspect of the procedure. Out of the pilot study will come timing for each stage of the study process, validation of the process as a whole, refinements of the Zoom scripts, any refinements enabling driving to a consensus more effectively, and insights into the phrasing of each question. Adjustments to the case study protocols will be made after the completion and analysis of the Pilot Case Study Test.

Due to the simplicity of the survey, the Team Survey Pilot Test has fewer refinement expectations. The Team Survey Pilot Test will be delivered to a current scrum team. Expected outcomes will include better timing information, refinements to questions, and a deeper understanding of the survey process. This certainly includes using the survey tools and reporting capabilities which will play a more significant role in the analytical portion of the research.

Quality of Research Methodology

Construct Validity

Construct Validity is the measure of quality showing how strongly the test predicts observed items of interest (Cronbach & Meehl, 1955). Construct Validity is sometimes difficult to demonstrate in case studies and is a frequent criticism of case study research. Addressing validity concerns, this study contains five replicated cases of study, multiple sources of evidence, maintains a chain of evidence, and multiple touchpoints for triangulation for each case (Yin, 2018). Using multiple cases provides replication of the study. This is one form of multiple sources of evidence. The second form of multiple sources of evidence is the individual study, consisting of a written interview, an in-person interview, and an impact assessment scored by the respondents. The detailed protocol

and scripted procedure are intended to provide consistency of execution across each study. The Mixed-Method Sequentially Replicated form of the study is directly intended to provide validity across the multiple cases being studied.

Internal Validity

Internal Validity is used for explanatory case studies to show a causal relationship between conditions (Yin, 2018). Because this case study is of an explanatory nature, internal validity is extremely important. The form of the study is planned to drive consistency of the within-case conclusions. This consistency across the key personnel internally validates the within-case conclusions. Yin proposes four tactics for solidifying internal validity in the analytic phase of case studies (Yin, 2018). The first of four tactics include pattern matching, which will be utilized in the cross-case analysis as well as in the interviews of sub-team key personnel. The second tactic is explanation building which is a direct result of the multiple exposures to the questions and qualitative responses that naturally comes from the Mixed-Method Sequentially Replicated process consisting of written interviews, in-person interviews, and final reviews for consistency. The third tactic is to consider rival explanations. These will be drawn out in the interviews if not seen directly as conflicting information between the two rounds of interviews. The fourth tactic for internal validity is to utilize a logical model. The logical model derived from the literature research is the basis for the case study research structure and is used for framing the questions.

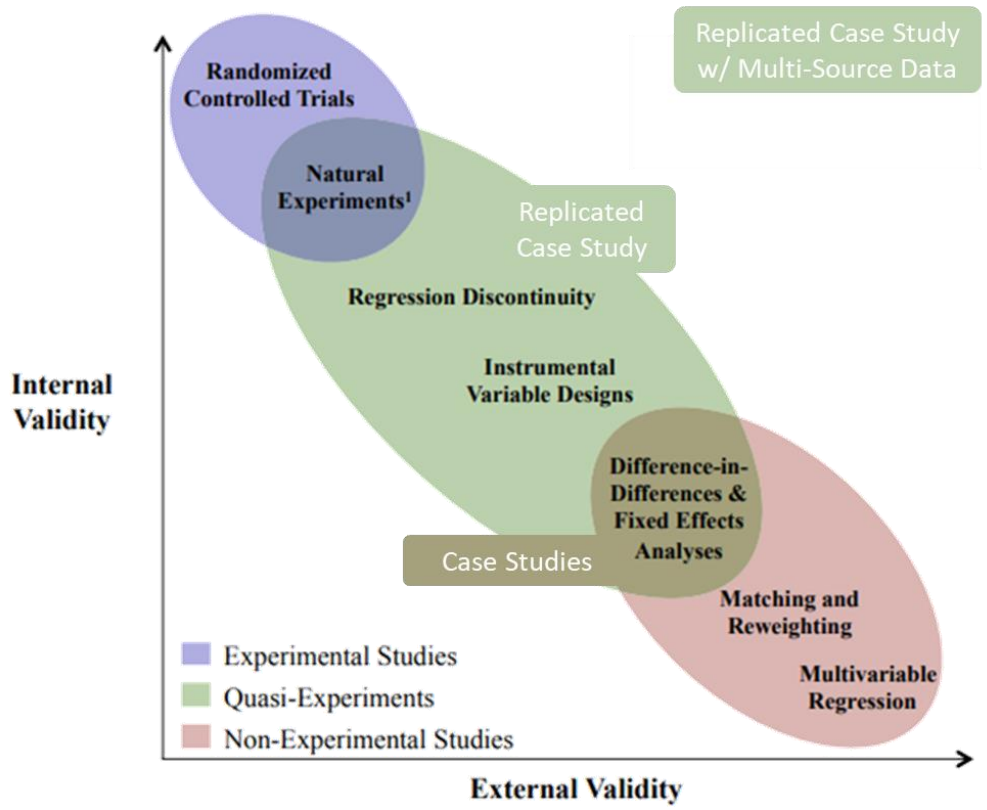


Figure 26: Trade of Internal versus External Validity (Geldsetzer & Fawzi, 2017)

External Validity

Generalizability: A case study is more analogous to an experiment than a sample in an experiment (Yin, 2018). Geldsetzer & Fawzi describe Quasi Experiments as an observational study with an explanatory variable that the research does not control. Yin describes case studies as quasi-experiments as experimental isolation more so than randomized trials used in the medical industry. Therefore, the case study research is not intended to be statistically generalizable to a population. This replicated research intends to produce significant reliability such that it can be considered generalizable across the study and to theoretical propositions.

External Validity is the generalizability of the case study to other external items. In the case of a replicated case study, external validity refers to the generalizability to similarities found in the cross-case analysis (Yin, 2018). Most research studies desire to draw generalizable conclusions, referred to as statistical generalizability. Case studies should not, in general, look toward statistical generalizability. Replication of similar cases in a larger case study provides analytic generalizability (Yin, 2018). Each study should be viewed as a self-contained experiment.

Reliability

Reliability is the ability to repeat the research (Yin, 2018). A fully documented procedure will be created and followed throughout the study period to ensure consistency across the various case studies and key personnel. Each case and sub-case, from the survey through the interview, will follow a documented protocol where the data set will be collected via the specified process and stored via the specified mechanism. Survey questions and data will be stored in a database. As documents are reviewed, the data collected, notes, and results will be stored in the same database. When conducted, the interview questions and responses will be transcribed with the text stored in the database. Raw interview recordings will be encrypted and stored on removable media.

Potential Sources of Bias

All research is subject to bias. Leedy and Ormond identify six strategies for eliminating or minimizing bias in qualitative research. This includes reflectivity, triangulation, distinguishing between data and reflection/memos, seeking exceptions and contradictory evidence, spending considerable time on site, and member checking and audit trails

(Leedy & Ormrod, 2020). Reflectivity refers to the personal, social, and political bias that would enter research from a researcher not reflecting and considering these factors. Reflectivity has been addressed in three ways, attempting to select projects from a wide variety of industries from around the world, reflecting on the conceptual model to define questions, and following a defined detailed protocol.

Triangulation is achieved by consistently applying the Mixed-Method Sequentially Replicated Case Study process through each case. By gaining written qualitative responses from multiple sources, then driving the sources to a consensus through a defined and reflective process, research bias is minimized, and individual respondent opinion bias is reduced. An additional triangulation source is achieved by conducting and analyzing the team survey in the context of the case study results. Yin refers to this approach as “converging lines of inquiry” (Yin, 2018).

To clearly distinguish between data and reflections, the researcher has created a protocol in the case study that has the other leadership team members reflecting on the responses as a team rather than the researcher making reflective memos that could easily be biased.

Seeking contradictory evidence as a bias control will be achieved through several avenues. First, the case studies selected are from varying industries, customer markets, and contract types. This ensures that the research is not rooted in one market where there may be a prevailing bias. Second, the projects selected for case study research are global. This helps to see projects from many cultural and social constructs. The third is to use the survey as a comparative data point to the case study. Fourth, the researcher will not draw direct conclusions from a single qualitative response. Instead, the research uses the Mixed-Method Sequentially Replicated method to support the factual gathering of

information. Finally, as analysis and conclusions are drawn, the researcher will bring in literature that supports and contradicts the results.

As a qualitative research project, field data is critical to understanding phenomena occurring within and across projects. The case study approach spends considerable time with each participant and case study. This provides significant opportunities to draw out the factual conditions and experiences within each project being studied.

The final area of bias, as articulated by Leady and Ormond, is “member check and audit trails” (Leedy & Ormrod, 2020). The pilot-tested protocol and replicated case study approach is a documented audit trail that can be checked and validated during and after the project's data collection phase.

Data Analysis

With-in Case Analysis

Data analysis will begin immediately as data collection begins. Each phase of the Case Study process requires analysis of the individual responses and generation of themes throughout the collection process. The procedure used to analyze the qualitative data is referred to as Thematic Analysis. Thematic Analysis is a specific process for pulling themes from qualitative data. This process is outlined in Figure 27 - Thematic Analysis Process Steps. The individual theme analysis will be collected in theme content analysis tables. The theme in the content analysis tables is the table owner, and the individual respondents are the contents. This approach gathers all responses for a given theme into a single source table for future analysis.

Phase	Description of the process
1. Familiarizing yourself with your data:	Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas.
2. Generating initial codes:	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3. Searching for themes:	Collating codes into potential themes, gathering all data relevant to each potential theme.
4. Reviewing themes:	Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis.
5. Defining and naming themes:	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
6. Producing the report:	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

Figure 27: Thematic Analysis Process Steps (Braun & Clarke, 2006)

Braun and Clarke's Thematic Analysis Process Steps are a general approach. These steps will be slightly customized to fit the research at hand. The initial codes are the factors and sub-factors identified through the literature research. The sub-factors may jump out as themes for some responses. Some responses may need to be bound into the factor groups for consolidation. This is analogous to what was done to consolidate factors in the literature research when developing the conceptual model (Braun & Clarke, 2006).

Following the Case Study process, the themes will be further analyzed for within-case observations. The within-case observations will be analyzed against the conceptual model and categorized as agreeing with or contradicting the concepts and hypotheses. In this portion of the analysis, no direct conclusions can be drawn as to the validity of the overall hypothesis.

Cross-Case Analysis

The Cross-Case analysis will be performed when all cases have been completed. The cross-case analysis combines all themes across the study versus looking into a single

case. This analysis will begin with the consensus reports using the qualitative responses as examples of the phenomena at hand. The analysis will take place for each factor of the conceptual model as well as overall observations.

Survey Analysis

A multi-stage set of analyses are planned for the survey data. While the survey is not expected to provide external validity for this set of quasi-experiments, it will be analyzed with the full intent to confirm or contradict the assumptions and hypotheses. Survey data will be analyzed for each case. Given the small data set, these conclusions will be used to support the within-case observations from the Case Study. Cross-case survey analysis will also be performed. The survey data will also be combined with qualitative response data to support conclusions for within and cross-case analysis. For each phase of analysis (within-case and cross-case), Figure 28 – Survey Analysis Workflow shows the analysis workflow.

Survey responses are collected, and responses are validated using the Qualtrics survey software and reporting tools. Only responses from direct team members are considered in the analysis. Respondents that specify their role as “Stakeholders” will not be included in the analysis. These responses will be saved and stored as other records. Confirmatory and Explanatory analysis will be performed across both the with-in and cross-case data sets. This information and data analysis will be used to test the hypotheses for rejection. The results of the data analysis will be used in a supportive manner with the qualitative response data to confirm or reject overall hypotheses and draw conclusions from the research.

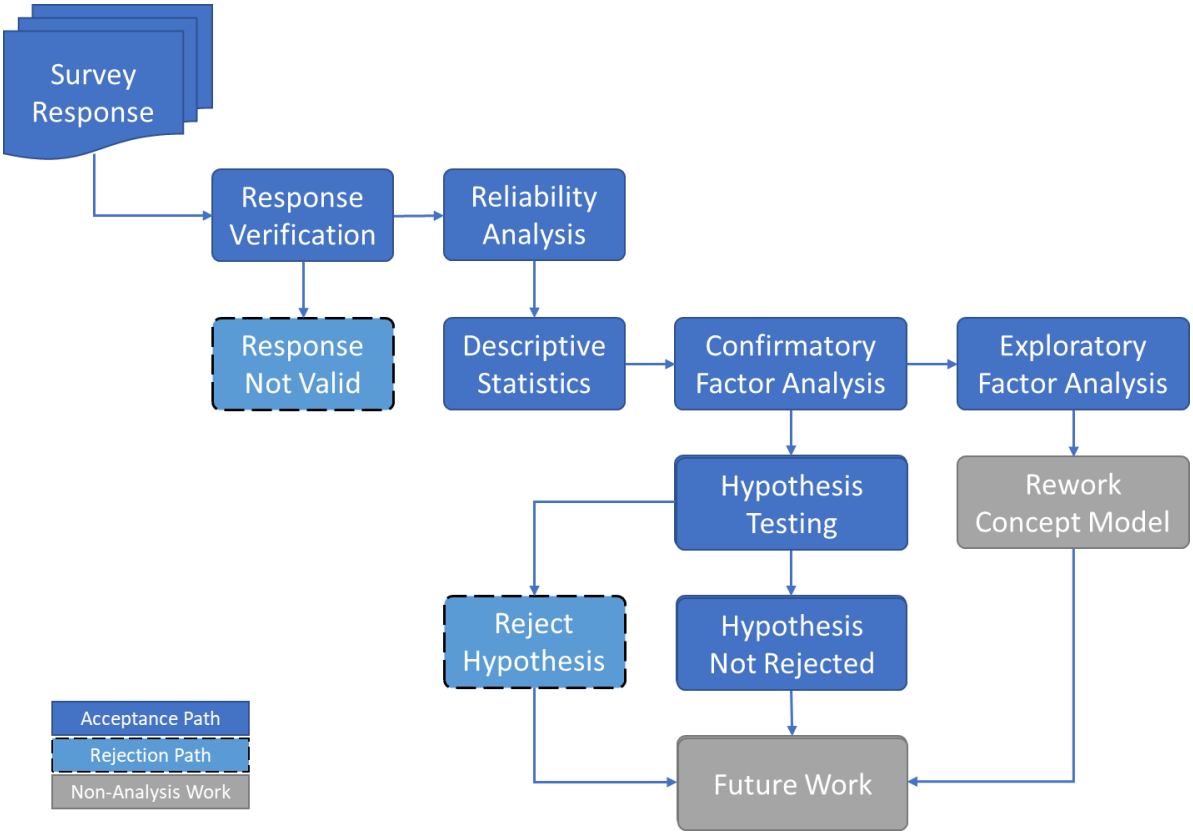


Figure 28: Survey Analysis Workflow

Hypothesis Testing

As shown in Figure 29 - Hypotheses Relative to Conceptual Model, the core hypotheses will be tested against the qualitative response data as part of the cross-case analysis. The survey data will be utilized in conjunction with the qualitative response data for confirmatory or derogatory information with regard to total combined hypothesis testing.

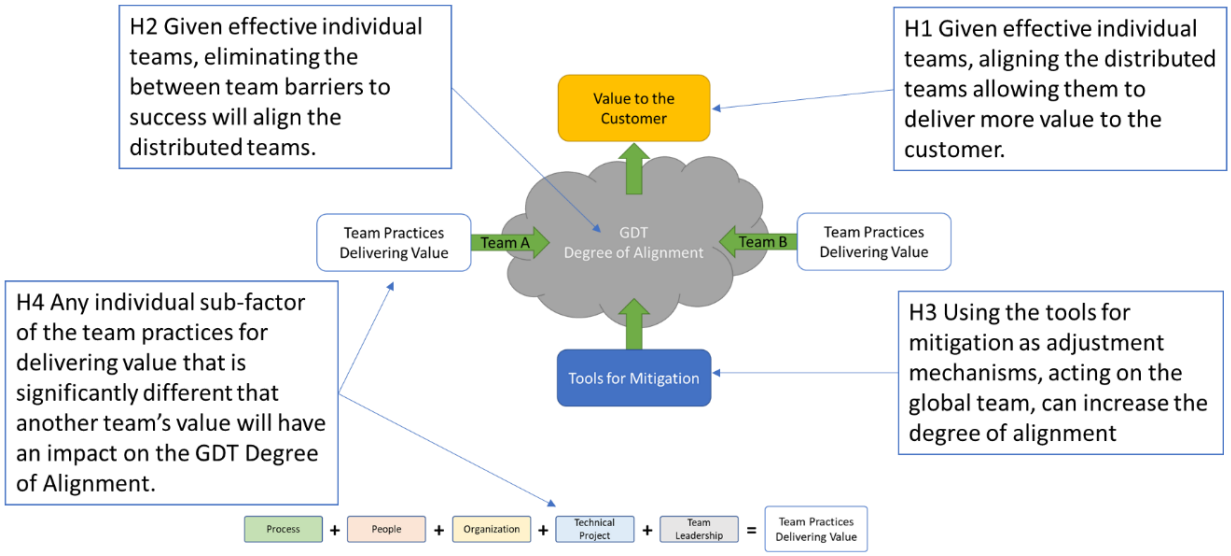


Figure 29: Hypotheses Relative to Conceptual Model

Research Design and Methodology Summary

The replicated case study over three to five cases should provide significant reliability. Assuming the cases being studied are similar enough to each other, the replicated style of the protocol could reach a point of having external validity or generalizability even though the quasi-experiments of each case do not typically lend themselves to external validity. Internally to a case, the Case Study provides validity and reliability through "converging lines of inquiry" (Yin, 2018). While the case studies should have no issues standing on their own, the team surveys will either add to the validity of the conclusions or conclude questions. Either way, the conclusions should help to reject or support (not able to reject) the hypotheses drawn in the conceptual model. While the conceptual model is believed to be correct, the research should provide the ability to conclude an analysis. This will fuel recommendations for future research and identify better methods for working in a globally distributed world.

CHAPTER FOUR: DATA ANALYSIS

Introduction

This chapter will discuss the data collection procedures, adaptions, and issues as the data is collected and analyzed. Raw, unfiltered results and analyzed data are presented. The chapter begins with the pilot study execution and adaptions undertaken as a result of the pilot study. Following the pilot study section, case selection describes why the chosen cases were selected. The data analysis section begins with the final Replicated Case Study and team survey procedure and the data collected for each study.

Pilot Study

A pilot study has been undertaken to refine the procedure and questions being utilized in the research. The Mixed-Method Sequentially Replicated Case Study pilot has been executed with experienced program managers that have in excess of 20 years of experience each. Each leadership case study pilot contributor is trained in agile software development and has experience leading agile development teams locally and globally.

For the team survey, an agile software development scrum team was chosen. The team has a mix of experienced and new software engineers on it. The team includes DevOps engineering and is responsible for developing their own automated tests as part of their user stories. The team regularly works with other teams inside and outside the company.

Pilot Study Execution

The Case Study Pilot was executed following the research data collection documented protocol. The participants were brought together for the pilot study's Leadership Case Study collection portion, where the research process overview was explained. The team

was informed that a Leadership Response Survey collecting qualitative data would be sent to them to complete. The emails and processes detailed in the research data collection document were followed to identify procedural issues and issues with clarity of the communications.

Leadership Case Study

The Leadership Case Study was executed using Qualtrics as a data collection tool. The steps outlined below provided the execution flow for the pilot study at a high level.

- Email to program leadership from Company Representative
- Email from program leadership to participants
- Email from Qualtrics (Ben Park) to begin Phase I of the Leadership Case Study
- Phase I Leadership Response executed by participants
- Phase II Leadership Interview executed via Zoom for each leader
- Audio Transcription and Theme generation consolidation by the researcher
- Phase III Leadership Consensus executed via Zoom for the leadership team

Team Survey

The Team Survey was executed using Qualtrics as a data collection tool. The steps outlined below provide the flow of execution for the study at a high level.

- Email to program leadership from Company Representative
- Email from program leadership to software development team member participants
- Email from Qualtrics (Ben Park) to begin Team Member Survey

Pilot Study Results

Leadership Case Study

As one might expect, pilot studies do not always go as expected. Several learnings came out of executing the pilot study. The learning opportunities started early with the timing of sending the initial emails from the company representative to program leadership and the email sent from the program to participants. Once the emails are sent, the clock starts ticking. For the pilot, the initial leadership team members were not engaged simultaneously. The lack of synchronization of engagement caused a perceived delay from the initial request to the actual start time.

The original pilot plan called for executing all emails via Qualtrics. As the Leadership response survey was deployed, it became immediately apparent that current network security implementations prevent emails with embedded links, as was the case in the pilot. As a workaround, the program leadership sent the email to the participants so they could access the survey. The data collection protocol has been updated to account for the change in the process. The email will be generated via Qualtrics and tested for firewall conveyance. If the Qualtrics emails are blocked, a similar email will be sent to the program leadership and the participants.

The Leadership interview and consensus meetings encountered script and question issues that required adjustments to better clarify what was being asked. The introductory email for the Leadership interview did not fully explain the coming process. This email has been updated to explain the process better. From walking through the script of the interview and consensus meetings, it was determined that some minor adjustments

needed to be made. Expressly, person and project identification must be confirmed before dropping the introduction screen.

Pilot users were asked and specified a desire to keep the definitions prior to the questions. The pilot users identified the definitions as providing context for the survey. A pilot user suggested identifying sections of the survey as “1 of 15” and “2 of 15” so the user could quickly identify their location within the survey tool. An additional issue with the pilot study was identified when the user transitioned past the last question where the survey ended. To address this issue, a final “thank you” message was included in the survey so the user could back up to other questions within the survey. Numerous question suggestions were made for clarity of questions or grammatical reasons. Table 12 - Question-Wording Changes from Pilot Study shows the original question and the changes from suggestion or analysis to the new question. The Qualtrics Leadership Survey and the Team Survey have been updated to match these question changes.

Table 12: Question-Wording Changes from Pilot Study

Original Question	New Verbage
GDT Tools for Mitigation - Architectural Modularity	
We run independently from other teams while being able to develop to our goals and mission.	We execute independently from other teams while developing to our desired goals and mission
GDT Tools for Mitigation - Media Richness	
In our communications with other teams, we mostly use video (camera on) for meetings, conversations, and clarification of issues.	In our communications with other teams we typically use video for our meetings, team collaboration and issue resolution
GDT Tools for Mitigation - Cross-Team Leadership	
The overall project leadership identified and addressed technical and people related issues effectively and quickly.	The overall project leadership identified and adequately addressed technical and personnel related issues quickly and effectively
Team Practices for Delivering Value - Organization	
The organization supports the team by supplying the right tools, training, and people for the project.	The organization adequately supports the team by supplying the right tools, training and personnel
Team Practices for Delivering Value - Technical/Project	
The team I am on has the business/domain knowledge to directly understand the customer's needs as well as the technical skills to implement the solution.	The team I am most closely associated with has the business and domain knowledge to adequately understand the customer's needs and the technical skills required to implement a quality solution.
Team Practices for Delivering Value - Team Leadership	
Local team leadership moves quickly to remove impediments, communicate information from other teams, and value us as individuals.	Local team leadership demonstrates their commitment to individual contributors by moving quickly to remove blocker impediments and communicating relevant information from other teams

Pilot Leadership Case Study response documents, and transcripts, are available in Appendix A Pilot Study Notes and Collected Data.

Team Survey

The Pilot Team Survey was executed using Qualtrics as a data collection tool. The steps outlined below provided the flow of execution for the study at a high level.

- Email to program leadership from Company Representative
- Email from program leadership to software development team member participants
- Email from Qualtrics (Ben Park) to begin Team Member Survey

Learnings from the Pilot for the team survey are similar to the Leadership Case Study. The email from Qualtrics failed to penetrate the firewall. The email issue was remedied by sending the anonymous link to the program leader, who, in turn, provided it to all participants. There were some suggestions regarding the wording of the questions. These were incorporated with the Leadership Case Study suggestions and are shown in Table 12 - Question-Wording Changes from Pilot Study. Pilot Team Survey response documents, and transcripts, are available in Appendix A Pilot Study Process and Collected Data.

Case Selection

The case selection process is complex in today's mega-company environment. Figure 30 – Case Selection Process outlines the overall process for selecting a single case. The Contact phase involved reaching out to known individuals, associations, and networks of people, providing them with details regarding the purpose and scope of the research. The research project reached out to more than 55 initial contacts from more than 45 companies or divisions in this process. The initial contact was often not the approving contact from a corporate approval perspective. Once contacted, gaining Company Participation required navigating through the maze of approvals specific to each company.

In many cases, the Company Participation was totally disconnected from Project Identification. The Project Identification phase required discussions with numerous individuals to determine if a known project was compatible with the research requirements. Once projects were identified, Project Participation was obtained through discussions with the project leadership. With Project Participation agreed upon, the Case

Study would begin in earnest. In order to ensure the participation emails arrived in front of the participants, the project leader often needed to send the email directly.

Figure 30: Case Selection Process

Selecting the right cases to study requires a combination of factors. The cases must meet the criteria for selection. The criteria included multiple scrum teams separated by distance and, ideally, separated by at least one time zone. The project state needed to have produced at least one release. The people for the Case Study (leadership team) had to be accessible. While this usually means the project could not be completed, it was not a requirement. The entire software development team's availability was desirable, but not a binding requirement as the team survey is confirmational information. Table 13 – Project Selection summarizes projects selected for the Mixed Methods Sequentially Replicated Case Study. The project selection goal was to select projects from a cross-section of market segments, a variety of team locations and sizes, and a variety of company sizes.

Table 13: Project Selection

Project Name	Market Segment	Leader Team	Team Size	Company Size	Locations
Case I	Food & Beverage	6	18	Large	US (TX, FL) and India
Case II	Healthcare	4	6	Small	US and India
Case III	Oil & Gas	6	11	Large	US and India
Case IV	Insurance	3	10	Medium	US and India
Case V	IoT	3	7	Small	US and India

Data Collection

Case Study and Team Survey Procedure

The Case Study and Team Survey followed the Mixed-Method Sequentially Replicated Case Study Procedure documented in Appendix B Research Data Collection Document. The Research Data Collection document was updated following the Pilot Study and was used for all case study analyses.

The Research Data Collection document describes a plan to collect the leadership data in three phases. Phase I begins with the qualitative survey. Phase II, the leadership interview, ensures an understanding of the qualitative response. Phase III, the team interview, was to determine the impacting factors. As Case Study I Leadership Interviews concluded, it became clear that the team interview was unnecessary due to a minor change made during the interview process. The data collected during the leadership interview clearly indicated each leader's view of the impacting factors. The impacting factor evaluation was indicated by the individual and team scoring of the factors during the leadership interview process. A preliminary scoring was performed prior to the interview. The interview process change included updating the individual scores to reflect the individual leader's final scoring of the factor. Updating the individual scores during the interview process allowed the researcher to re-evaluate the team score impact of each factor without having to reconvene the leaders in another meeting.

In the Case Study Analysis sections below, Leadership Responses have been scored from 1 to -1 based on the Phase I Survey responses and the follow-up Phase II Interviews. The responding participant determined the scoring during the interview process. The researcher asked the following question: "Based on your response, would you categorize

this factor as having a Positive, Neutral, or Negative impact on your project?" Positive scores equal one; Neutral scores equal zero; and Negative scores equal minus one. These scores are averaged to determine the average impact score as assisted by Leadership.

A thematic analysis was performed against the raw responses to determine the importance of factors relating to this Case Study. The thematic analysis shows broad trends and specific issues with the qualitative responses. The complete thematic analysis table, organized per case study, is documented in Appendix C - Thematic Analysis Data. The key results and observations within the case studies are summarized below.

Case Study "Within Case" Data Reporting

A series of charts and tables in each case study help explain the observed within-case results. The Team Structure figure, as shown in Figure 32, depicts the organizational construct of the team under study. The size and location of the team are identified on each of the team structure figures.

A summary table in the general results section of the within-case results shows the leadership response and the team survey summary scores. See Table 14 as an example of the summary in each case. The table summarizes the positive and negative characteristics on a factor-by-factor basis. These characteristics are drawn from responses derived from the thematic analysis. Analogously, the average Likert scores are derived from the average of the team member's responses. With the characteristics sitting side-by-side, one can conclude as to the agreement or lack thereof between the team member's responses and the leader's responses. The average leadership impact score

chart is shown in Figure 32 and depicts how the leadership valued the impact of each factor on the overall project. The gradient-colored chart, described in Figure 31 - Explanation of Leadership Response vs. Team Survey, depicts a colored gradient showing the alignment between the leadership and the team members. The green areas on the chart show alignment between the leaders and the team members. As the green fades to red, the alignment is lost. In the red, the team and leadership have different perspectives regarding the factor. Besides alignment, the Leadership Response vs. Team Survey chart depicts the strength or impact of the team and leadership response by being located at higher Likert scale values (1=Strongly Disagree to 5=Strongly Agree) and higher leadership interview scores. When the Team Survey question is asked in a negative context to the leadership scoring mechanism, the team score is inverted and highlighted in red in the table.

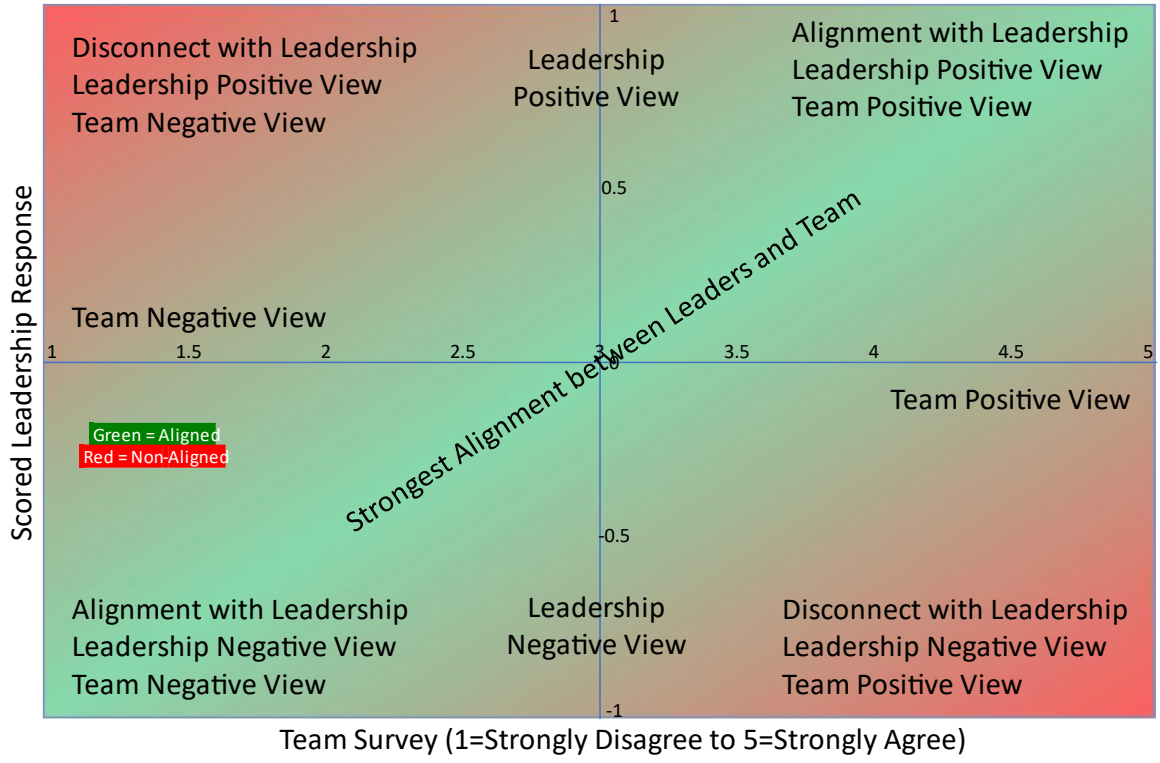


Figure 31: Explanation of Leadership Response vs. Team Survey

There are a series of charts and tables created on a factor-by-factor basis. The Leadership Response table shows the scored value of each leader and the average score. Table 15 is an example of the Leadership Response table. As described above, the leadership scores have been scored by the leaders in a range from one to minus one. The Team Survey Response Regarding Factor charts shows the team member responses. Figure 35 - Team Survey Response Regarding Task Conflict is an example of the Likert-based response chart.

Within-Case Study Analysis

Case I

Project Overview

The project studied as Case I was only a small portion of a significant update of the company's SAP software system. The complete project included updating the SAP software, normalizing all SAP data across numerous divisions, and incorporating the data normalization changes throughout every system interfacing with the SAP Software. The portion of the project selected included just the warehouse management systems as downstream software connected to the SAP Software system. The SAP upgrade project was initially scheduled to include 18 months of development with about eight months of end-to-end testing prior to site deployment. Program leadership provided an overview of the project as well as the teams involved.

Selected Participants

The warehouse management software updates consisted of two development teams, one in Florida, USA, and one in India. An overall test team is also part of the India development team. The overall project leadership was located in Texas, USA. The participants selected and their locations are depicted in Figure 32 – Team Structure for Case Study I. From the overall leadership team, the overall program manager and technical leader were selected to be participants. The team identified as Team A had a clear technical product owner and scrum master. Team B had a person co-located with the leadership team acting in the technical product owner role. In contrast, the scrum master role was executed in India.

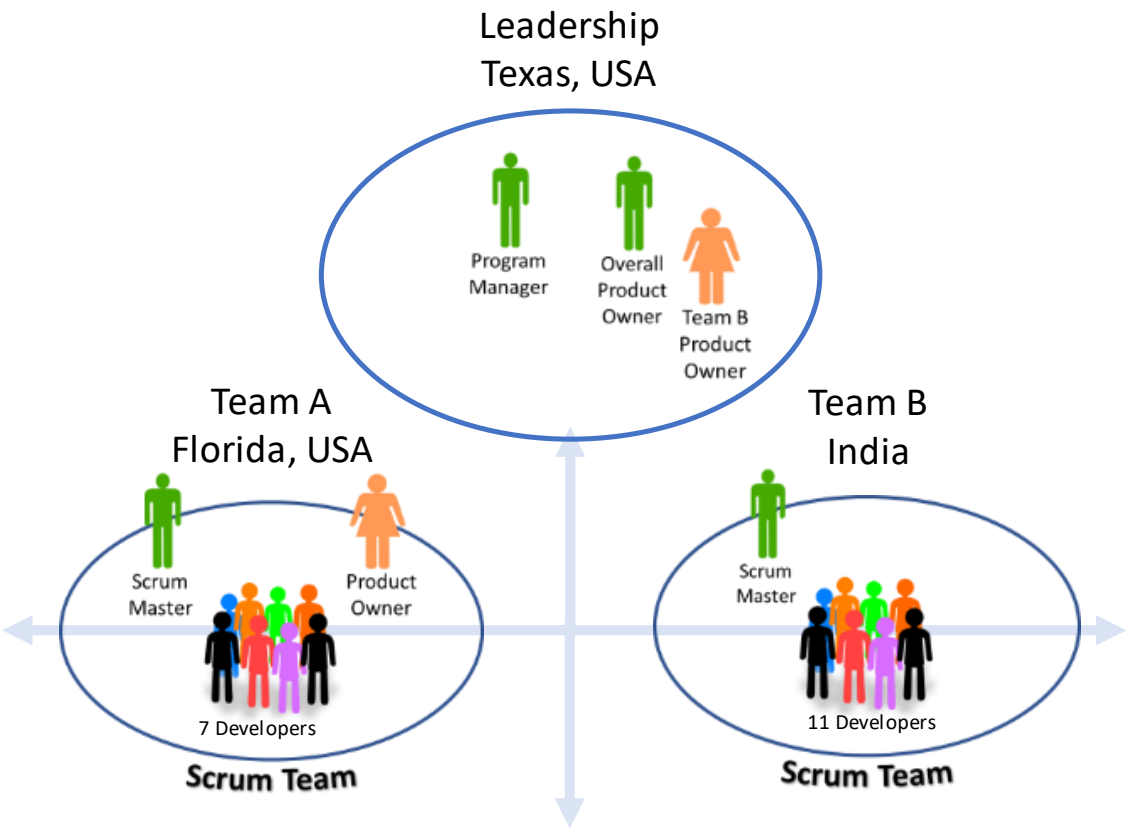


Figure 32: Team Structure for Case Study I

Participation Levels

Four of the six identified individuals for the case study responded to the Phase I Leadership Response. Responses were received from the overall program leadership and each team's leadership. Phase II Leadership Interview proceeded without issue for all Phase I respondents. Initial Team Survey response consisted of eleven out of eighteen respondents participating.

Within Case Reflections

Overall project status shows the project is six-plus months behind the desired and original schedule. The two downstream teams are showing signs of requirements creep and

rework. As identified by the leadership team, their sprints are often light on well-defined work.

General Reflections regarding the overall project studied indicate it is running reasonably well with areas for improvement. At this time, the issues seen are not so pervasive as to impact the total execution of the project. The SAP team (upstream of this study) submits changes and requirements to the leadership team as the overall design flows to completion. The leadership team has not been able to adapt to this evolving situation. This issue is discussed in the detailed factor observations under the process conflict section.

A summary in Table 14 – Summary of Factor Reported Impacts shows the leadership response and the team survey summary scores. The table summarizes the positive and negative characteristics on a factor-by-factor basis. These characteristics are drawn from responses derived from thematic analysis. Analogously, the average Likert scores are derived from the average of the team member's responses. With the characteristics sitting side-by-side, one can conclude as to the agreement or lack thereof between the team member's responses and the leader's responses.

Table 14: Summary of Factor Reported Impacts

	Leadership Response				Team
Factor	**Positives**	**Negatives**	**Mitigations Taken**	**Impact Avg**	**Survey Avg**
Task Conflict	Good Communications Regular Meetings Work Divided/Modular			1	4
Process Conflict		Process Differences No Backlog New to Agile	Training Process Adjustments	-0.5	3.5 1.5
Affective Conflict	Leaders Isolated Contact	Isolated Conflicts	Minimized Contact	0	2.4 2.6
Architectural Modularity	API Driven Modularity Independent Operation			0.5	3.7
Degree of Dispersion	Only Team Lead crossed timezones	Turnover and burnout	Leader Adjusted Hours	0.75	3.4
Media Richness	Plenty of Capabilities Media Windows	Video Not Used	No Mitigations Taken	0.5	2.8
Cross-Team Leadership	Recognized Conflict Open Discussions		Minimized Contact	0.75	4
Process	Shared Integration Plan	Mostly Manual Testing Differences in Processes	Creating Automation	-0.25	3.3
People	Trust within Team Shared Goals Cooperation			0.75	4.4
Organization		Limited Agile Training No Resources Available	Resource Issues Overcome	0.5	4.1
Technical/Project	Highly skilled	Scope Creep Schedule Creep	Kept the same team	0	4
Team Leadership	Open Leadership Rapid Response			0.25	4
Process and Affective Conflict require inverted survey responses (Inverted/Non-Inverted) Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

Project Status	Not Successful – Six months late due to Process Conflict

The scored impact of each factor is shown in Figure 33 – Average Leadership Factor Impact Score. The leadership team identified Task Conflict as the most positively impactful factor. The teams regularly discuss application programming interfaces (API) changes and their implementation. The leadership team also identified Process Conflict as the most negatively impactful factor, while the team score was significantly positive. Reportedly, this is primarily due to the upstream SAP team changing the implementation following an initial phase which is likely not visible to most team members.

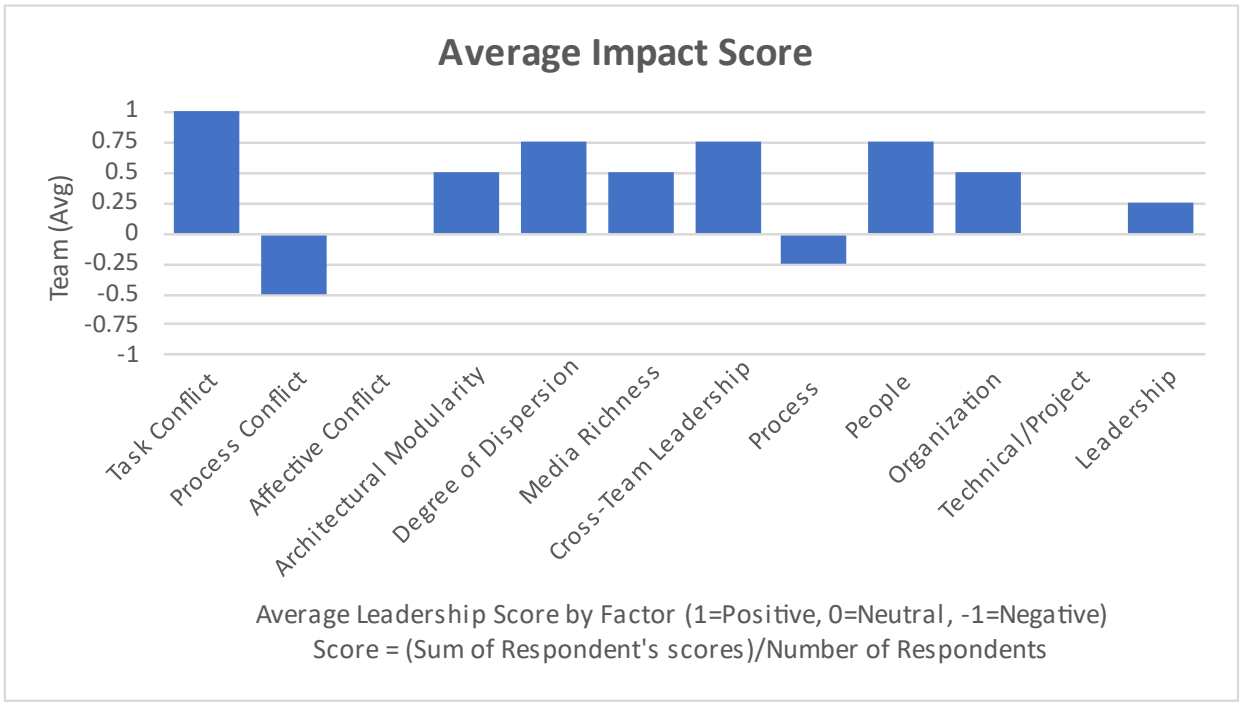


Figure 33: Average Leadership Factor Impact Score

Team A responded to the team survey with every member participating. Team B had only half of the members respond. The team survey results roughly correspond to the leadership results. Figure 34 – Alignment and Impact Across the Team show the alignment of the leadership compared to the team members.

For Case Study I, the leadership response vs. team survey identifies a robust alignment for Affective Conflict, Architectural Modularity, Process Conflict, and People. Cross-Team Leadership and Organization have the next most substantial alignment. While alignment between the leadership and team members is beneficial, it is more informative when the alignment is coupled with impact. The chart shows that the leadership and team are mostly aligned across the factors. The factors having the most alignment and impact are

People and Architectural Modularity as a positive impact. Process Conflict is aligned between leadership and team but with a strong negative impact.

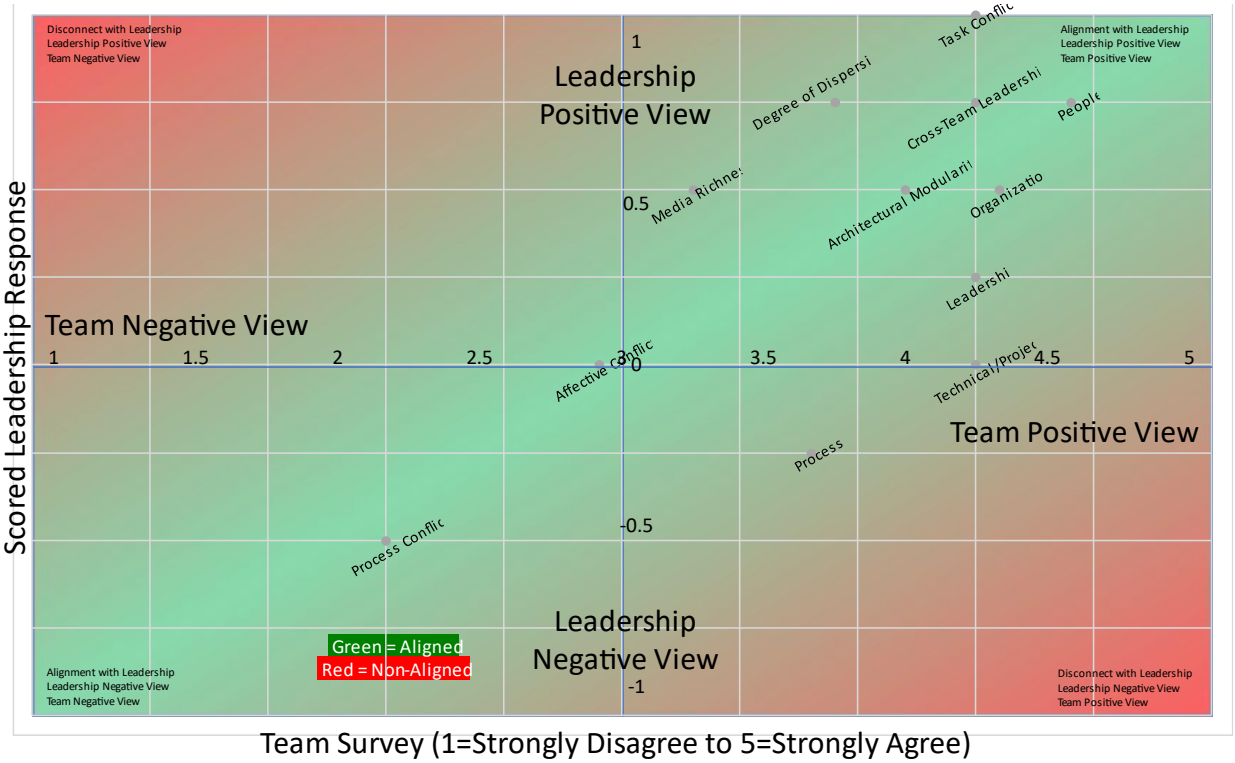


Figure 34: Alignment and Impact Across the Team

Task Conflict

Task Conflict refers to the alternatives to implementing a particular feature. Regarding this factor, identification of communication regarding how items are implemented is desired. Task conflict is essential as it shows the team members are safe to discuss alternatives to the current implementation or design. Task conflict between teams demonstrates that teams are relatively equal in their knowledge and ability to complete the work. Table 15 – Leadership Response Regarding Task Conflict consistently indicates that all leaders identified Task Conflict as being present and positively impacting the project.

Table 15: Leadership Response Regarding Task Conflict

GDT Degree of Alignment Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Task Conflict	1	1	1	1	1
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

The top-level leadership seems to provide good cross-team leadership with extensive discussion times and topics in this area. The regular engagements between teams clarify API decisions, design choices, and ways of working. Respondent B encapsulated the task conflict with this quote “We have a regular call to discuss system requirements and changes. In that call, we would discuss how a change would impact each team, and there are questions with regards to the requirements before we do the actual implementation.”

Figure 35 – Team Survey Response Regarding Task Conflict corroborates the leadership survey conclusions, with all respondents indicating a positive or neutral response. The figure below shows the respondents for each Likert response collected through the Team Survey. The corroboration between the leadership and team responses indicates a high level of communication among the team members and between the teams.

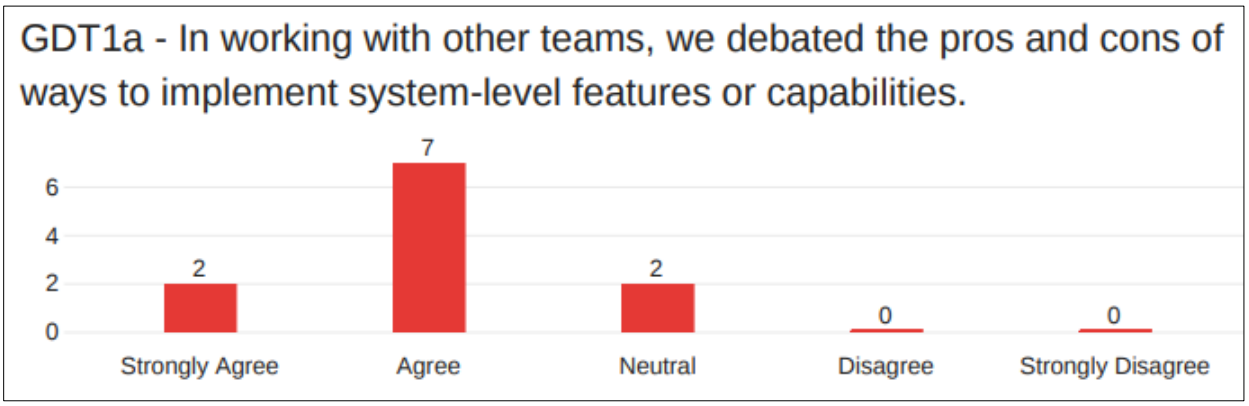


Figure 35: Team Survey Response Regarding Task Conflict

Process Conflict

Process Conflict occurs when teams have differing processes incompatible with the timing and quality of what they deliver. Table 16 – Leadership Response Regarding Process Conflict indicates that the leadership team sees a negative impact of the Process Conflict on the overall project. The upstream SAP issue is where the upstream team has been late in defining work or changes submitted after the implementation that cause rework. The impact of this issue is outside the focus of this research. Still, it is a typical project execution issue causing project delivery delays. The second issue is overlapping work without clarity. With one team defining an interface or changing a process, another team should not be working on the same item in the same iteration without a clear definition. Overlapping work without a clear definition can cause significant delays. It also has a high likelihood of rework and contributes to not completing work within an iteration or sprint. The cross-team leadership can address the process conflict by having one team execute what is defined. In contrast, the other team or teams designs how it would be implemented in their portion of the solution. This approach can work if there is enough schedule runway to accommodate the staggering of work.

Figure 36 – Team Survey Response Regarding Process Conflict shows that the team members agree with the leadership response. The agreement is that the Process Conflict had a negative impact on the project. That is to say, the processes utilized did not create alignment between teams.

Table 16: Leadership Response Regarding Process Conflict

GDT Degree of Alignment Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Process Conflict	0	-1	-1	0	-0.5
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

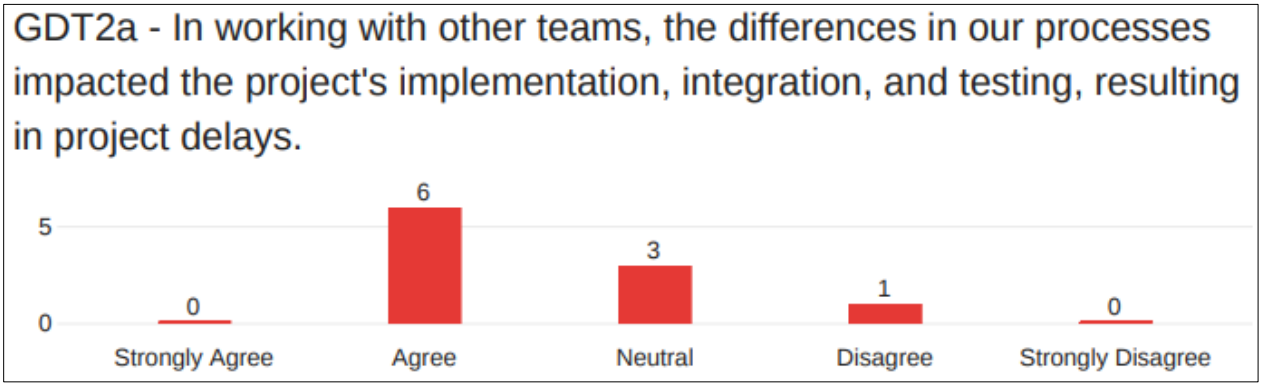


Figure 36: Team Survey Response Regarding Process Conflict

Affective Conflict

Affective Conflict has been cited as inhibiting communication between team members. The inhibiting communication can come in avoidance of contact or the withdrawal of participation in meetings. In either form, the lack of effective communication hurts the team's operational effectiveness. Respondent A stated, “The relations between teams were cordial for the most part, but there have been a few individuals whose personality and attitude did cause conflicts. We tried our best not to let these conflicts affect our work and to focus on the deliverables.” Table 17 – Leadership Response Regarding Affective Conflict shows where the respondents agree and disagree on this factor. The strong negative response from this leader identifies an issue. The affective conflict was re-identified through a second source during the interview process with respondent C. The other two respondents did not identify any affective conflict issues in their responses or

interviews. Based on the partial identity of an affective conflict issue, one might conclude that the issue is only seen in some situations or interactions.

The team survey responses, shown in Figure 37 – Team Survey Response Regarding Affective Conflict, show a similar bifurcated response to the leadership response. As identified, there seemed to be a singular individual causing some disruptions in some meetings while other team interactions worked without the affective conflict.

Table 17: Leadership Response Regarding Affective Conflict

GDT Degree of Alignment Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Affective Conflict	0	0	1	-1	0
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

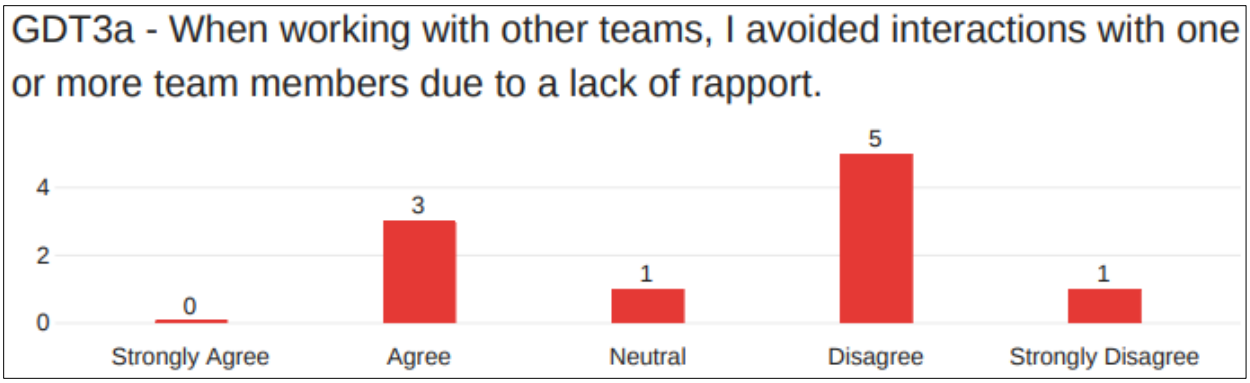


Figure 37: Team Survey Response Regarding Affective Conflict

Architectural Modularity

Architectural Modularity is the ability to work independently from other teams as the design work progresses. The teams perform work based on an interface specification. They work independently from other teams. Even given significant changes in design throughout the project, the team responded with consistently described highly modular

architectural decisions, such as renegotiating the interfaces to implement the changes to system designs. Table 18 – Leadership Response Regarding Architectural Modularity shows one respondent with an opposite view of Architectural Modularity to the other leaders. Respondent B summarized the state of architectural modularity: “Generally speaking, the teams work very independently. While we are working from a common set of requirements requiring a significant number of changes beyond the specifics of the interface changes, how one team executes their changes has little or no effect on the other.” Respondent D sighted the influence of the upstream team as having a significantly negative impact on their ability to work independently.

The team survey response is generally favorable. The survey view in Figure 38 – Team Survey Response Regarding Architectural Modularity agrees with the general leadership response. There is a strong alignment between the leadership and team members regarding this factor, with a reasonably strong impact score for this factor. From this data, the leadership and team members feel like this factor is important to their success.

Table 18: Leadership Response Regarding Architectural Modularity

Tools for Mitigation Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Architectural Modularity	1	1	1	-1	0.5
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

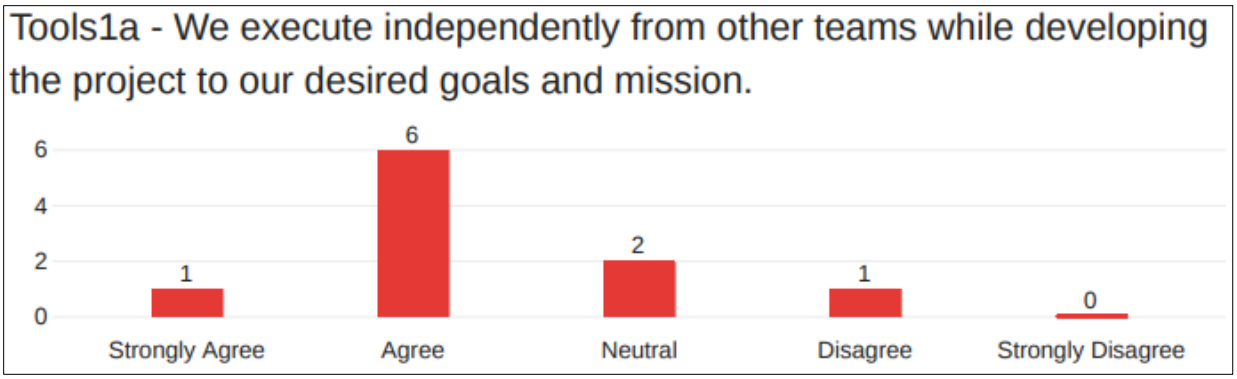


Figure 38: Team Survey Response Regarding Architectural Modularity

Degree of Dispersion

Degree of Dispersion is the separation of time and distance between the teams. With teams located in Texas, Florida, and India, the project is an example dealing with the Degree of Dispersion given the 9.5 hours of time shift among the teams. The operational structure of the team places one of the India team leaders in Texas, with the other leader co-located with the team. This construct is ideal from a team performance perspective as it provides local communication vehicles to both project constructs while bridging the significant Degree of Dispersion created by the time zones between Texas and India. The structural approach has been viewed as positively impacting the project, as shown in Table 19 – Leadership Response Regarding Degree of Dispersion. The business domain leadership is co-located with other project leaders.

In contrast to product ownership being at a distance, the technical execution leadership is co-located with the development team. The drawback of this construct comes from anecdotal evidence, which indicates that this construct increases the turnover and burnout of individuals in these roles. The increased turnover and burnout potentially come from the work responsibilities required from this type of construct. The leaders must

regularly coordinate and communicate outside the standard work hours for either leader. The late-night calls or very early meetings to support the needed collaboration can significantly disrupt one's work/life balance.

The team survey response mostly agrees with the leadership response. Figure 39 – Team Survey Response Regarding Degree of Dispersion shows mostly agreement with some disagreement. The response from the team shows that the team is adapting but with mixed results.

Table 19: Leadership Response Regarding Degree of Dispersion

Tools for Mitigation Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Degree of Dispersion	0	1	1	1	0.75
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

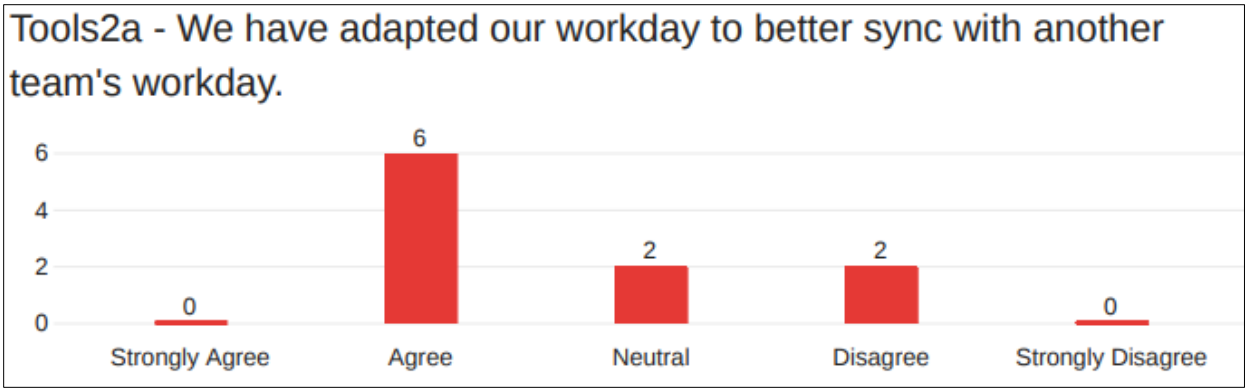


Figure 39: Team Survey Response Regarding Degree of Dispersion

Media Richness

Media Richness is the bandwidth and tools to communicate over a medium. Respondents, in this case, all described using the tools for Media Richness as inadequate. Table 20 – Leadership Response Regarding Media Richness shows this with

the variability among the leadership respondents. At the same time, the respondents stated that they did not utilize the tools to their full capabilities. Respondents described using Zoom for meetings. However, they also stated that for almost all communications, no video was used. When questioned about using the chat and whiteboard capabilities of the Media Richness tool (Zoom in this case), for the most part, the respondents were not aware Zoom had a whiteboard feature. They also were unaware of or did not use the chat features of Zoom outside of a direct meeting.

Respondent A summarized the overall status tool usage for Media Richness with “We mostly used Zoom for communication. Chat was always the least effective. Communication significantly improved when we used Zoom voice meetings over Zoom chat. However, even in Zoom voice calls, most people (usually about 80%) would simply keep their cameras turned off. I would say that turning off the camera did not noticeably decrease the quality of communication. The lack of a whiteboard for face-to-face discussion was definitely felt.” The knowledge gap identifying the capabilities of the tools versus what was used shows a lack of organizational training regarding the tools, their usage, and how to utilize them to accomplish the desired goals effectively.

As shown in Figure 40 – Team Survey Response Regarding Media Richness, the team declares that they are not utilizing the technology completely. While this agrees with the leadership responses, no conclusion is made here as to why they chose not to utilize the full capabilities of their tools.

Table 20: Leadership Response Regarding Media Richness

Tools for Mitigation Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Media Richness	0	0	1	1	0.5
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

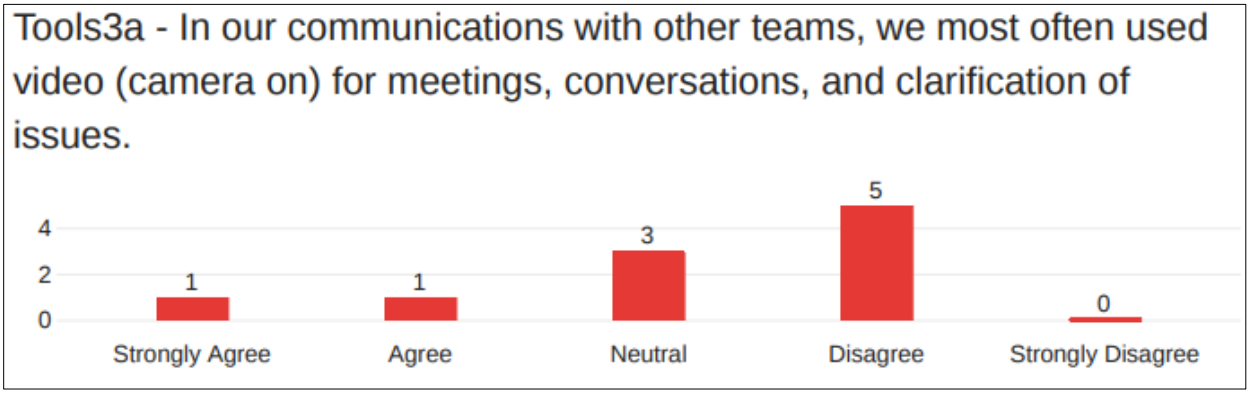


Figure 40: Team Survey Response Regarding Media Richness

Cross-Team Leadership

Cross-Team Leadership is team management above the individual team leaders. Respondents across the group identified no specific issues relating to cross-team leadership. Most respondents identified strong leadership, as seen in Table 21 – Leadership Response Regarding Cross-Team Leadership. Figure 41 – Team Survey Response Regarding Cross-Team Leadership shows that team members respond with similar strengths. The more subtle signs of some cross-team leadership issues show up in the inefficiencies of team operation. Some affective conflict was identified. However, no specific response could be identified to the demonstrated conflict. A potential lack of organizational training could be identified regarding the usage of Zoom for Media Richness, with no identified recognition of the issue by the cross-team leadership. From a down and into the team perspective, cross-team leadership seems to be effective.

Respondent C specifically calls out weekly calls and issues being “addressed in a timely manner.” This effective leadership is contradicted by statements regarding the lack of addressing impacts of upstream teams not delivering or performing as desired.

Table 21: Leadership Response Regarding Cross-Team Leadership

Tools for Mitigation Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Cross-Team Leadership	0	1	1	1	0.75
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

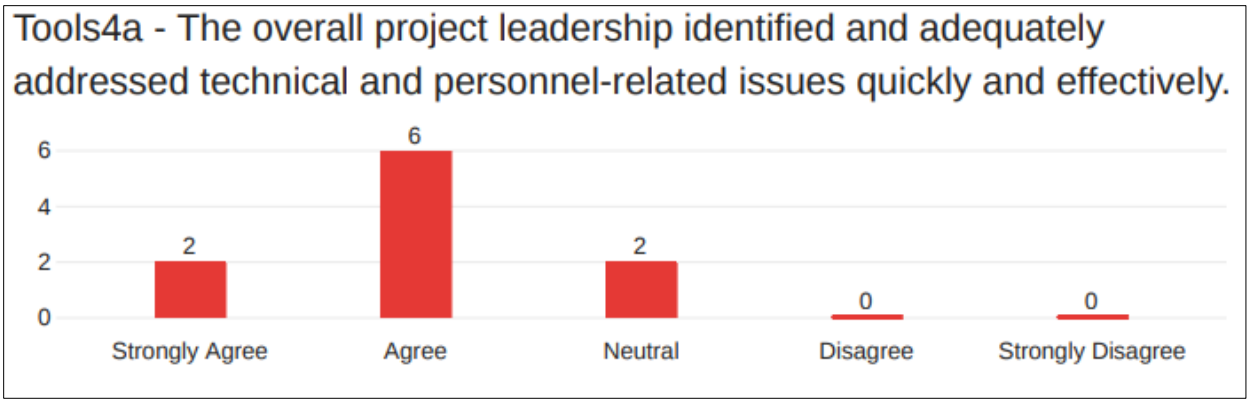


Figure 41: Team Survey Response Regarding Cross-Team Leadership

Process

The within-team processes seem to conflict when compared between teams. The interactions between the teams are intended to be synchronized. The work performed within each team is similar in levels of completeness and testing. However, the processes are in conflict, with the cited reason being the upstream team. Automated testing has been shown to significantly benefit the successful delivery of software in today’s environment. The lack of automated testing indicates that integration in later phases will be significantly more complex and elongate the project schedule.

The team member's responses identify the similarity between team processes. The responses shown in Figure 42 – Team Survey Response Regarding Process confirm the leadership responses. The leadership respondents for Team A indicate they adapted their process to match the Team B process workflow.

Table 22: Leadership Response Regarding Process

Team Practices for Delivering Value Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Process	0	-1	0	0	-0.25
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

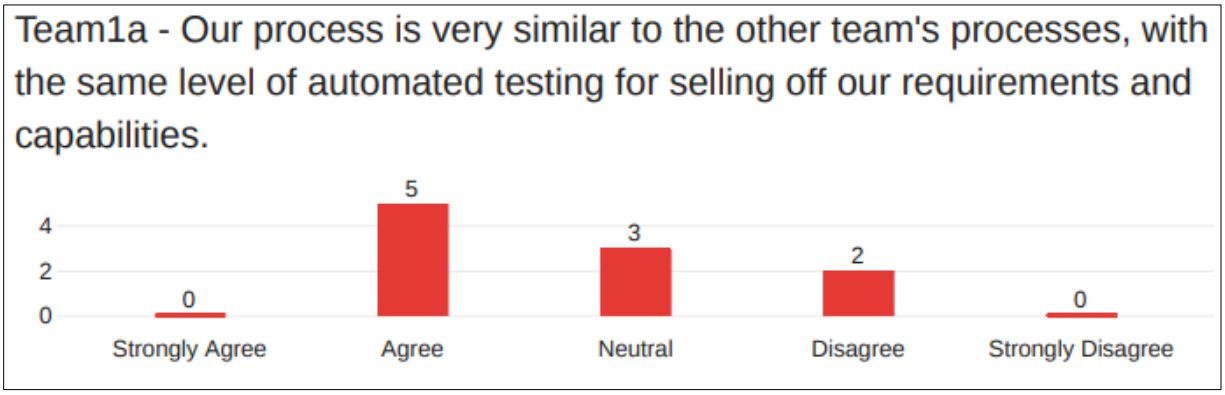


Figure 42: Team Survey Response Regarding Process

People

As indicated by the respondents, internal to each team, the people seem to get along quite well. From all signs, there seems to be a high level of trust within each team. The individual teams work with shared goals and objectives. They collaborate extensively. The high level of team interaction is shown in Table 23 – Leadership Response Regarding People and Figure 43 – Team Survey Response Regarding People.

Table 23: Leadership Response Regarding People

Team Practices for Delivering Value Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
People	0	1	1	1	0.75
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

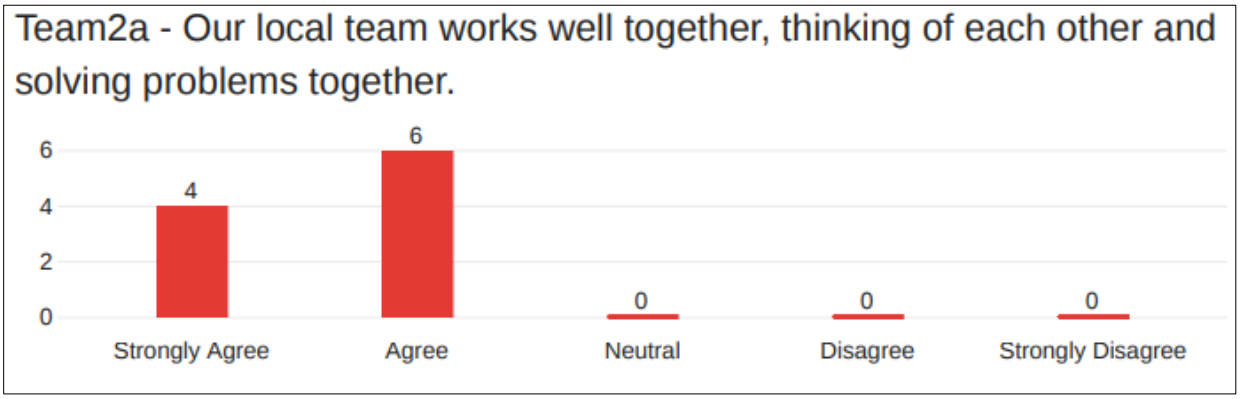


Figure 43: Team Survey Response Regarding People

Organization

All respondents indicated that the organizational support was sufficient to meet their needs to succeed. Some leadership respondents felt the organization had a positive impact, while others saw little to no impact. Table 24 – Leadership Response Regarding Organization shows the scores and positive average. The team member response confirms the leadership responses and is shown in Figure 44 – Team Survey Response Regarding Organization. Each team identified areas where the organization could have improved, such as more people resources or better training. The organizational support was, however, not listed as a deficiency. The sense provided via the responses is that more improvement opportunities were missed, but the support was sufficient to succeed. One such opportunity lost is identified in the Media Richness factor, where better

knowledge of how the Zoom tool works could have improved communication between teams.

Table 24: Leadership Response Regarding Organization

Team Practices for Delivering Value Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Organization	0	1	1	0	0.5
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

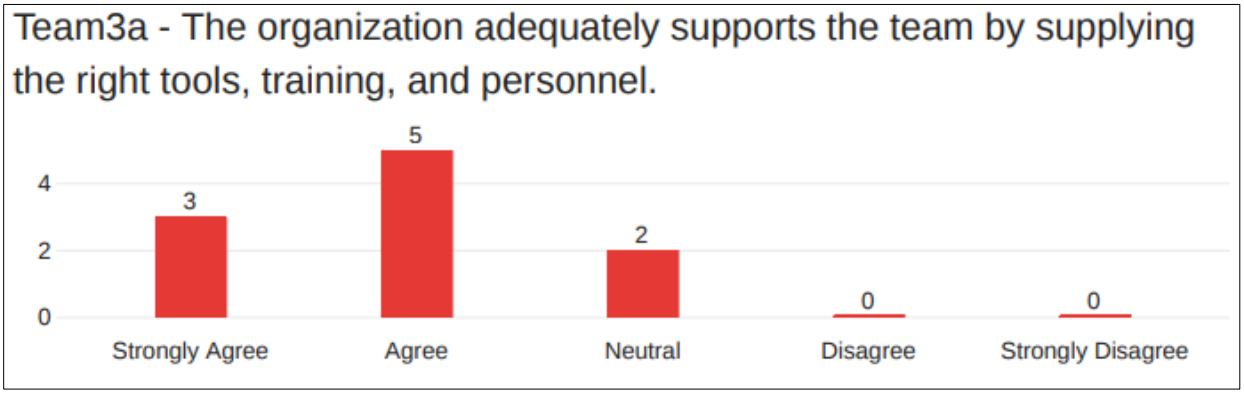


Figure 44: Team Survey Response Regarding Organization

Technical/Project

Highly qualified software developers are located on both development teams. Both teams have been identified as having insufficient domain knowledge for the warehouse management system they are modifying. The leadership responses showed a wide variance among the leaders, as seen in Table 25 – Leadership Response Regarding Technical/Project. The Florida team has a significant advantage as they have a large group of experts readily available to help define, teach, and explain domain-specific features and capabilities. Figure 45 – Team Survey Response Regarding Technical/Project shows that the team members feel they have the necessary technical and domain knowledge internally. The development team located in India has no such

support structure. The domain knowledge disadvantage does not prevent the team from being successful. However, it requires the team's leadership to provide more information and context to the requested work.

Table 25: Leadership Response Regarding Technical/Project

Team Practices for Delivering Value Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Technical/Project	1	0	0	-1	0
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

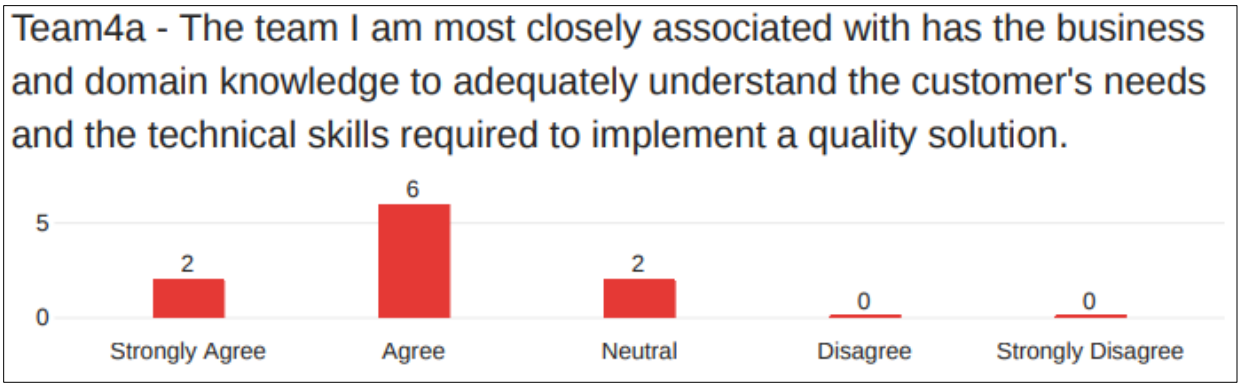


Figure 45: Team Survey Response Regarding Technical/Project

Team Leadership

Team Leadership differs from Cross-Team Leadership in that it refers to the local team. With strong team leadership, the lack of domain knowledge at project start seems to be mitigated. All teams are executing with little or no outside consulting at this point. However, Table 26 – Leadership Response Regarding Team Leadership clearly shows that Leadership is mixed regarding the quality of leadership guiding each team. The team leaders communicate effectively, raise issues quickly, and seem to have developed a

culture of trust within each team. Figure 46 – Team Survey Response Regarding Team Leadership shows that the team members feel better about their leaders.

Table 26: Leadership Response Regarding Team Leadership

Team Practices for Delivering Value Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Team Leadership	1	0	1	-1	0.25
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

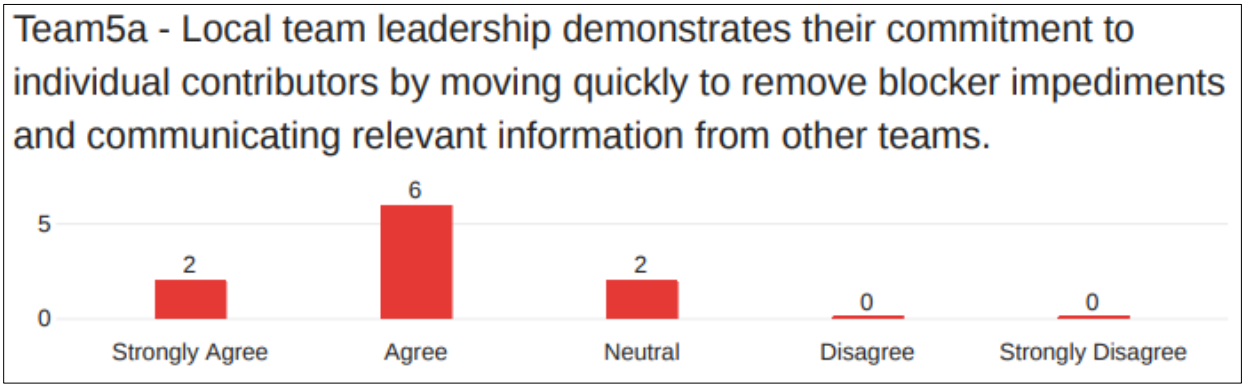


Figure 46: Team Survey Response Regarding Team Leadership

Within Case Summary

Case I provides some interesting findings, including the adjustments made for improved performance. The adjustments to handle the Degree of Dispersion seem to be one of the most impactful adjustments to the team's standard practices. The Process and Affective Conflict were not mitigated sufficiently to positively impact the team's performance. Case Study I is deemed not successful because the ongoing project is more than six months behind schedule, with clear signs that more project delays will arise.

Case II

Project Overview

Case Study II is a project executed for a US-based healthcare company. The project customizes and migrates a SharePoint website to an Office 365 implementation. Program leadership provided an overview of the project as well as the teams involved. When surveyed, the project was approximately 80% complete with customization and migration.

Selected Participants

The SharePoint migration project consists of two teams, both in India. Team A is the customization team, while Team B is the migration team. The project leadership was located in the USA. The participants selected and their locations are depicted in Figure 47 – Team Structure for Case Study II. From the overall leadership team, the overall program manager and technical leader were selected to be participants. Both execution teams identified a clear team leader.

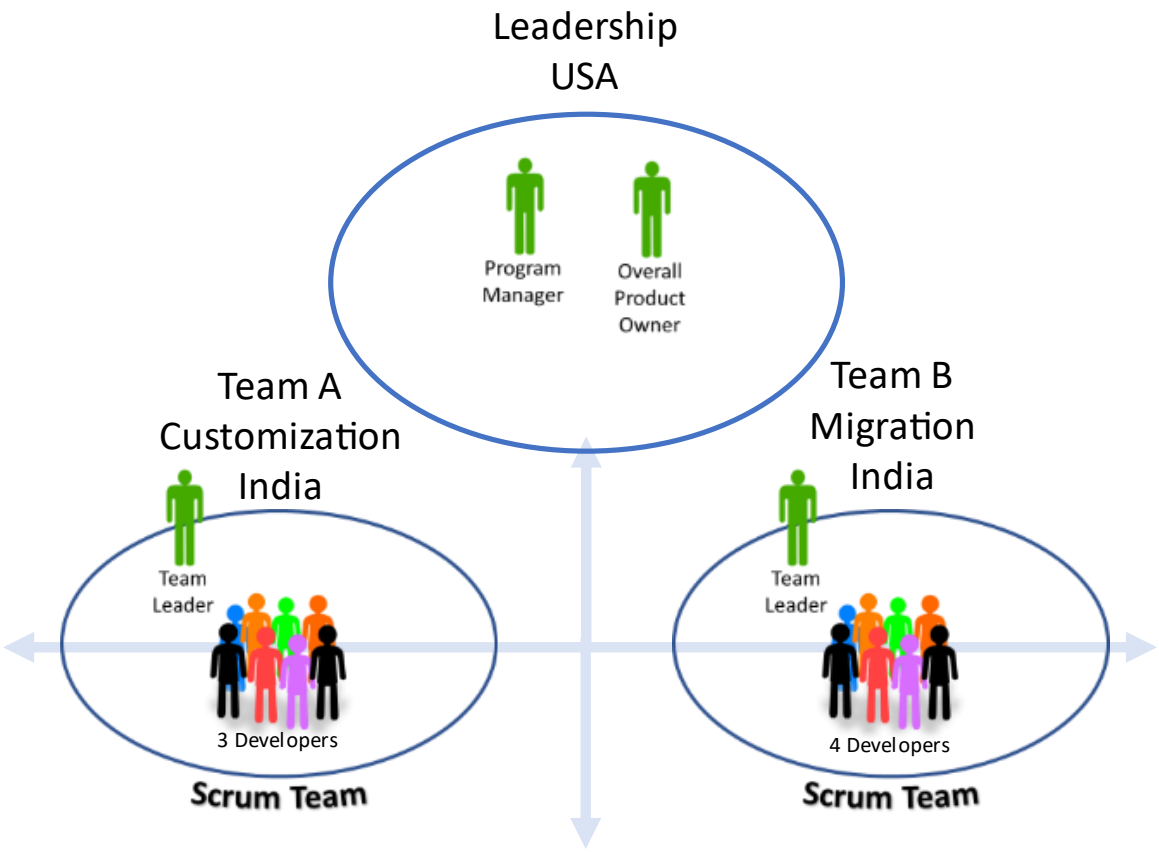


Figure 47: Team Structure for Case Study II

Participation Levels

The total team complement for this project is small, about ten people. With only four leaders identified to participate, it was stressed to the teams that everyone needed to participate for the case study to be considered valid. The program leader had to ask the leaders in India to redo their surveys to get the desired completion.

The project started to develop some issues quickly. The customer wanted the project executed using a waterfall process. The project structure, team, and internal processes were all geared toward an agile process. The issue was eventually addressed by replacing the overall project manager and working with the customer on a compromised process.

Within Case Reflections

With the customer relations issues addressed, the project is now executing without contractual or customer-related issues. The overall project is now slightly ahead of schedule and executing smoothly. General reflections include the notable team cohesion of this small but dispersed team. A universal feeling of goodwill to teammates was made clear by all respondents surveyed.

A summary in Table 27 – Summary of Factor Reported Impacts shows the leadership response and the team survey summary scores. The table summarizes the positive and negative characteristics on a factor-by-factor basis. These characteristics are drawn from responses derived from thematic analysis. Analogously, the average Likert scores are derived from the average of the team member's responses. With the characteristics sitting side-by-side, one can conclude as to the agreement or lack thereof between the team member's responses and the leader's responses.

Table 27: Summary of Factor Reported Impacts

	Leadership Response				Team
Factor	**Positives**	**Negatives**	**Mitigations Taken**	**Impact Avg**	**Survey Avg**
Task Conflict		Work Assigned Minimal Discussion Assigned by Experience		0.25	4.5
Process Conflict		Customer Process Issue Completion Status	Adapted Process	-0.5	3 2
Affective Conflict	Full Trust	Lack of Communication Respect between Team Members	Resolved by talking	0.25	3 2
Architectural Modularity	Intentional Work Separation			0.25	4
Degree of Dispersion		Shifted Work Impact	Adjusted Work Schedules	0.5	4.5
Media Richness	Video to Build Team			0	4.5
Cross-Team Leadership	Conflict Resolution	Technical Approach Issues	Replaced Leadership	0	4
Process	Workflow Based	Different Processes	Adapted Process	-0.25	4.5
People	Strong Chemistry			0.75	4.5
Organization	Supportive Organization	No Development Staffing Mentality Individual Isolation	Video Meetings	-0.25	5
Technical/Project	Strong Technically	Growing Domain Weak Domain		0.25	4.5
Team Leadership	Quick Response Eliminating Conflicts Team Resolution			0.75	4
Process and Affective Conflict require inverted survey responses (Inverted/Non-Inverted) Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

Project Status	Successful – Mitigated issues early

Figure 48 – Average Leadership Factor Impact Score shows the impact of each factor. The leadership identified the people as the most positively impactful factor. For this project team, it also correlates to very low Affective Conflict. The team took extensive steps to build solid relationships among the team members.

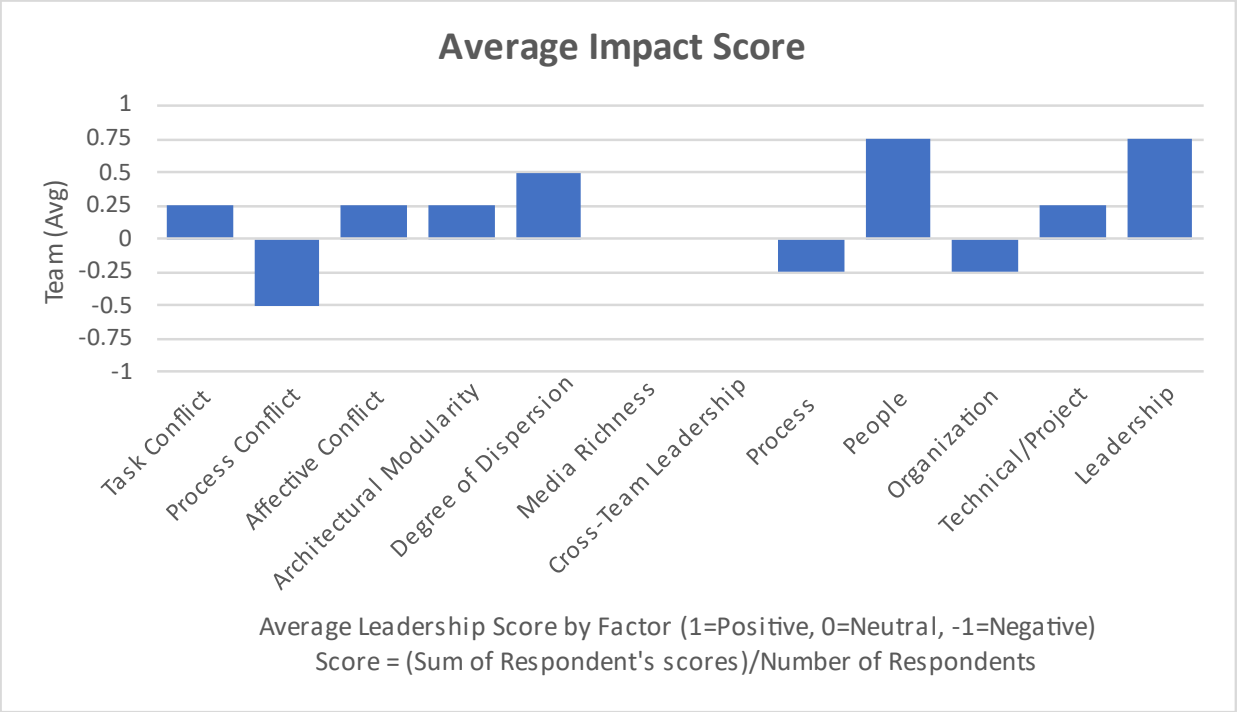


Figure 48: Average Leadership Factor Impact Score

Case II has two small teams, a website migration team, and a PowerApp Development team. With nine people making up the teams and four identified as leaders, the team member response population was small. Of the team members, only 50% responded to the survey, meaning that only two team member surveys were returned. The small response created strong anomalies in the comparative charts and large swings in the scores.

Figure 49 – Alignment and Impact Across the Team show the alignment of the leadership compared to the team members. For Case Study II, the leadership response vs. team survey identifies Process Conflict and Organization as the most substantial factors where the team and leadership are not aligned. The comparative alignment figure identifies Architectural Modularity and Technical/Project as the strongest aligned factors. With only

two team member participants, it is feasible that the responding team members did not view or experience the same issues as the leaders. During the interview, issues were raised with the team's process and organizational support.

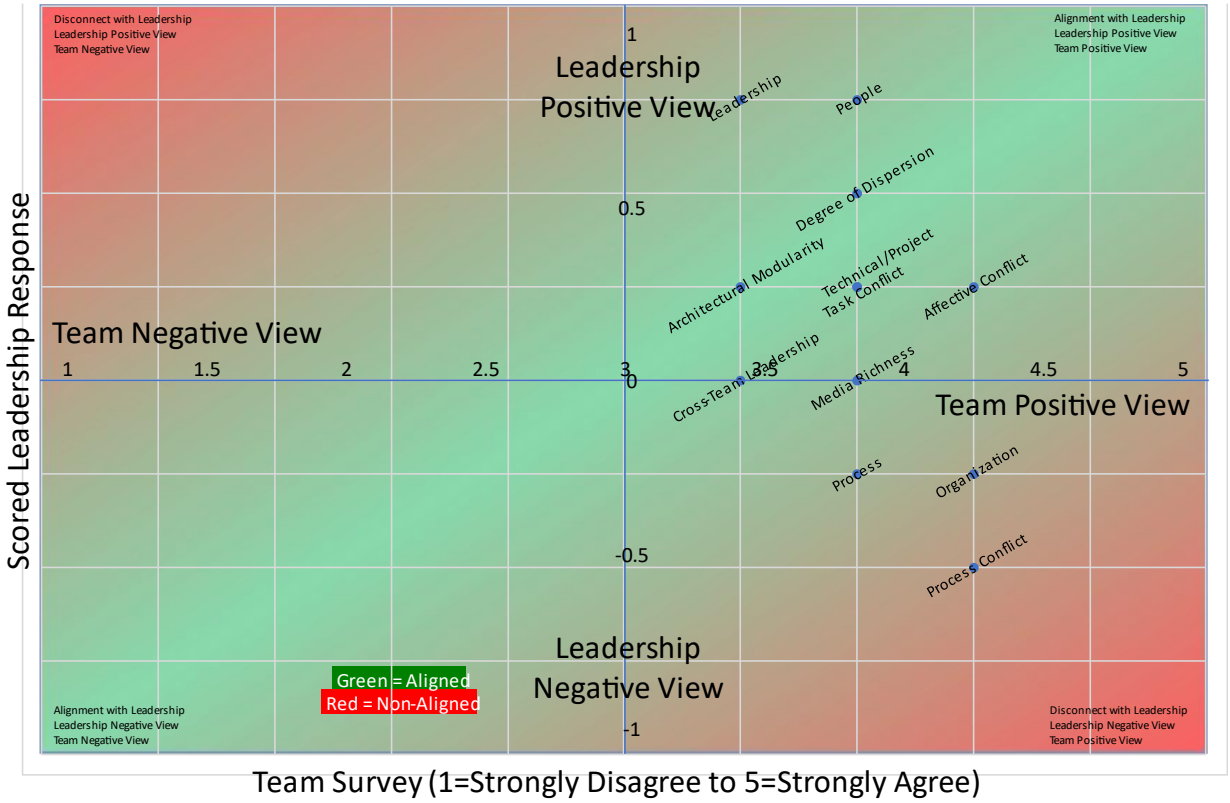


Figure 49: Alignment and Impact Across the Team

Task Conflict

Task conflict is the debating of how something should be designed or developed. With a small team of specialists, there is minimal task conflict. The lack of task conflict is evidenced by responses such as “Work was divided based on the team member's previous experience.” Table 28 – Leadership Response Regarding Task Conflict indicates that this factor is not significantly impacting the project positively or negatively. The lack of impact is validated with qualitative responses indicating that work is assigned

to the most experienced person rather than debating how the work should be accomplished. Figure 50 – Team Survey Response Regarding Task Conflict indicates the team disagrees with the leadership regarding discussing and debating work items.

Table 28: Leadership Response Regarding Task Conflict

GDT Degree of Alignment Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Task Conflict	0	0	1	0	0.25
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

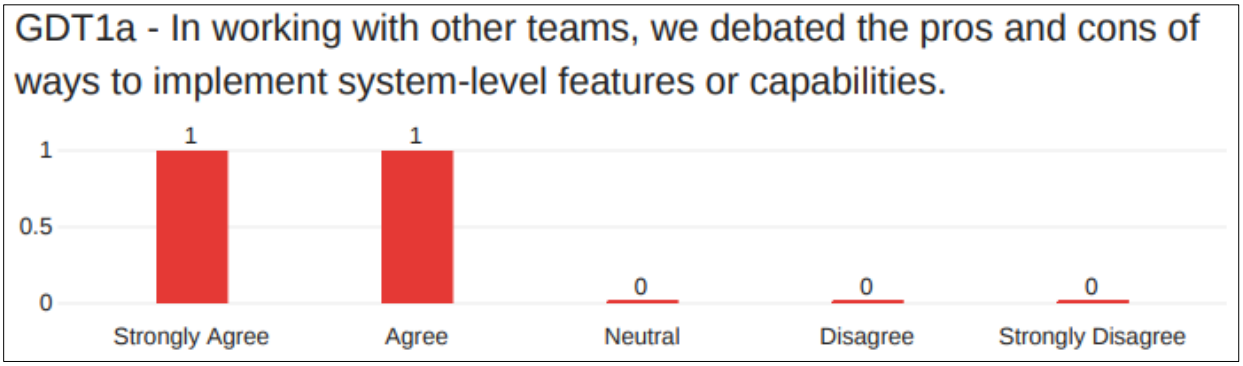


Figure 50: Team Survey Response Regarding Task Conflict

Process Conflict

The customization team operates in an Agile Scrum framework using short iterations. The migration team operates in an Agile Kanban perpetual mode. Table 29 – Leadership Response Regarding Process Conflict indicates that the leadership team sees a negative impact of the Process Conflict on the overall project. The team began with significant Process Conflict and has reorganized the work and teams to minimize the conflict. From a schedule and handoff perspective, no process conflict was identified or inferred between the teams after the adjustments. The migration team identified a completeness

process conflict, which acts as the integration and test team for the customized components. Respondent C summarized the issues: “While working as a SharePoint tester, developers working on PowerApps would develop about 50% of the work and pass it to our team. When the developer finished, everything would have to be retested. Many times, features previously complete were then broken.” Figure 51 – Team Survey Response Regarding Process Conflict shows that the team members agree with the leadership response.

Table 29: Leadership Response Regarding Process Conflict

GDT Degree of Alignment Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Process Conflict	0	-1	0	-1	-0.5
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

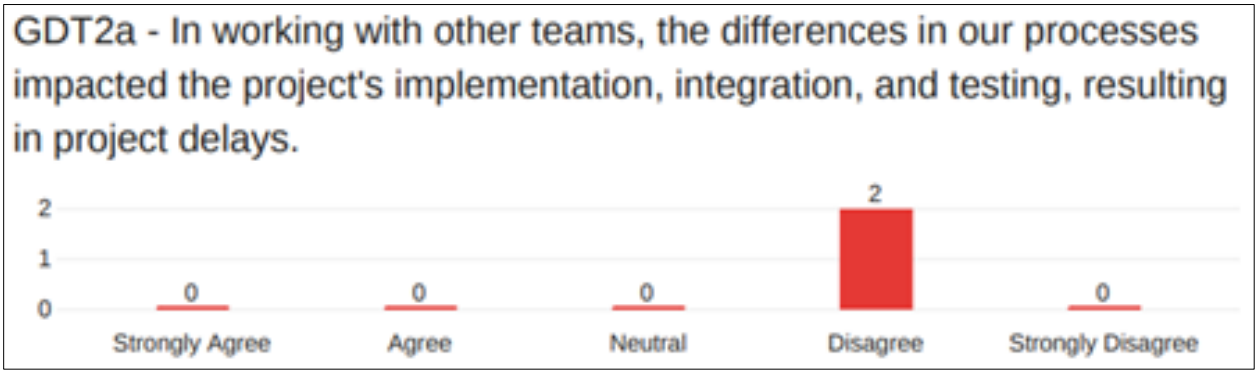


Figure 51: Team Survey Response Regarding Process Conflict

Affective Conflict

Affective Conflict is the personal conflict that occurs when people do not get along. For this team, it was identified that Affective Conflict exists between the leadership team and elements of the customer. More than one respondent identified behaviors by the customer

as impacting the overall project. Program leadership has successfully addressed some of the issues with the customer. Residual issues still exist but were not pursued as it is out of scope for the research focus. With some of the external issues resolved, Table 30 - Leadership Response Regarding Affective Conflict shows the post-adjustment impact on the project as minimal.

Turning inward toward the team, the affective conflict shows no sign of existing. There have been miscommunications, as one would expect. Respondent A recounted a situation where they tried to explain an issue, and the team member inferred that they were using the wrong process. The communication was clarified by other leadership. Aside from what seems to be common miscommunications, the team shows all signs of working very well together. Respondent C said they solve problems together and are very friendly. Figure 52 - Team Survey Response Regarding Affective Conflict confirms the qualitative responses, aligning the team members and leadership.

Table 30: Leadership Response Regarding Affective Conflict

GDT Degree of Alignment Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Affective Conflict	0	1	1	-1	0.25
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

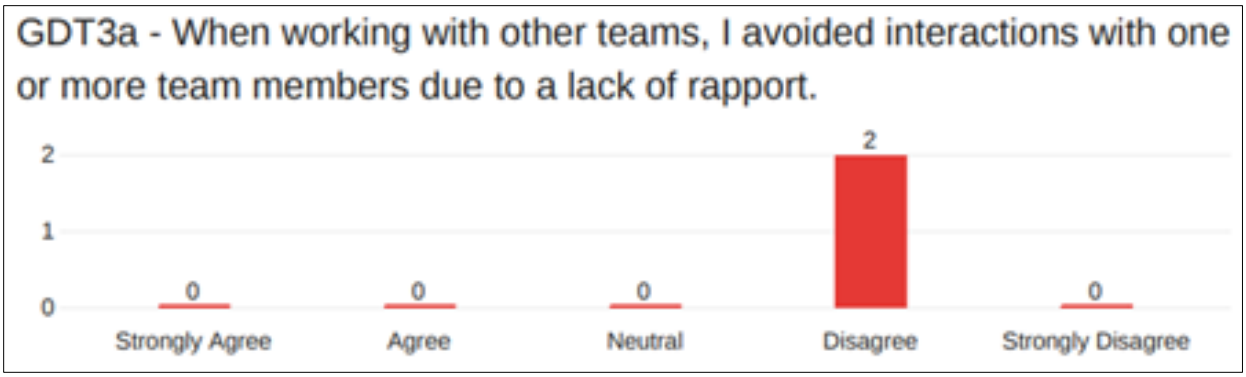


Figure 52: Team Survey Response Regarding Affective Conflict

Architectural Modularity

The project lends itself well to parallelization of tasks, indicating a strong Architectural Modularity. Work items are small in scope and completed quickly. Customization tasks mainly consisting of Office PowerApp modules are executed in an Agile Scrum framework. The migration team operates in an Agile Kanban flow, testing and integrating completed work while migrating SharePoint data to the new system. Because program leadership has structured the project in this manner, there is near-perfect architectural modularity for project execution. Table 31 - Leadership Response Regarding Architectural Modularity shows that while it is high, the leadership does not view it as an impactful factor for this project. Figure 53 - Team Survey Response Regarding Architectural Modularity shows agreement with the strong sense of Architectural Modularity.

Table 31: Leadership Response Regarding Architectural Modularity

Tools for Mitigation Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Architectural Modularity	0	0	0	1	0.25
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

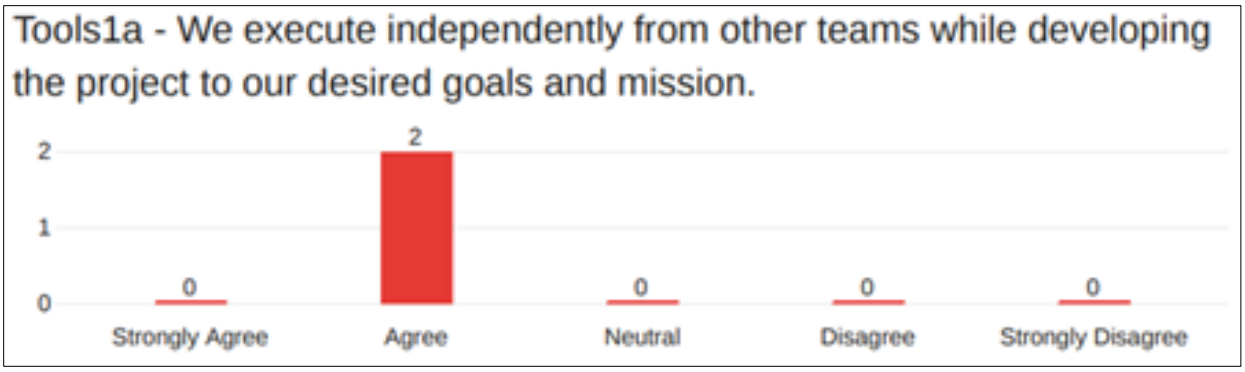


Figure 53: Team Survey Response Regarding Architectural Modularity

Degree of Dispersion

From the East Coast of the US to Hyderabad, India, there are 9.5 hours of dispersion. Table 32 - Leadership Response Regarding Degree of Dispersion shows the leader's view of the impact of these time zones on the project. The Degree of Dispersion has been impactful on this project. The scores in the response table reflect post-adjustment views according to the interview responses.

The teams have gone through various constructs to determine what works best for their execution. The teams tried to work on the US schedule. As stated by the team leaders, working on the US schedule was just too hard for the team members to function. Working on a standard workday also proved not to work well. Respondent C recanted an issue where they could not log in to the system in the morning. They had to wait for the US team to come into the office to resolve the issue. An entire day was lost for this issue. Figure 54 – Case Study II Workday Shift and Overlap shows how the India team has shifted their work and what hours overlap due to the shifting of the workday.

Figure 54: Case Study II Workday Shift and Overlap

Shifting the workday to create some overlap between the teams and the leadership has helped with communication and helped to resolve issues, as indicated by several respondents. The team is now operating on a flexible work schedule. They have a daily team call at 10 AM EST, which is 7:30 PM in India. The team starts work about mid-day most of the time. The mid-day start provides a few hours where they can accomplish some work tasks. With several hours of workday overlap, both teams and leadership have time to collaborate and answer questions. Using the remaining workday, the US leadership interfaces with the customer to get feedback, changes to features, and provide overall project status. Figure 55 - Team Survey Response Regarding Degree of Dispersion shows agreement that the workday has been adapted to better sync with all teams.

Table 32: Leadership Response Regarding Degree of Dispersion

Tools for Mitigation Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Degree of Dispersion	0	1	0	1	0.5
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

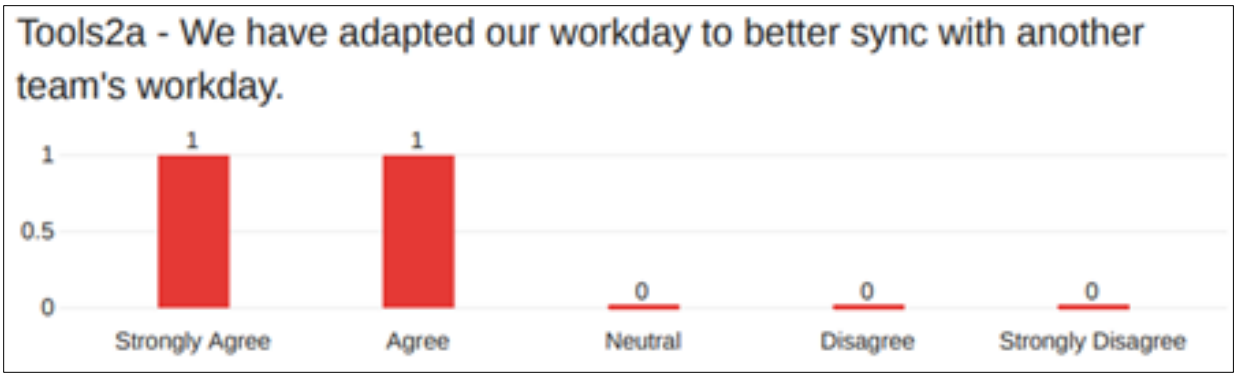


Figure 55: Team Survey Response Regarding Degree of Dispersion

Media Richness

Media Richness measures how complete the tools and technology are over the available media. All individuals on the project have access to Microsoft Teams with video capabilities. They rarely use video in their communications. The exceptions seem to be for customer meetings and virtual get-togethers. Respondents C (team leader in India) and D (US-based leader) raised the value of virtually getting together for team-building activities. All respondents cited a lack of video usage during regular team meetings. They also indicated that most communication outside meetings was instant messaging within Microsoft Teams. Table 33 - Leadership Response Regarding Media Richness indicates that the team's leadership does not feel that Media Richness has impacted the overall project's success. Figure 56 - Team Survey Response Regarding Media Richness indicates that the team uses the media to its fullest extent. While there is agreement on the usage of the tools to their fullest, the team does not equate this usage to the success of the project.

Table 33: Leadership Response Regarding Media Richness

Tools for Mitigation Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Media Richness	0	0	0	0	0
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

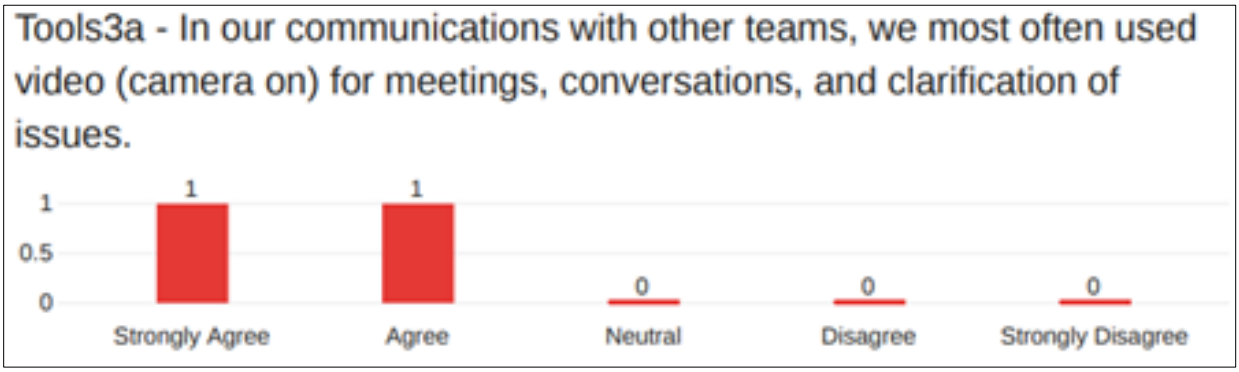


Figure 56: Team Survey Response Regarding Media Richness

Cross-Team Leadership

Cross-Team Leadership deals with the top-level program or project leadership. With the program manager being replaced part way through the project, the cross-team leadership seemed to be initially lacking. New leadership has corrected the relationship with the customer and developed a strong relationship with the remote teams in India. Table 34 - Leadership Response Regarding Cross-Team Leadership shows the impact of this adjustment with the significant variance between Respondent A and Respondent D. The variance was reportedly from the pre or post-adjustment.

Post-adjustment, the remote team leaders indicated they feel connected and well-informed regarding project matters. Initially, the project fell behind schedule. With the new leadership, the project is on or slightly ahead of schedule, as respondent C. Respondent D summarized the overall leadership issues and status: “From a technical perspective,

there were multiple points of contention regarding the approach to the migration. From a personnel perspective, there were issues with the project manager and how the overall project was being handled at a high level. The client has made it difficult to make concrete decisions for certain situations. Overall, the project is running relatively smoothly now, and most of these conflicts have been resolved." Figure 57 - Team Survey Response Regarding Cross-Team Leadership indicates agreement between the team members and leadership.

Table 34: Leadership Response Regarding Cross-Team Leadership

Tools for Mitigation Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Cross-Team Leadership	1	0	0	-1	0
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

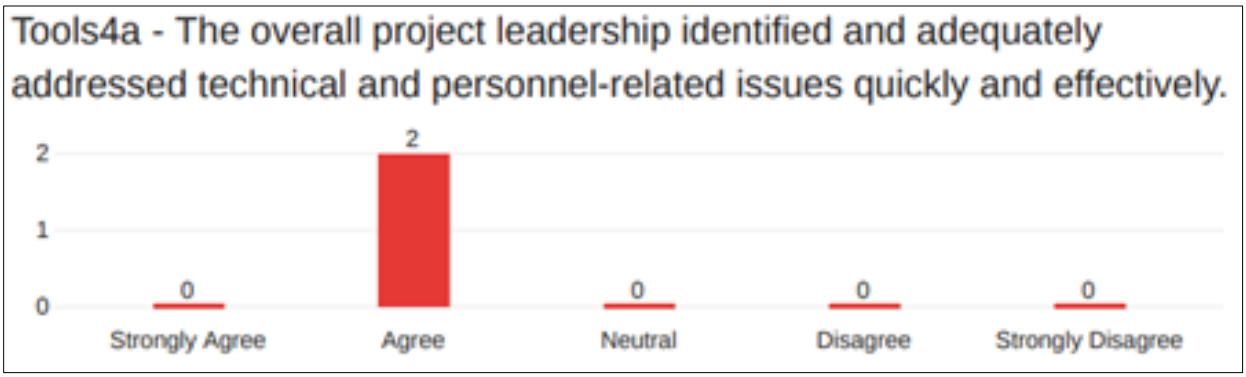


Figure 57: Team Survey Response Regarding Cross-Team Leadership

Process

The customization team operates in an Agile Scrum framework, while the migration team operates in an Agile Kanban framework. Table 35 - Leadership Response Regarding Process indicates that the current process is not significantly impactful to the project. The

teams and leadership have connected the teams in such a way that no process conflict exists between the teams. Figure 58 - Team Survey Response Regarding Process shows that the team members agree that the processes used on each team are working. As scrum work is completed, it creates a ticket in the Kanban system for integration. The customization work must be completed prior to the scheduled site migration. Schedule agility must be maintained in this construct with effective communication to the customer regarding work completed and work postponed. The Kanban ticket approach allows the migration team to continue other work easily when a customization task is delayed. Tying these two frameworks together in the manner described positively impacts the project, as indicated by being ahead of schedule.

Table 35: Leadership Response Regarding Process

Team Practices for Delivering Value Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Process	0	0	0	-1	-0.25
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

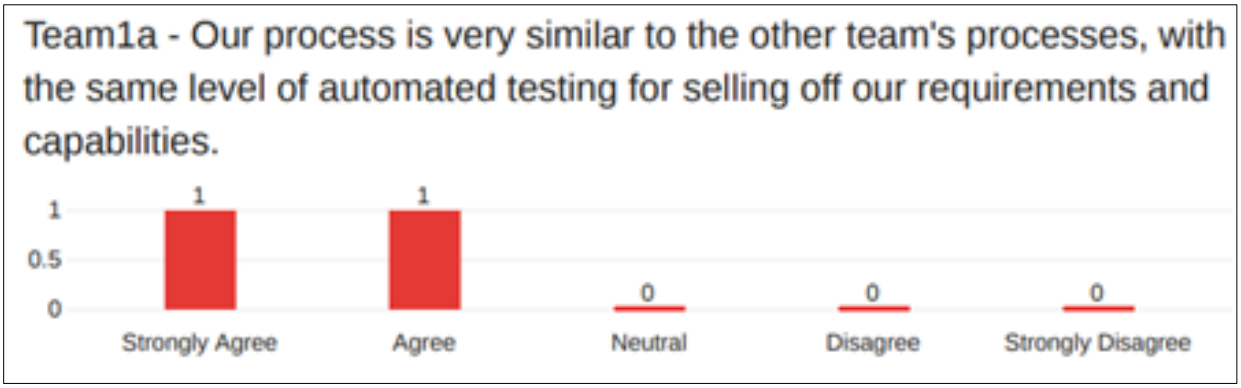


Figure 58: Team Survey Response Regarding Process

People

The People sub-factor describes the relationship on each team. Each of the respondents talked about how well the team worked together. Table 36 - Leadership Response Regarding People and Figure 59 - Team Survey Response Regarding People show that the leaders and the team feel everyone is working well together. Respondent D described the people's relationships: “Overall, the relationship has been positive both within the local team and other teams. We all work together nicely and treat each other with respect. On several occasions, we have worked together to solve problems related to customizations and migrations.” Respondent C described how they used Microsoft Teams to conduct virtual get-to-know-you meetings. The description from the respondents implies they have developed a shared mental model of each other to some extent.

Table 36: Leadership Response Regarding People

Team Practices for Delivering Value Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
People	1	1	1	0	0.75
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

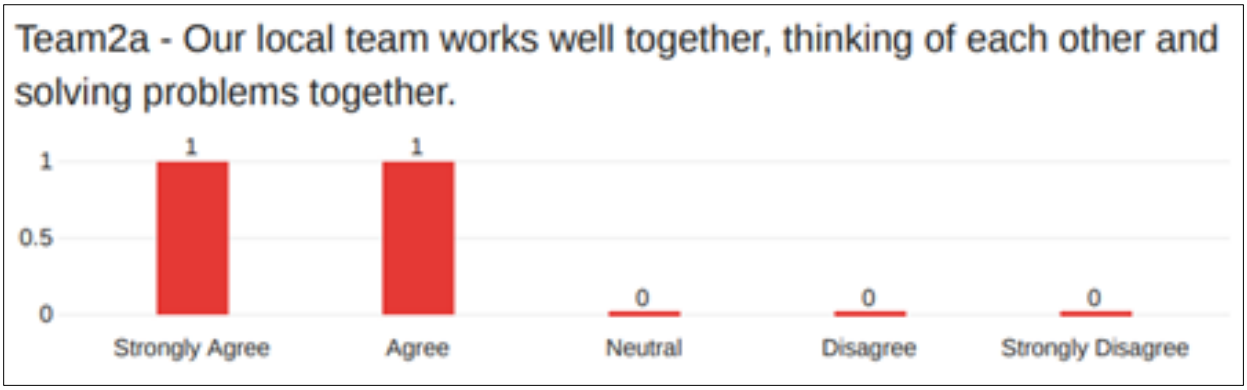


Figure 59: Team Survey Response Regarding People

Organization

The Organization sub-factor describes how the organization supports the team and received mixed reviews. Table 37 - Leadership Response Regarding Organization shows the strong negative response from Respondents A and D. During the interview, respondents voiced their displeasure with the organization, which was not nearly as clear from the written response. Respondent D summarized the sentiment regarding the company's support for individuals: "The company has a staffing mentality and therefore does not support individuals with the desired growth." Respondent B had a contrary view: "The organization supports us by helping us with certifications which is nice. They could do better with leaves and vacations." The Organization seems to have supported staffing, training, and individual development enough to be a neutral factor with respect to impact on the project. The team survey response shown in Figure 60 - Team Survey Response Regarding Organization indicates the organization's support.

Table 37: Leadership Response Regarding Organization

Team Practices for Delivering Value Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Organization	-1	1	0	-1	-0.25
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

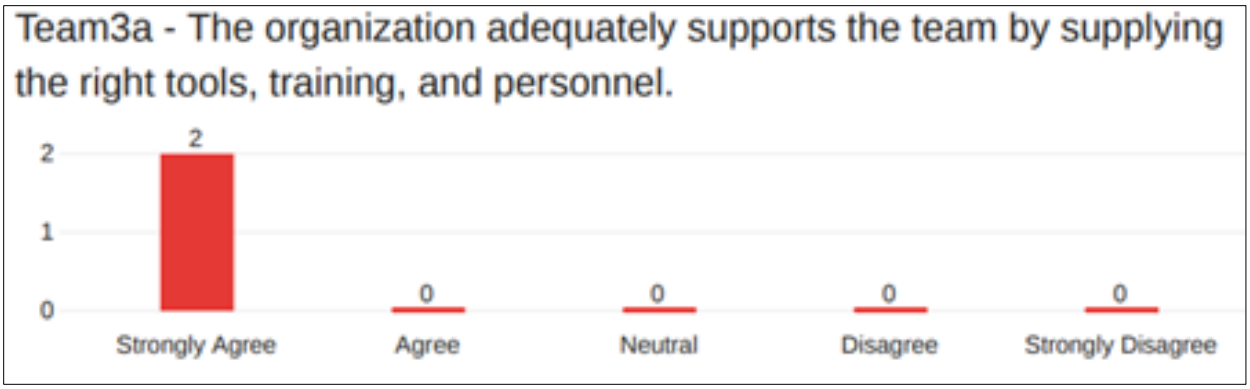


Figure 60: Team Survey Response Regarding Organization

Technical/Project

The customization team comprises developers capable and experienced in developing Microsoft PowerApps. The migration team is experienced in migrating SharePoint websites. Together, these teams had the technical expertise to execute the project. The Leadership Responses and Interviews stated that neither team started with domain knowledge specific to the customer, but their knowledge grew over time. Table 38 - Leadership Response Regarding Technical/Project shows that technical and domain knowledge has not significantly impacted the project. The team's knowledge has grown over time as well. Figure 61 - Team Survey Response Regarding Technical/Project shows that the team now knows to execute this type of project.

Table 38: Leadership Response Regarding Technical/Project

Team Practices for Delivering Value Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Technical/Project	0	1	0	0	0.25
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

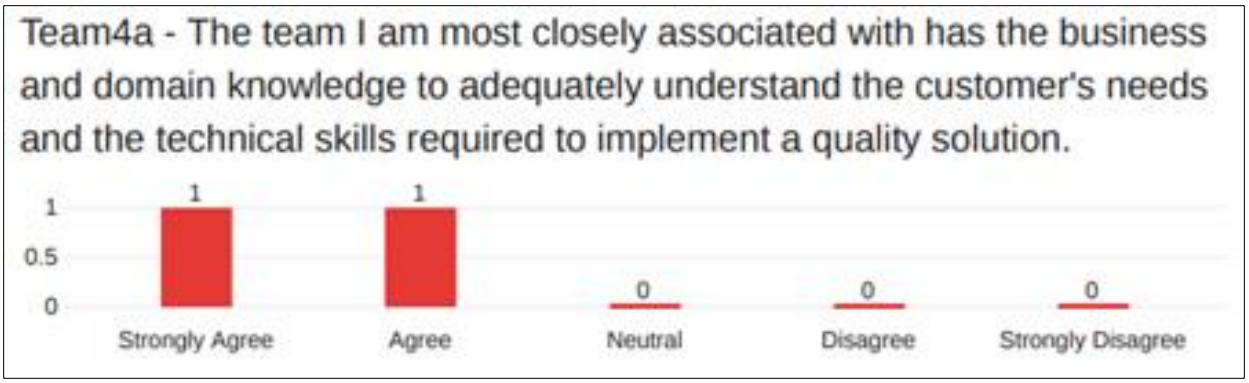


Figure 61: Team Survey Response Regarding Technical/Project

Team Leadership

The customization and migration teams are both small. While this implies the leadership task would be less complicated, the unanimously positive response regarding team leadership and people within the team leads to a strong team leadership conclusion. Table 39 - Leadership Response Regarding Team Leadership indicates that this team's leadership is impactful. The team members agree with the sentiment of solid leadership, as shown in Figure 62 - Team Survey Response Regarding Team Leadership. The team and overall project leaders recognized the issues caused by 9.5 hours of time zone dispersion. They worked to build a singular team by shifting some workdays and conducting virtual get-togethers for team building.

Table 39: Leadership Response Regarding Team Leadership

Team Practices for Delivering Value Factor	Leadership Respondents				Leader (Avg)
	A	B	C	D	
Team Leadership	1	1	1	0	0.75
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative					

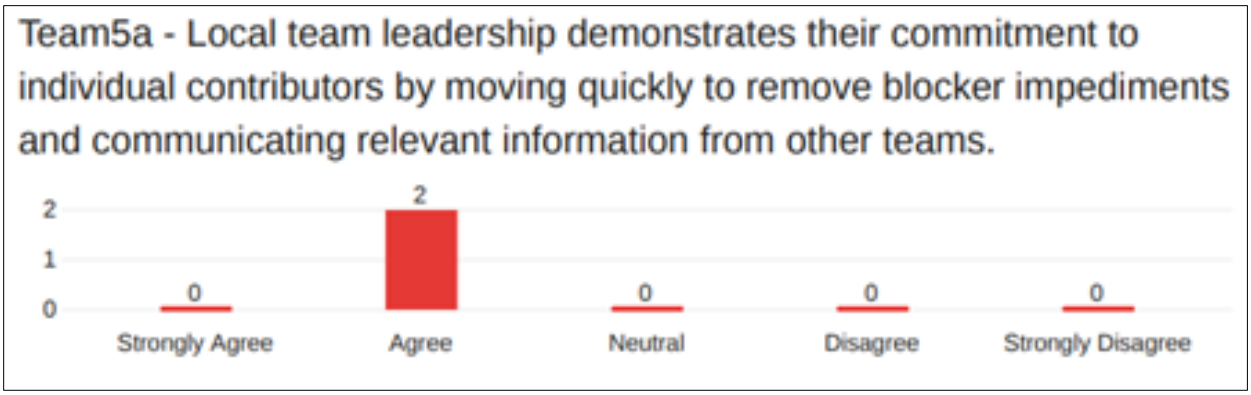


Figure 62: Team Survey Response Regarding Team Leadership

Within Case Summary

Case II has undergone significant adaptation during the execution. The team has replaced its overall program manager. They have adapted their work schedule more than once to find what works for them. Moreover, they have maximized their Media Richness to build a more robust and better remote team.

Respondents B and D commented on the value of the process to their current project. Respondent D stated, “I think this exercise is something that I would recommend as a mid or postmortem as a project evaluation. I think this is great. This is something that should be common practice within any company and could improve projects overall. “

Organizational support seems to be in question. The Leadership Response showed an understated feeling of negativity regarding the organization. The team and management should investigate the organizational misgivings more to fully understand how to correct the issues at hand.

Case III

Project Overview

Case III consisted of three main parts: a SharePoint migration, upgrades from InfoPath to Power Apps, and the development of a 20-year-old Excel application. The oil and gas industry's customer has site locations worldwide. The project includes migrating individual sites to a consolidated solution. While the migration is underway, the project is updating some outdated and no longer supported software technology used in the infrastructure. The final thread of work is to upgrade a legacy application. The application is a highly complex Excel project. The scope of work is to convert the Excel application into a web application hosted in the newly migrated SharePoint solution.

Selected Participants

Case Study III consists of two teams in India with all program and direct team leaders in the United States. Figure 63 – Team Structure for Case Study III shows, at a high level, the team structure and location of individuals. The team leaders co-located with each of the teams were also developers on the team. Team A and Team B are remote, separate from each other, and regularly interact only through work assignment collaboration.

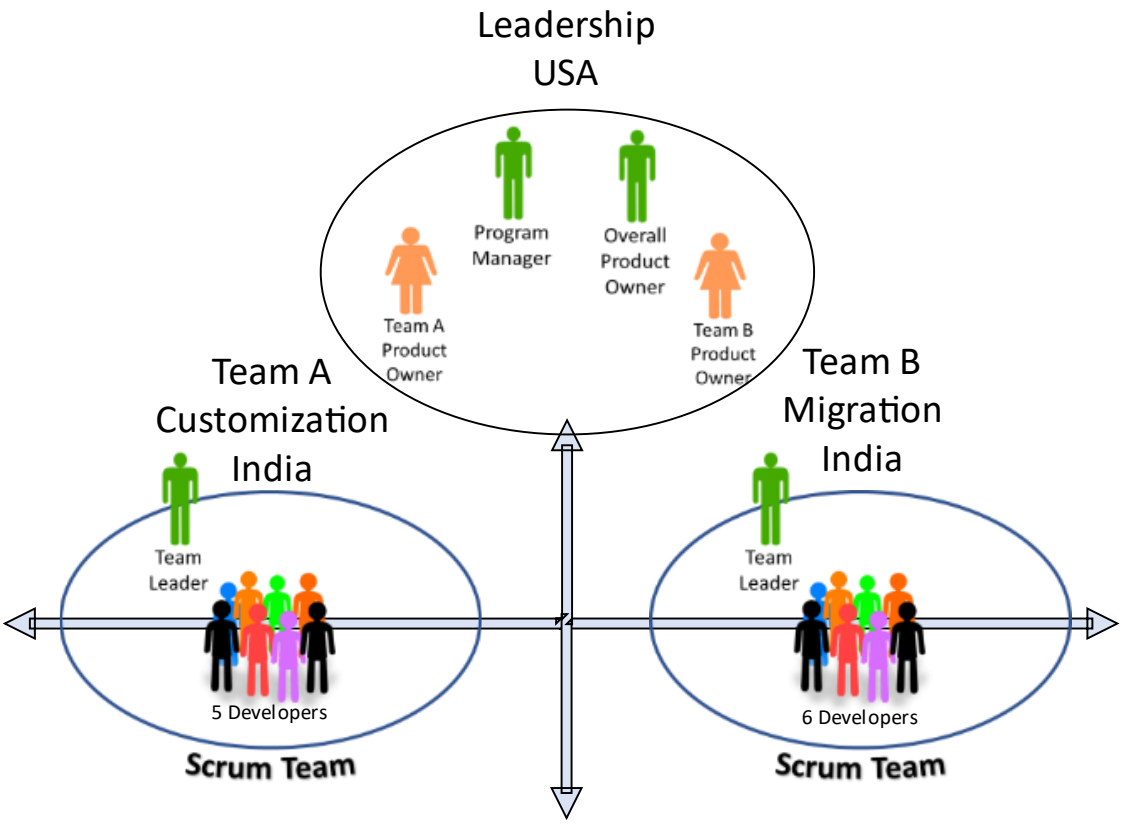


Figure 63: Team Structure for Case Study III

Participants considered for Case III were the overall program leader, the overall technical leader, and the two product owners for the project. The team leaders were not considered for the leadership survey because their role was more closely related to team members.

Participation Levels

The customer canceled the project shortly after beginning the case study. Two of the four requested participants responded to the Leadership Response Survey before shutting down the project. After the project shut down, the remaining participants were no longer available for the study. No team member survey responses were received from the team members. The limited response from the leadership team provides limited value. Given

the limited information from the case, some areas and comparisons cannot be completed. Specifically, no alignment analysis could be conducted between leadership and team members' data.

Additionally, some within-case reflections are of limited comparable value due to the lack of validation and triangulation regarding responses. While this case provides some good insights for this project, this information is limited in value as a complete case analysis. Nevertheless, it may help us understand why projects get canceled.

Within Case Reflections

Case III has an array of issues that stem from the very beginning of the project, as shown in the summary Table 40 – Summary of Factor Reported Impacts. The table summarizes the positive and negative characteristics on a factor-by-factor basis. These characteristics are drawn from responses derived from thematic analysis. The responses show a degree of conflict across the project. Task Conflict, which is desired to be reasonably high, shows almost no cross-team discussion. The typically visible outcomes of Process Conflict are poor quality which can also be viewed as late deliveries. The most significant flag of alarm is Affective Conflict. Aggressive team members, lack of trust, and missing personal relationships are significant issues that the team did not adequately address.

Table 40: Summary of Factor Reported Impacts

	Leadership Response				Team
Factor	**Positives**	**Negatives**	**Mitigations Taken**	**Impact Avg**	**Survey Avg**
Task Conflict	Regular Communications	Multiple Project Threads Team left to figure it out		N/A	0
Process Conflict		Inconsistent Quality		N/A	0
Affective Conflict		Aggressive Team Members Lack of Trust Minimized Interaction Missing Personal Relationships		N/A	0
Architectural Modularity	Highly modular work			N/A	0
Degree of Dispersion		Time Zones Challenges Elongated Workday No Workday Shift Limited Communications		N/A	0
Media Richness		Limited Video Usage		N/A	0
Cross-Team Leadership	Responsive Elevation No Affective Conflicts Raised Quality Issues Not Raised Lack of Ownership	Team Members Stretched Across Multiple Teams Assignments Muddy		N/A	0
Process		Communications Issues Process Conflict Process Issues		N/A	0
People				N/A	0
Organization				N/A	0
Technical/Project	Technically Adequate Business Knowledge			N/A	0
Team Leadership	Raised Issues Resolved Issues			N/A	0
Process and Affective Conflict require inverted survey responses (Inverted/Non-Inverted) Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

Project Status	Not Successful – Poor Leadership, Aggressive Team Members

The factor-by-factor subsections will detail the observations found with the limited information available. The project's cancelation, as described in the Case Logistics section of this case, resulted in the usual series of charts and tables being unavailable for this case study.

Task Conflict

Task Conflict is the discussion of implementation details. The team had regular meetings to discuss the project's direction, as noted by Respondent A. Regular discussions would lead one to think Task Conflict was occurring initially. However, from the responses of

both leaders, the teams were mostly left to figure out the design implementation on their own.

Process Conflict

Process Conflict occurs when groups or teams follow different processes, resulting in incompatible deliveries or outcomes. Respondent A and Respondent B equally indicated that the process was a significant issue on the project. Respondent A went so far as to say, “We were more agile, and the other teams were forcefully waterfall.” Respondent A’s statement is a clear sign of Process Conflict, which was not addressed by the overall leadership.

Affective Conflict

Affective Conflict is the anxiety or hesitation to conduct communications with someone. Identifying the team as aggressive and untrustworthy certainly qualifies as Affective Conflict. Respondent A brings this issue to light with the following response, “Specific team members were aggressive and untrustworthy, so being minimal in interaction was the best path.” As a team leader, one must ask why this issue was not addressed. The avoidance behavior demonstrates a lack of leadership in dealing with the issue.

Architectural Modularity

Architectural Modularity is the ability to execute in parallel without dependence on another team to deliver a particular part or section successfully. In this case, the project had three workstreams that were very loosely coupled. The SharePoint migration work is not directly dependent on the Power Apps or Web Parts. However, to deliver the complete solution, the Power Apps and Web Parts do have to be delivered. With the switch in the direction

from Power Apps to Web Parts, the team found itself lacking the technical skills necessary to deliver the project, as mentioned by Respondent B.

Degree of Dispersion

With 9.5 hours of time zone shift between the team and the team leadership, this is a good example showing the impact of the Degree of Dispersion. As stated by Respondents A and B, very little was done to increase the workday overlap. Neither the team nor leadership regularly shifted their day to increase the opportunity to communicate. The program leadership team made adjustments when needed to meet with the teams.

Media Richness

Media Richness measures how well one uses the tools and bandwidth to improve communication. Respondent B summarizes the usage of tools with the following, “Meetings were generally ad hoc Communications in general were in all mediums. We had also had MS Teams with many channels in both our domain and in the clients. Multiple email accounts for most folks. All of this was a challenge. I think it caused issues with everyone to keep track of or give up trying to.” From this comment, one could conclude that regular and clear communication was a problem on this project.

Cross-Team Leadership

Cross-Team Leadership is the overall leadership component of the project structure. Extrapolating a little from the numerous issues identified, a strong cross-team leader would have recognized the Media Richness issue and clarified the communication channels. A strong cross-team leader would have recognized the Process Conflict and addressed the issue or at least minimized the impact of the process differences. Lastly,

a strong cross-team leader would have recognized the Affective Conflict, noticed the lack of communication, and raised the issue for clarification.

Process

The Process factor portion of the Team Practices for Delivering Value scores how well the team's process works for them. Process Conflict occurs when one team's process poorly interacts with another team's process. Respondent A clearly states the issue, "We were more agile, and the other teams were forcefully waterfall." Respondent B confirms the issue and describes it as a "stakeholder management issue."

People

A high-performing team develops when team members like each other, gain a shared mental model, and trust each other as they work toward the goal. Aggressive people generally break down the social and emotional bonds that build a strong team. Untrustworthy actions nearly always destroy the bonds that build a strong team. From Respondent A's responses, there was clearly an issue elevating to Affective Conflict with the relationships on or between one or more teams. Respondent A stated, "Specific team members were aggressive and untrustworthy, so being minimal in interaction was the best path."

Organization

Organizational support includes people, software, equipment, network, training, facilities, and other organizational support items. Leadership identified that the team lacked the technical ability to develop Web Parts. As was intimated by Respondent B, not having the right people could be from program change. It could also be that the organization was not

supplying the right people for the project. Respondent B indicated the organization was lacking in several areas and stated, “We did find out that some didn’t have dual monitors and such, but generally was remedied. Training was a major issue. Too much time was spent on training and onboarding and charged to the client. Evidently, this was not well planned or communicated.”

Technical/Project

The Technical/Project factor of Team Practices for Delivering Value consists of the technical knowledge as well as the business domain knowledge to execute the project. Neither respondent directly commented regarding the Technical/Project factor in the survey. Respondent B, in other questions, indicated that the team lacked the technical ability to develop Web Parts.

Team Leadership

Team Leadership governs the leadership of the individual team as opposed to the overall project leadership. Again, neither respondent provided a direct response to this question. However, one can infer from the issues across the board that the Team Leadership could have been stronger on this project. A stronger team leader could have raised issues more quickly and resolved internal conflicts, eliminating some of the overall failures on this project.

Within Case Summary

There is not one cause for this project's failure. With hindsight being what it is, the lack of Cross-Team Leadership seems to be the most significant contributor to the many failures on the project. With stronger leadership, communication issues could have been

addressed earlier, technical issues not allowed to grow as large, and personnel issues involving trustworthiness dealt with more quickly.

Case IV

Project Overview

Case Study IV is from the insurance industry. The project is a performance improvement effort to improve the Self-Funded Services Standard Data Extract Process. The project is to create an automated Extract Transform Load (ETL) process to create, test, and deliver standardized data extracts. The extracts include Medical Claims, Pharmacy Claims, Member Eligibility, and Provider Demographic to vendors and clients. While the project is intended to be short-term, the team will remain together to tackle additional process improvement projects.

Selected Participants

Case Study IV consists of two hybrid teams in the US and India. Figure 64 – Team Structure for Case Study IV shows, at a high level, the team structure and location of individuals. The Product Owners were co-located in the US with the overall Program Manager for the group. Team A was located entirely in India, while Team B had resources from the US and India. Team A consisted of the Product Owner and four developers. Team B consisted of the Product Owner and six team members, which included a business analyst, developers, and testers.

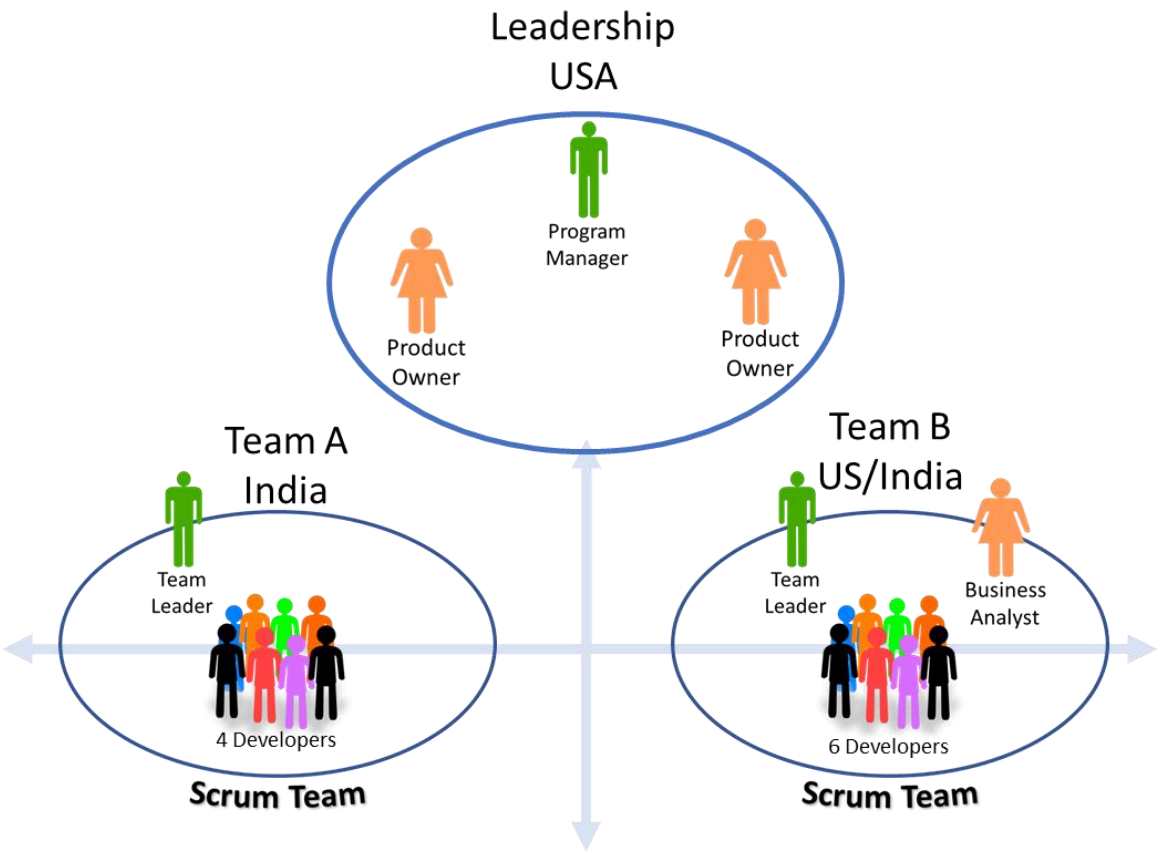


Figure 64: Team Structure for Case Study IV

Participation Levels

The project consisted of three people in leadership positions and ten people across two teams. With only three participants available for the leadership response, it was required that all three respond to the leadership survey for the study to be valid. The project was an internally funded effort. Given this, one would expect strong alignment regarding the process, good organizational support, and excellent domain knowledge of the work to be performed. While all three leadership team members completed the Leadership Response, only three of the ten members completed the Team Survey. The low response

rate from team members draws into question the validity of comparing the team survey to the leadership response survey.

Within Case Reflections

General Reflections regarding the overall project studied indicate it is running reasonably well with areas for improvement. Case IV is an internally funded project. With management continuing to fund this team beyond its initial project scope, the general conclusion would be that they are satisfied with the outcome. Throughout the Leadership Response interviews, the leaders were optimistic with nearly every factor discussed. The project had issues and limitations, but the leadership seemed to fix, deal with, or work around the issues. For example, the team members in India could not use a camera during most meetings. The team found other mechanisms to build strong relationships.

Table 41 – Summary of Factor Reported Impacts shows the leadership response and the team survey summary scores. The table summarizes the positive and negative characteristics on a factor-by-factor basis. These characteristics are drawn from responses derived from thematic analysis. Analogously, the average Likert scores are derived from the average of the team member's responses. With the characteristics sitting side-by-side, one can conclude as to the agreement or lack thereof between the team member's responses and the leader's responses.

Table 41: Summary of Factor Reported Impacts

	Leadership Response				Team
Factor	**Positives**	**Negatives**	**Mitigations Taken**	**Impact Avg**	**Survey Avg**
Task Conflict	Regular Communication Scope Debate	Limited Debate Separation of Duties		0.67	3.3
Process Conflict	Linked Processes Dedicated Team	Process Delays People Not Available		0	1.7 3.3
Affective Conflict	Close Relationships Bonded Team Shared Help Across Team Communication			0.67	1.3 3.7
Architectural Modularity	Continuous Integration			0.33	2
Degree of Dispersion	Shifted Workday Hours Leads Shifted Hours Blackout Times for Continuity	Working Hour Issues Language Barriers		0.67	2.7
Media Richness	Set Standards for Interactions Daily Sync Calls Onsite Call Mostly Video Video Calls Helped Frequent Video Usage	Other Groups No Video Citrix Prevented Cameras		0.33	2.3
Cross-Team Leadership	Leadership Action Tracking Clear Communication Project Issue Tracking Regular Review of Issues Regular Meetings Personnel-Related Issues			1	3
Process	Standardized Processes	No QA	Process Adjusted to Fit	0.67	2.7
People	Great Synergy in Team Proactive Support Team Success Model Trust within Team Good Comradery			0.67	3.7
Organization	Resource Encouragement Everything They Need Collaboration Tools Maturing			0.33	3.3
Technical/Project	Clear Requirements Good Technical Knowledge Strong Domain Knowledge			0.33	3.3
Team Leadership	Raised Issues Addressed Proactive Communication			1	3.3
Process and Affective Conflict require inverted survey responses (Inverted/Non-Inverted) Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

Project Status	Successful – Expert Domain Knowledge, Strong Leadership

The scored impact of each factor is shown in Figure 65 - Average Leadership Factor Impact Score. From this view, it is interesting that the Leadership Response is exceedingly positive across the board, with Leadership being very strong. The strong leadership scores could be due to the experience of the team. All leaders on this team have extensive experience and business domain knowledge.

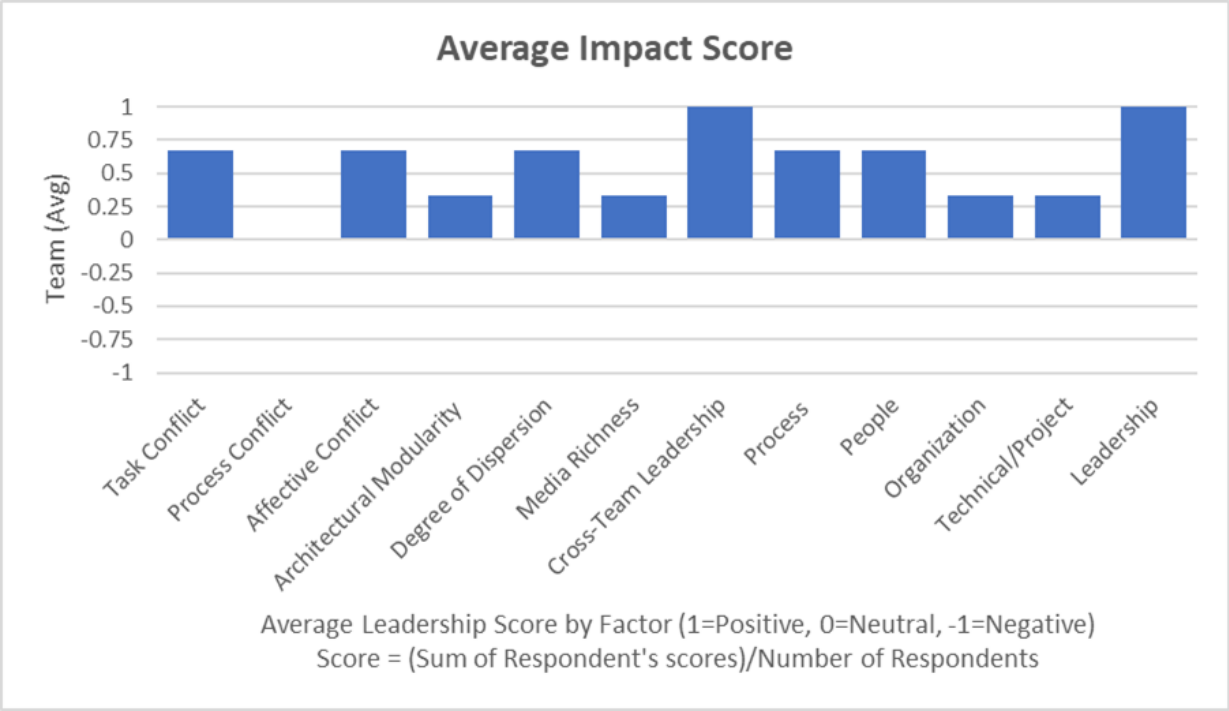


Figure 65: Average Leadership Factor Impact Score

The alignment or disconnect between the team and leadership becomes immediately apparent when viewing Figure 66 - Alignment and Impact Across the Team, which shows the Leadership Response plotted against the Team Survey. The Team Survey scores pull the majority of factors into the right side of the chart. The upper right side of the alignment chart shows high or positive team survey scores and positive leadership scores.

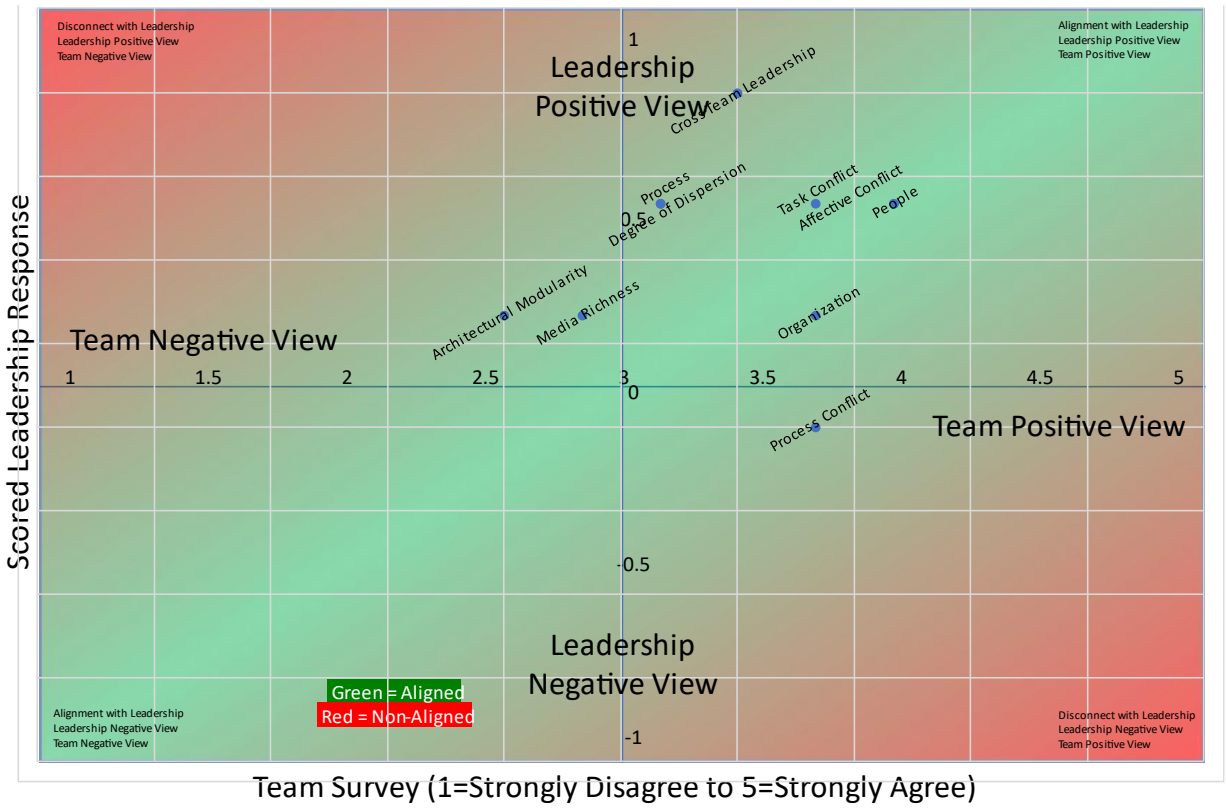


Figure 66: Alignment and Impact Across the Team

One would be tempted to draw strong conclusions from the visual impact of the Alignment and Impact chart, but with only three responses, more investigation should be conducted before making conclusions. People, Organization, Task Conflict, and Affective Conflict are in the best alignment between the team and leadership. In the following subsections, each factor will be analyzed in more detail, which may allow for better conclusions to be drawn.

Task Conflict

Task Conflict refers to the alternatives to implementing a particular feature. Regarding this factor, respondents cited regular communication and scope debating as positively impacting the project. Separation of duties and limited debate were also cited. In the

interview process, it was said that the separation of duties limited the implementation debate for features, but there was ample discussion regarding the scope of a feature. Table 42 – Leadership Response Regarding Task Conflict indicates that two of the three leaders identified Task Conflict as being present and positively impacting the project.

Figure 67 – Team Survey Response Regarding Task Conflict corroborates the leadership survey conclusions, with all team members indicating a positive response. The figure below shows the respondents for each Likert response collected through the Team Survey. The corroboration between the leadership and team responses indicates a high level of communication among the team members and between the teams.

Table 42: Leadership Response Regarding Task Conflict

GDT Degree of Alignment Factor	Leadership			Leader (Avg)
	A	B	C	
Task Conflict	0	1	1	0.67
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

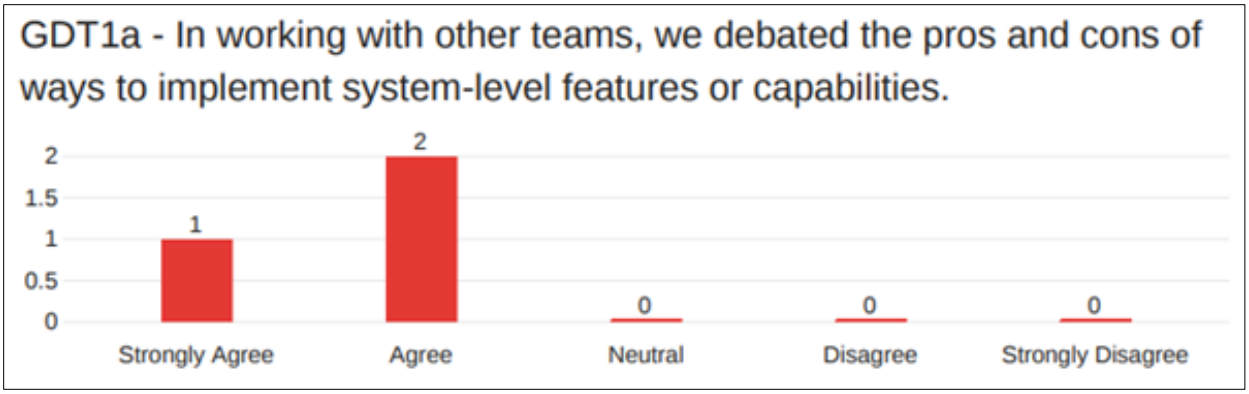


Figure 67: Team Survey Response Regarding Task Conflict

Process Conflict

Process Conflict occurs when teams that interact utilize processes that do not align. The conflict can look like quality issues but most commonly is seen as a schedule delay. Team B had a specific process issue that caused delays for the overall project. Other responses indicated a well-managed process contributing to a neutral or positive impact on the project, as shown in Table 43 - Leadership Response Regarding Process Conflict. Respondent B stated, “Our processes are well designed/defined in such a way that it complements other teams rather than creating process conflict.” The team survey corroborates the lack of Process Conflict, as seen in Figure 68 - Team Survey Response Regarding Process Conflict.

Table 43: Leadership Response Regarding Process Conflict

GDT Degree of Alignment Factor	Leadership			Leader (Avg)
	A	B	C	
Process Conflict	-1	1	0	0
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

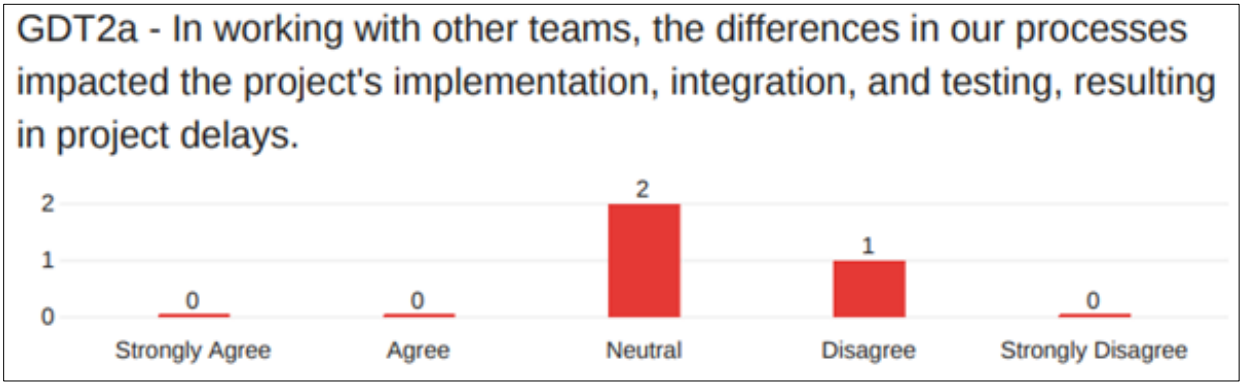


Figure 68: Team Survey Response Regarding Process Conflict

Affective Conflict

Affective Conflict is the anxiety or hesitation in participation due to specific people being involved. Respondent B describes the lack of Affective Conflict as follows, “My interactions with counterparts on other teams were very fruitful and played a key role in success of the project. Each team/Team member tried to help each other and came forward for meetings/calls whenever needed to support each other.” Table 44 - Leadership Response Regarding Affective Conflict shows a strong correlation with team survey response shown in Figure 4.40 - Team Survey Response Regarding Affective Conflict.

Table 44: Leadership Response Regarding Affective Conflict

GDT Degree of Alignment Factor	Leadership			Leader (Avg)
	A	B	C	
Affective Conflict	1	1	0	0.67
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

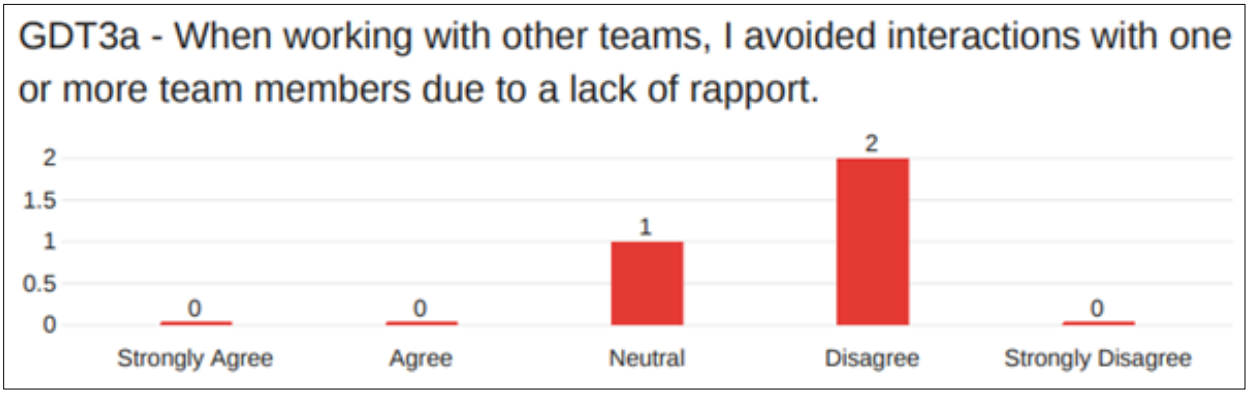


Figure 69: Team Survey Response Regarding Affective Conflict

Architectural Modularity

The ability to work in parallel or independently is the goal of the Architectural Modularity factor. Respondent B described the project's Architectural Modularity while describing the lack of Task Conflict in the following statement.

Work was grouped among different categories called as 'Extract' based on Functionality/Features. It was divided into 4 extracts called Eligibility, Medical claims, Pharmacy claims and Provider Extracts. A set of teams was dedicated to implement each extract that includes different skilled resources who can help in requirement/design/development and Testing.

The Leadership Response shown in Table 45 - Leadership Response Regarding Architectural Modularity and the Team Survey shown in Figure 70 - Team Survey Response Regarding Architectural Modularity would seem to conflict with a high Architectural Modularity. However, the structural organization of the project included the Architectural Modularity, which the team seemingly did not account for in these responses.

Table 45: Leadership Response Regarding Architectural Modularity

Tools for Mitigation Factor	Leadership			Leader (Avg)
	A	B	C	
Architectural Modularity	0	0	1	0.33
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

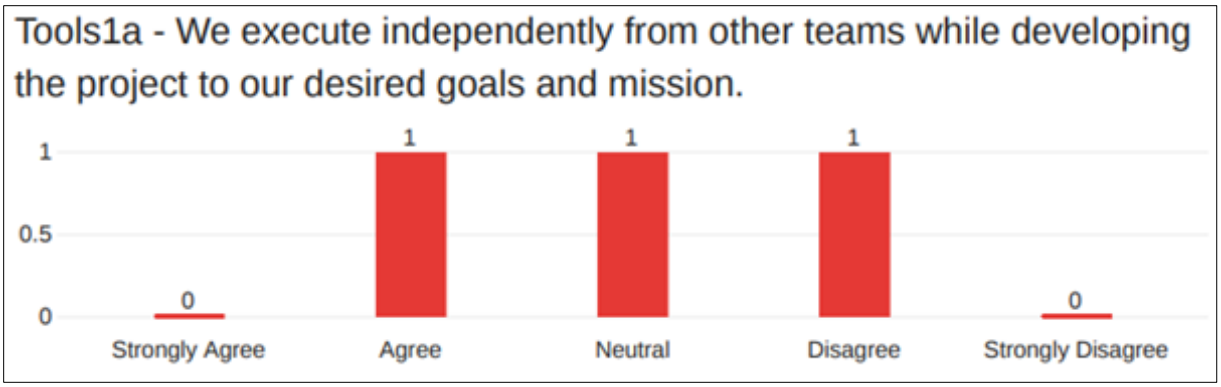


Figure 70: Team Survey Response Regarding Architectural Modularity

Degree of Dispersion

Degree of Dispersion is the separation of time and distance between the teams. With the teams in New York and India, the project deals with a Degree of Dispersion covering the 9.5 hours of time shift. The project team took the step to shift the workday of the teams in India but also extended the workday of the people located in New York. Respondent B stated, “Offshore team workday hours overlap with onsite team members' workday hours. It gives opportunity to different team members to sync up with each other.” Respondent C included the US adaption, stating, “Development leads make themselves available in the evenings to answer questions. Hand-offs occur during shift changes to ensure continuity.” Table 46 - Leadership Response Regarding Degree of Dispersion indicates that Respondents B and C see the adaptions made for Degree of Dispersion positively impacting the project.

Table 46: Leadership Response Regarding Degree of Dispersion

Tools for Mitigation Factor	Leadership			Leader (Avg)
	A	B	C	
Degree of Dispersion	0	1	1	0.67
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

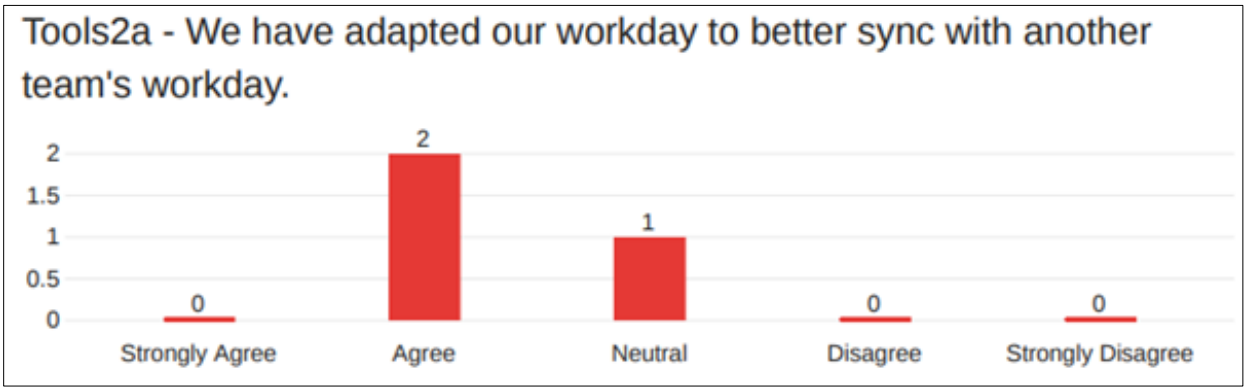


Figure 71: Team Survey Response Regarding Degree of Dispersion

Media Richness

Media Richness considers the connectivity available and combines this with the tools available to overcome the Degree of Dispersion. The project team has reasonable connectivity between locations. Tools include MS Teams with video, voice, and messaging capabilities. Respondent A set a standard for video usage during meetings by making it “highly recommended.” It was not always possible to use video on this project. Respondent C clarified the usage of video with the following, “Video chat is used frequently although not all resources are able to due to gaps in functionality using Citrix” Citrix is a tool to provide a remote connection and control to a user over a network. Citrix users could not access a video camera in this virtualized environment for this project. Table 47 - Leadership Response Regarding Media Richness shows that the respondents rated this factor as neutral to positive for impacting the project. Figure 72 - Team Survey

Response Regarding Media Richness shows the impact of Citrix and the “highly recommended” camera usage with the split between Agree and Disagree.

Table 47: Leadership Response Regarding Media Richness

Tools for Mitigation Factor	Leadership			Leader (Avg)
	A	B	C	
Media Richness	0	1	0	0.33
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

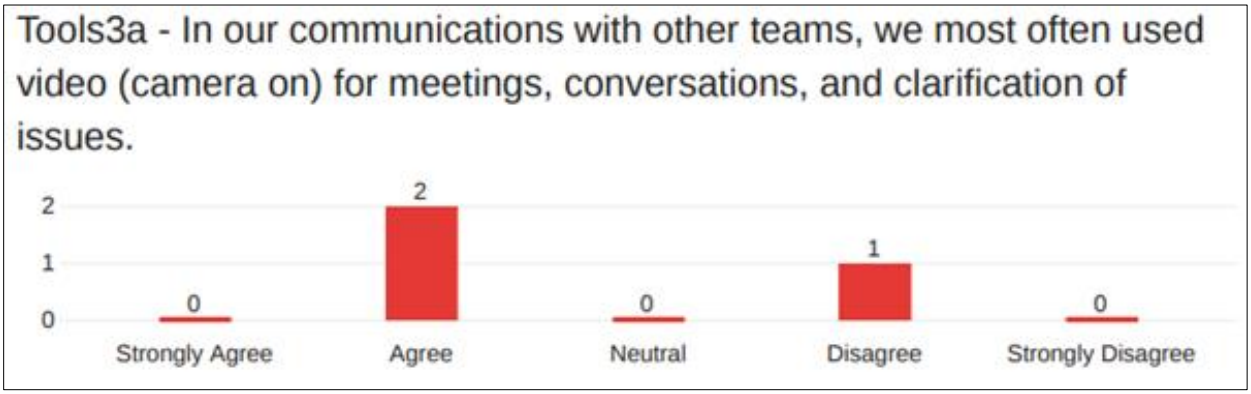


Figure 72: Team Survey Response Regarding Media Richness

Cross-Team Leadership

Cross-Team Leadership is the person or people who lead the work across the set of teams for the project. Table 48 - Leadership Response Regarding Cross-Team Leadership shows a strong positive indication by all respondents. Respondent B summarized the leadership style: "On a project level, different trackers were being maintained and tracked daily. It includes a query tracker, defect tracker, Observation tracker, etc. These trackers had been reviewed regularly, and appropriate action had been taken as needed. In addition to it, Risks/issues were also maintained and tracked

so that a mitigation plan could be created to mitigate it. Leadership and Team Members connect also happened regularly that helped to address personnel-related issues quickly and effectively." The team survey response in Figure 73 - Team Survey Response Regarding Cross-Team Leadership agrees with the Leadership Response.

Table 48: Leadership Response Regarding Cross-Team Leadership

Tools for Mitigation Factor	Leadership			Leader (Avg)
	A	B	C	
Cross-Team Leadership	1	1	1	1
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

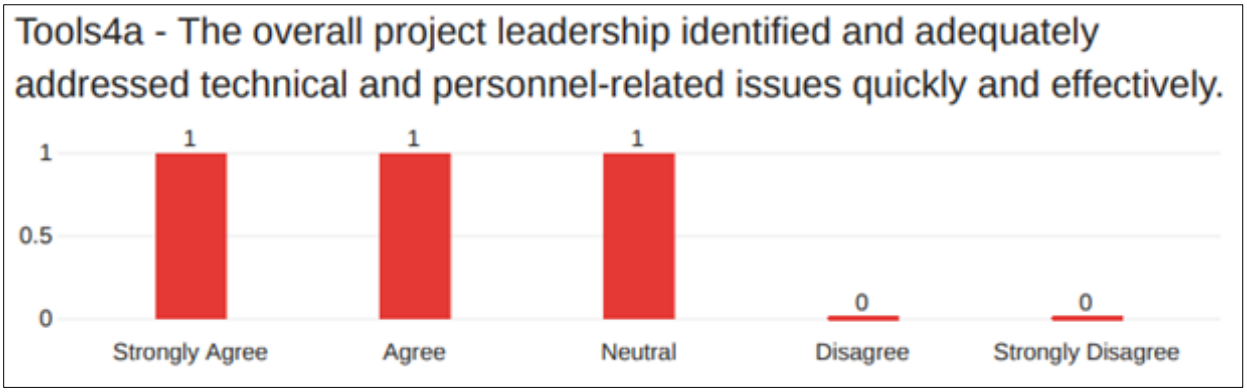


Figure 73: Team Survey Response Regarding Cross-Team Leadership

Process

The Process factor of the Team Practices for Delivering Value consists of the documented methodology used by the team to achieve the goal. Respondent B described the standard process used across all teams working on this project. Respondent A had an issue with the project where their team could not follow the standard process. A test person could not be assigned to their team. The test issue was raised as a Process Conflict as it caused delays in the project. For this reason, Respondent A did not rate Process as having a

positive impact on the project, as shown in Table 49 - Leadership Response Regarding Process. Figure 74 - Team Survey Response Regarding Process indicates similar process similarity across teams.

Table 49: Leadership Response Regarding Process

Team Practices for Delivering Value Factor	Leadership			Leader (Avg)
	A	B	C	
Process	0	1	1	0.67
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

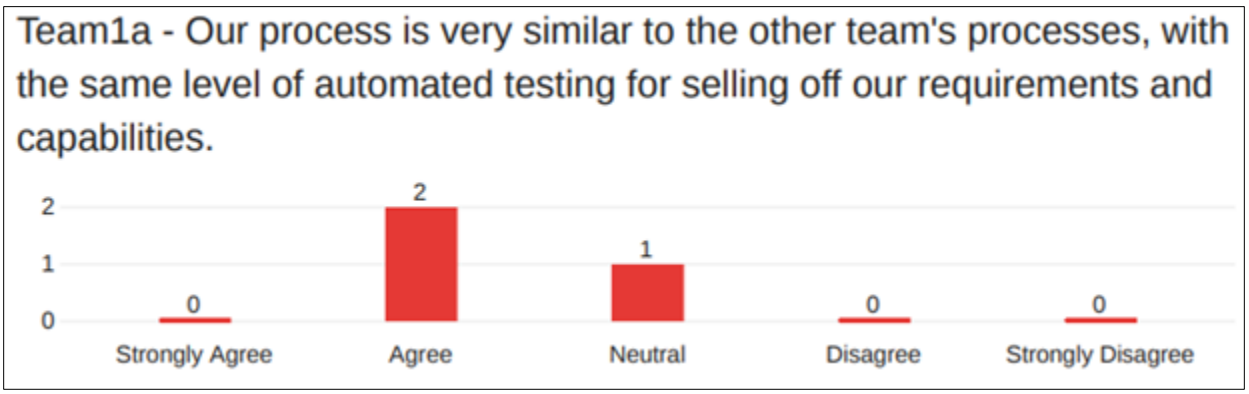


Figure 74: Team Survey Response Regarding Process

People

The People factor of Team Practices for Delivering Value includes a team's social and emotional aspects. By nearly all accounts, the team and people relationships on this project are solid. Table 50 - Leadership Response Regarding People shows a positive impact on the project. All leadership responses were positive. Respondent B stated, “Team members shared a great and healthy relationship with each other. It helped to create a great synergy among the team. This was well reflected with many examples like

how team members proactively came forward to help each other in case any issue surfaced in the project. People went beyond their area to extend support. The team strongly believed that individual success doesn't matter until Team gets success." The response from the team survey corroborates the positive sentiment, as shown in Figure 75 - Team Survey Response Regarding People.

Table 50: Leadership Response Regarding People

Team Practices for Delivering Value Factor	Leadership			Leader (Avg)
	A	B	C	
People	1	1	0	0.67
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

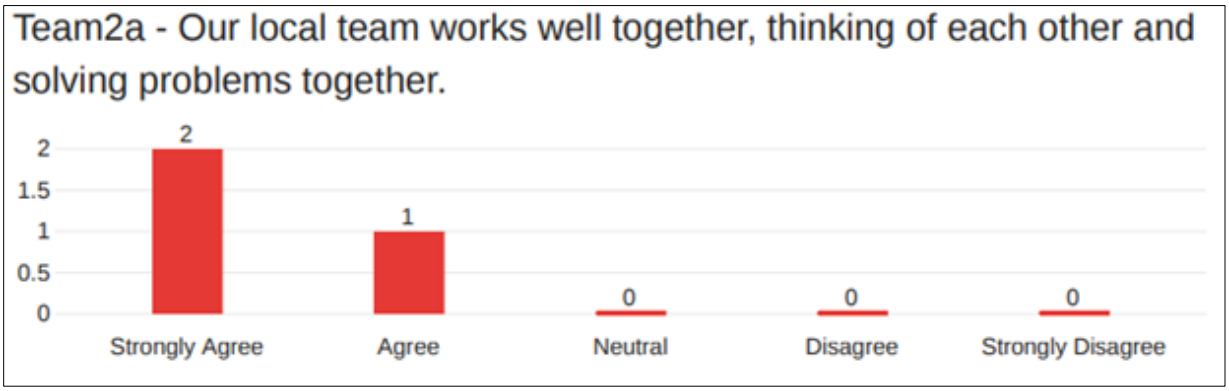


Figure 75: Team Survey Response Regarding People

Organization

The Organization factor in the Team Practices for Delivering Value includes all the items an organization might have to provide for a team to succeed, such as tools, facilities, computers, and software. People are likely the most pivotal component an organization needs to provide. Respondent A stated that a test person was not provided for their team. The lack of a test resource caused Process Conflict and project delays. Respondent C

scored the Organization as having a positive impact on the project, as shown in Table 51 - Leadership Response Regarding Organization. Respondent C stated, “The team is provided what is needed to be successful, including piloting testing tools to drive automation.” Figure 76 - Team Survey Response Regarding Organization shows the team members responding feel like what they are getting from the organization is sufficient for their needs on the project.

Table 51: Leadership Response Regarding Organization

Team Practices for Delivering Value Factor	Leadership			Leader (Avg)
	A	B	C	
Organization	0	0	1	0.33
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

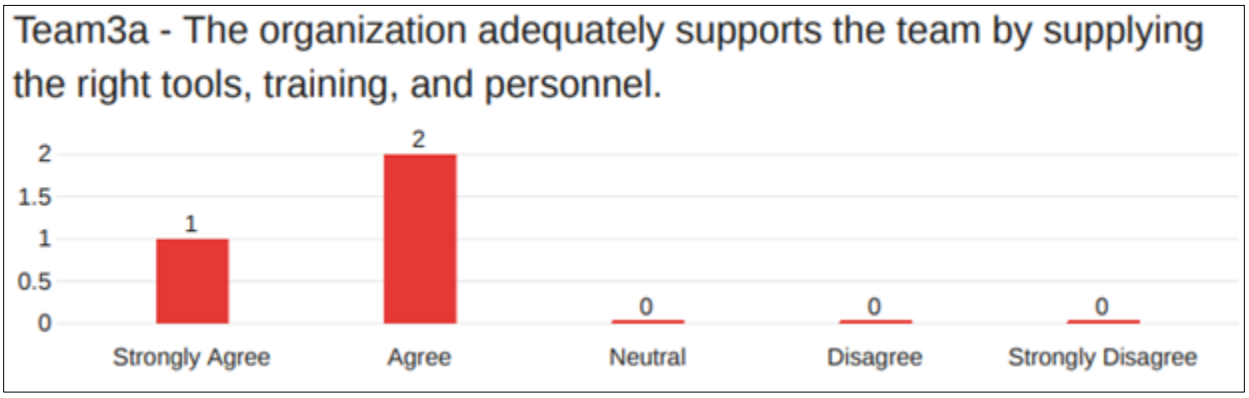


Figure 76: Team Survey Response Regarding Organization

Technical/Project

Highly qualified team members and leaders are located on both development teams. Both teams have been identified as having excellent domain knowledge for the project. These are the key ingredients for the Technical/Project factor of the Team Practices for

Delivering Value. The team applied subject matter experts across the teams to ensure that each team had the knowledge. While all respondents agreed the Technical/Project skills were on the teams, they mostly felt this factor did not impact the project's overall success, as shown in Table 52 - Leadership Response Regarding Technical/Project. Figure 77 - Team Survey Response Regarding Technical/Project shows that the team respondents believe the Technical/Project knowledge was strong for this project.

Table 52: Leadership Response Regarding Technical/Project

Team Practices for Delivering Value Factor	Leadership			Leader (Avg)
	A	B	C	
Technical/Project	0	1	0	0.33
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

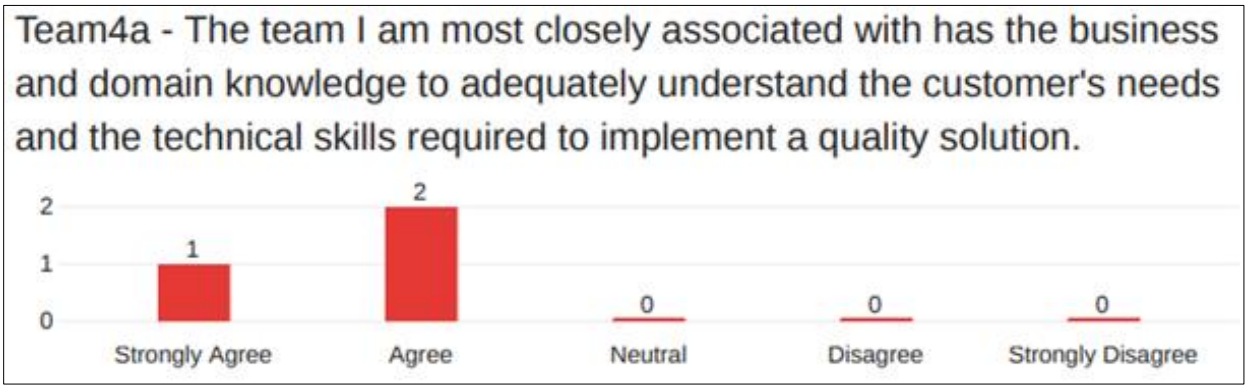


Figure 77: Team Survey Response Regarding Technical/Project

Team Leadership

The Team Leadership factor of Team Practices for Delivering Value is the local team leadership component of the project. Table 53 - Leadership Response Regarding Team Leadership shows that the leaders unanimously see Team Leadership as a driving factor for this project's success. The team member respondents, as shown in Figure 78 - Team

Survey Response Regarding Team Leadership, agree that the project's leadership contributes to the project's success. Respondent B summarized team leadership: “There were issues that surfaced during offshore time zone and local leads acted very diligently and spontaneously. E.g., Job not triggering in the Testing region. Lead reached out to IT Operation Support team and worked with them to get this issue resolved. Leads connected with me and were very proactive in communication about any issue especially impacting timeline or our deliverables.”

Table 53: Leadership Response Regarding Team Leadership

Team Practices for Delivering Value Factor	Leadership			Leader (Avg)
	A	B	C	
Team Leadership	1	1	1	1
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

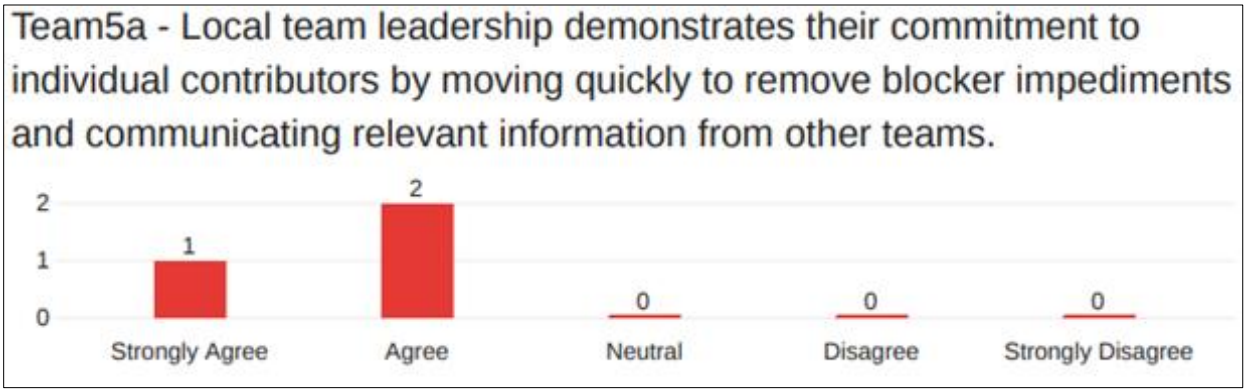


Figure 78: Team Survey Response Regarding Team Leadership

Within Case Summary

Summarizing Case IV, the project seems to be successful by most accounts. The team communicated effectively within and across the team. An interesting finding is the

extremely low Task Conflict. Architectural Modularity is so high that the team described nearly no Task Conflict.

The project seems to have strong Cross-Team and Team Leadership based on the team performance, qualitative responses, and team survey data. People are the strength and primary success factor for this project. The experience and business domain knowledge makes defining how the project should work significantly more manageable than many projects. The project's social and emotional components seem to help overcome the project's weaknesses, which is also seen in the Affective Conflict factor. Respondent B commented on the team having the experience and knowing each other so well that it made the project easy.

Case V

Project Overview

The project studied as Case V is a very long-running software development and operations management project. A software engineering company develops the project for another company, the system’s installer, and the product owner. The project has been running for more than five years, with most of the team project leadership part of the project for the entire duration. Case V is an Internet of Things (IoT) project. The project involves using the internet to manage and control on-premise devices at thousands of locations. The software was first migrated from local servers to a Cloud-based server solution and modernized. Once modernized, the project has continued to grow and progress with technology updates, software feature enhancements, and more robust monitoring solutions. This project is a mature team that morphed and changed throughout

the project's lifecycle. Today, the project has scaled back from the maximum size. It continues to manage all development and deployment of software for this project.

Selected Participants

Case Study V consists of development teams located in India from two locations, Chennai and Coimbatore. These locations are approximately 325 miles apart. While all development was performed in India, project oversight, business analysis, and customer interfacing are in the US. During the course (prior to the study) of the project, the team leader of the Chennai team moved to Canada. Figure 79 – Team Structure for Case Study V shows, at a high level, the team structure and location of individuals. The US team consists of Business Analysts, Solution Architects, and the overall Program Manager for the team. These people are co-located with the customer, while the development and technical leadership are in India.

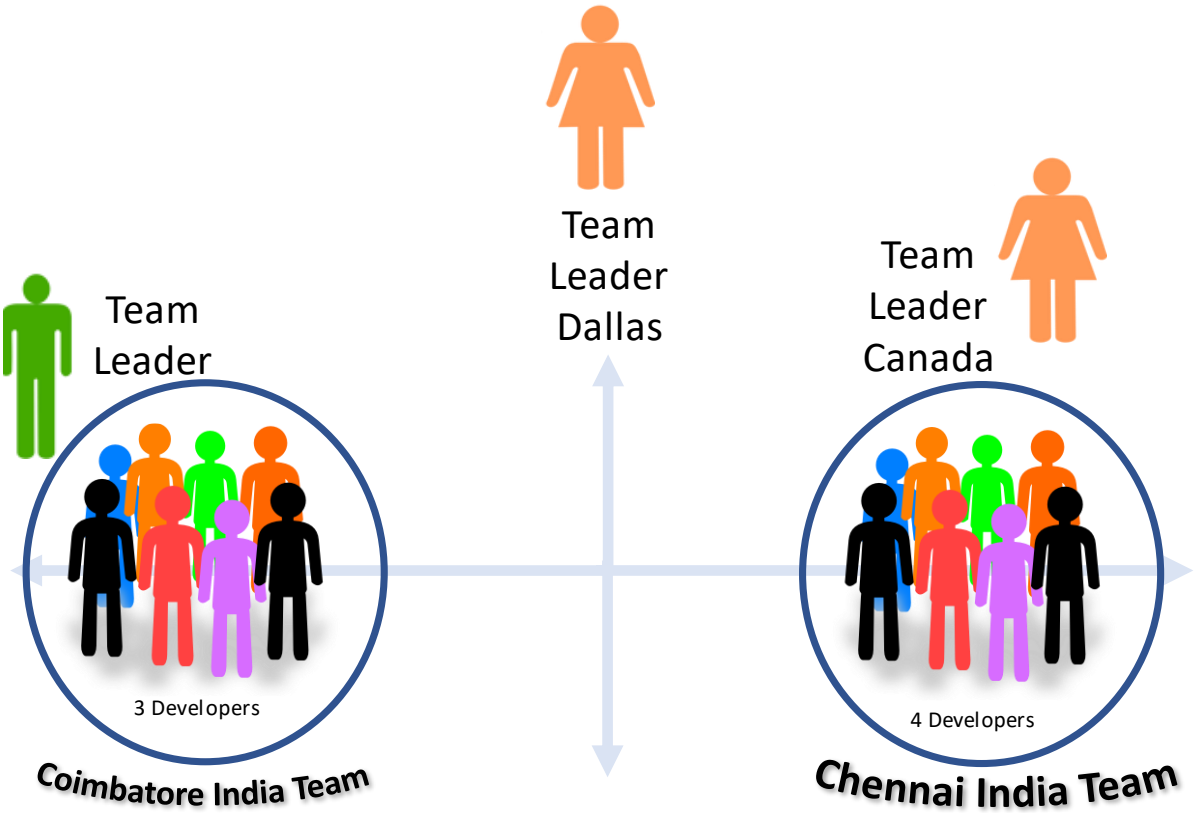


Figure 79: Team Structure for Case Study V

Participation Levels

The project consists of each team's leadership positions in the US and India. The company leadership determined they wanted to minimize the time commitment of participants while supplying valid input for the research. Therefore, leadership individuals were chosen rather than simply surveying all potential leadership individuals. All individuals responded to the qualitative survey and were interviewed as part of the Phase II Leadership Interview. The three respondents consisted of approximately 50% of the leadership team possible to include. The response rate is consistent with the general response from other case studies and covers all aspects of the desired response profile. The team survey was sent to all seven members, who responded appropriately.

Within Case Reflections

General reflections regarding Case Study V are that it is a highly successful project based on longevity, responses, continued execution, and sponsorship. Throughout the project, many structural changes and mitigations have adapted the team into a successfully performing operation. Over the six-year project period, the team adapted several times and in several ways to achieve its success. The project adopted an agile process and used the retrospective process to improve the process for success. The teams learned to adopt a Big Brother/Big Sister mentorship approach for new team members. They also interviewed internal candidates to ensure they would fit with their team.

The reported factor mitigations and the team survey average are shown in Table 54 – Summary of Factor Reported Impacts. The table summarizes the positive and negative characteristics on a factor-by-factor basis. These characteristics are drawn from responses derived from thematic analysis. Analogously, the average Likert scores are derived from the average of the team member's responses. With the characteristics sitting side-by-side, one can conclude as to the agreement or lack thereof between the team member's responses and the leader's responses.

Table 54: Summary of Factor Reported Impacts

	Leadership Response				Team
Factor	**Positives**	**Negatives**	**Mitigations Taken**	**Impact Avg**	**Survey Avg**
Task Conflict	Low task conflict Addressed Roadblocks High-Level task conflict			0.33	3.2
Process Conflict	Same Process for all Touchpoints Focus on Delivery		Adapted Process	0.33	3.5 1.5
Affective Conflict	Quick Resolution Candor Discussions Strong Rapport		Bonding Exercises	0.33	3.8 1.2
Architectural Modularity	Strong Modularity	Changes impact downstream teams		0.67	2.2
Degree of Dispersion	Shifted Workday	Shifted Workday	Adjust work hours on both sides	1	3.8
Media Richness	Whiteboarding Screensharing	No Video	Upgraded Tools	0	1.0
Cross-Team Leadership	Frequent Contact Quick Resolution One-on-Ones		Bonding Exercises	1	3.0
Process	Same Process Shared Testing		Adapted Process	0.33	3.0
People	Shared Social Background and culture	Remote-Only failed relationships	Big Brother/Big Sister	0.67	3.8
Organization	Needs Met Free Online Training Empowered Leaders	Limited HW for Team	Upgraded Tools	0.33	3.5
Technical/Project	Strong Domain Knowledge Strong Technical Knowledge		Six years on the project	0.33	3.7
Team Leadership	Daily Standups Quick Resolution Strong Rapport Communication Up and Down			0.33	3.7
Process and Affective Conflict require inverted survey responses (Inverted/Non-Inverted) Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

Project Status	Successful – Mitigated issues quickly, Strong Team and Leaders

The scored impact of each factor is shown in Figure 80 – Average Leadership Factor Impact Score. The leadership team identified the Degree of Dispersion and Cross-Team Leadership as impacting the project's success. The project team dealt with the Degree of Dispersion by shifting the US and Indian teams' hours. Respondent C summarized the shift in the following way, "While the development team is in India, the client team is in

the US. Both the teams agreed on a sync-up time such that the US team would start early and the Indian team would stay late than the regular working hours."

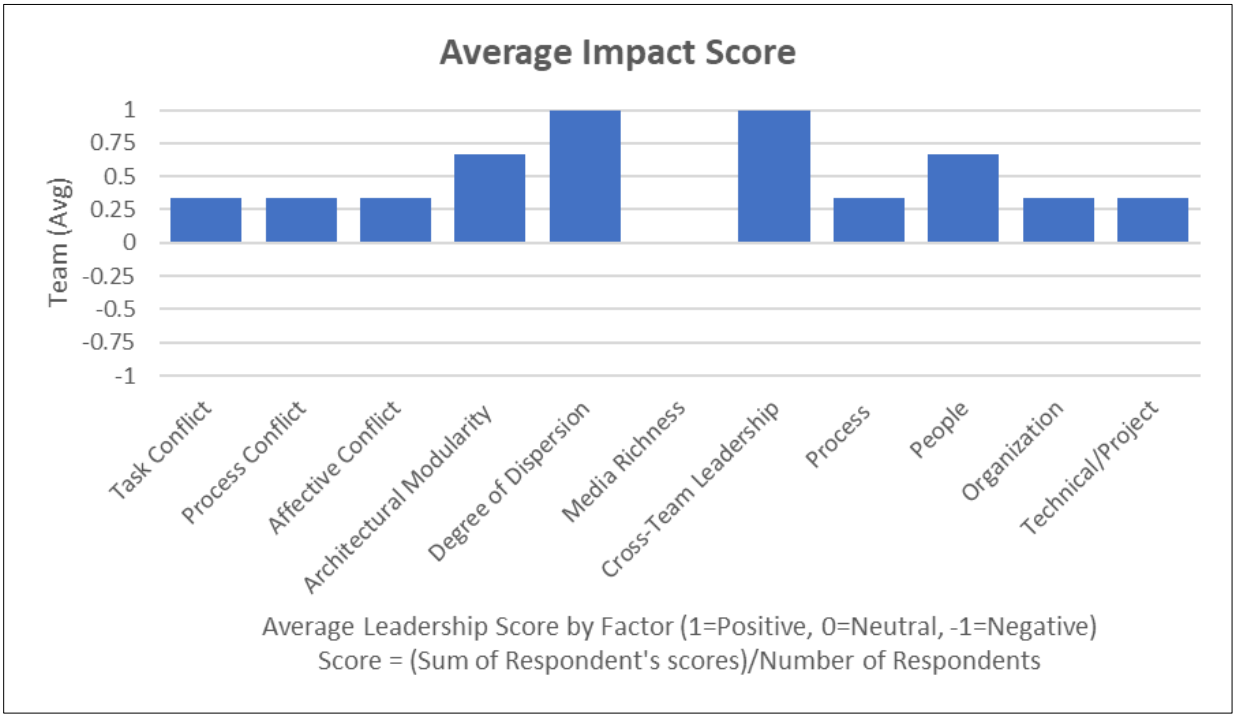


Figure 80: Average Leadership Factor Impact Score

Cross-Team Leadership was another factor impacting success. Respondent B described the cross-time leadership: "For technical matters, we have various focused calls like alerts review, Architecture review, project progress review, standups, etc. For personnel-related matters, the leader who is present locally along with the team does one-on-one meetings to attend to the needs and concerns."

The leadership respondents identified the Degree of Dispersion and Cross-Team Leadership as the most impactful factors. Figure 81 – Alignment and Impact Across the

Team show how the leadership inputs align with the team survey. The team survey shows Affective Conflict, People, and Degree of Dispersion as the most impactful items.

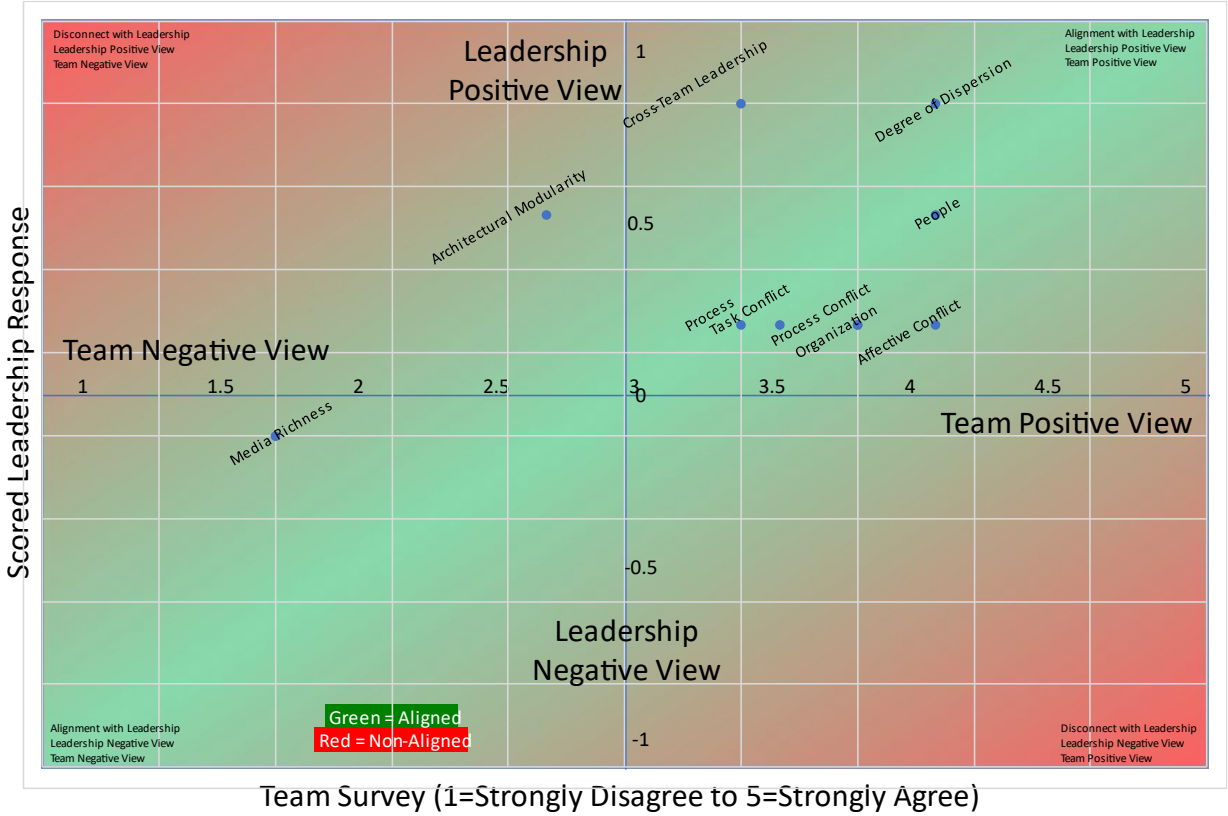


Figure 81: Alignment and Impact Across the Team

The team leadership and the team members seem to agree on the positive impact and strength of the People, Process, Organization, Task Conflict, and Process Conflict factors. The following section will elaborate more completely on the alignment and details found with each factor.

Task Conflict

Task Conflict refers to the alternatives to implementing a particular feature. Regarding this factor, Task Conflict is low across the teams because Architectural Modularity is high. In the Task Conflict response, Respondent B described that the business analyst and the cross-team leadership divide the work into UI, Development, and Network section and assign the work to the respective teams. Table 55 - Leadership Response Regarding Task Conflict shows a positive but low score assessed for Task Conflict. Respondent C describes the Task Conflict: “Team members were divided based on the number of features to be implemented and are encouraged to come up with the design for their own work. Such designs would be discussed among the teams under a supervision of a team lead. Teams are encouraged to debate and agree on the best design.” Figure 82 - Team Survey Response Regarding Task Conflict agrees with the statement regarding the teams being encouraged to debate. The responses indicated that cross-team leadership could quickly determine and assign work to the team with little debate regarding how the feature should be implemented.

Table 55: Leadership Response Regarding Task Conflict

GDT Degree of Alignment Factor	Leadership			Leader (Avg)
	A	B	C	
Task Conflict	1	0	0	0.33
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

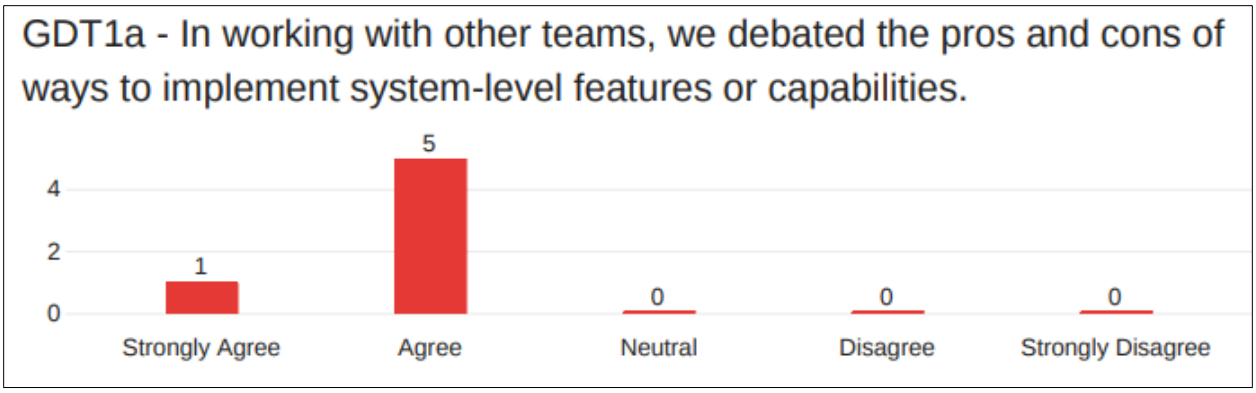


Figure 82: Team Survey Response Regarding Task Conflict

Process Conflict

Process Conflict occurs when teams have differing processes incompatible with the timing and quality of what they deliver. Table 56 – Leadership Response Regarding Process Conflict indicates that the leadership team sees little to no process conflict impacting the project. Respondent C stated, “We did not have any significant process conflict between this team and other teams, which impacted the delivery.” While this should be expected of a project that has been running for more than six years, the respondents confirmed that the adaptations taken over time had reduced the process conflict.

Table 56: Leadership Response Regarding Process Conflict

GDT Degree of Alignment Factor	Leadership			Leader (Avg)
	A	B	C	
Process Conflict	1	0	0	0.33
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

Over time, the team has trained everyone on and morphed the process the fit their needs avoiding Process Conflict. Respondent A describes this best, “Product team was trained in the SDLC process, and our process was adapted based on their feedback so that all teams were using more or less the same process. There was minimal impact. Figure 83 - Team Survey Response Regarding Process Conflict shows that the team members mostly agree. Without more data, the minimal Process Conflict identified by the team members cannot be quantified. Most of the team respondents and all the leadership determined that Process Conflict is minimal.

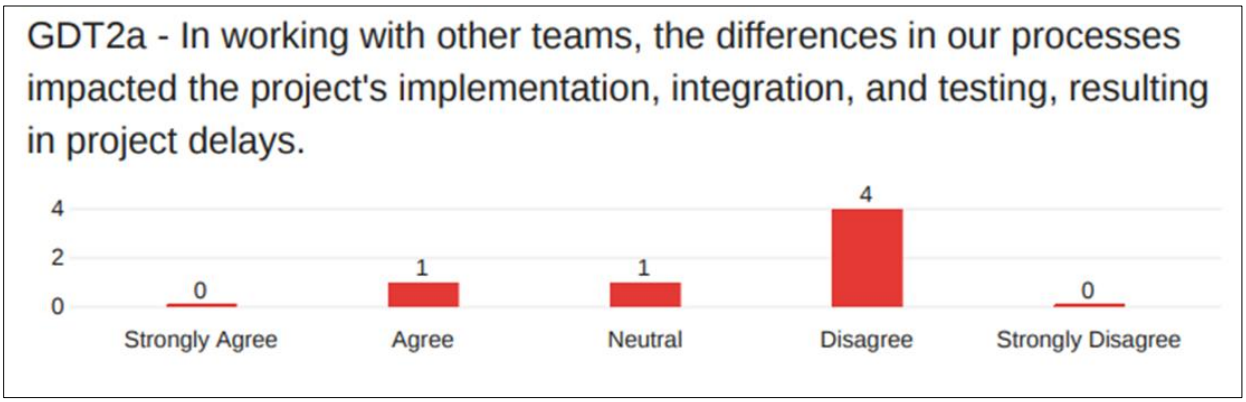


Figure 83: Team Survey Response Regarding Process Conflict

Affective Conflict

Affective Conflict has been cited as inhibiting communication between team members. The inhibiting communication can come in avoidance of contact or the withdrawal of participation in meetings. In either form, the lack of effective communication hurts the team’s operational effectiveness. Because Affective Conflict is highly negatively impactful, if existing, it should be eliminated over time with effective leadership. The

project has been running for many years. Table 57: Leadership Response Regarding Affective Conflict, in conjunction with their statements, shows the leaders believe there is minimal or no Affective Conflict. The team members also indicate a lack of Affective Conflict, as shown in Figure 84 - Team Survey Response Regarding Affective Conflict. With no identified Affective Conflict, the study looks for evidence of positive relationships throughout the team. Respondent C scored Affective Conflict as having a positive impact on the project due to the "regular team bonding exercises" conducted. Respondent A describes the situation: "Concerns were brought up early and with candor. Disagreements were resolved through consensus based on cost/efficiency or time." Respondent B confirms the state of Affective Conflict within the team, stating, "We been working together for many years. Language is not a barrier in our case, so we communicated with each other comfortably and established a rapport."

Table 57: Leadership Response Regarding Affective Conflict

GDT Degree of Alignment Factor	Leadership			Leader (Avg)
	A	B	C	
Affective Conflict	0	0	1	0.33
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

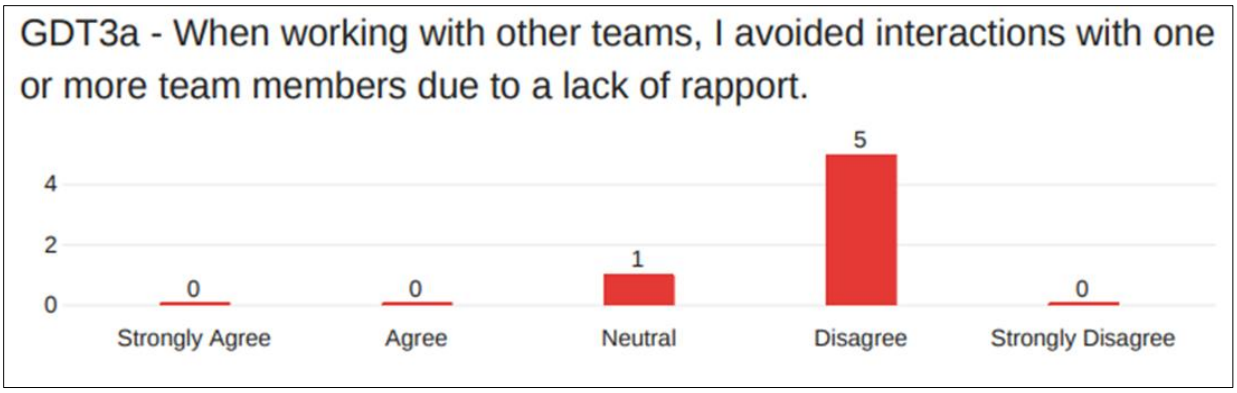


Figure 84: Team Survey Response Regarding Affective Conflict

Architectural Modularity

Architectural Modularity is the ability to work independently from other teams as the design work progresses. Table 58 - Leadership Response Regarding Architectural Modularity shows the leadership respondents scored Architectural Modularity as having a strong positive impact on the project. At the cross-team level, Task Conflict is low, with a cited reason being the high Architectural Modularity. Architectural Modularity is not clearly visible at the team level, as shown in Figure 85 - Team Survey Response Regarding Architectural Modularity.

Table 58: Leadership Response Regarding Architectural Modularity

Tools for Mitigation Factor	Leadership			Leader (Avg)
	A	B	C	
Architectural Modularity	1	0	1	0.67
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

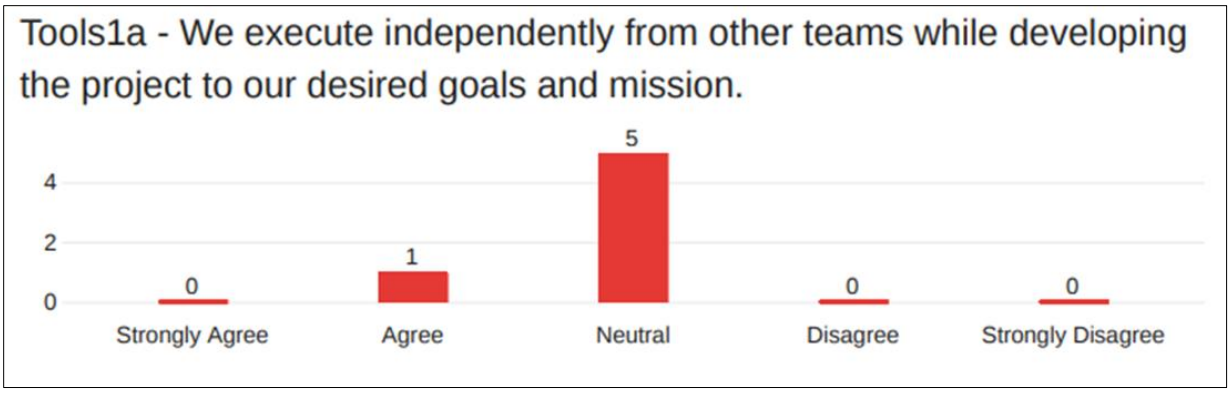


Figure 85: Team Survey Response Regarding Architectural Modularity

Respondent C describes why the Architectural Modularity is high, “The nature of the project itself was to bring architectural modularity allowing individual teams can work independently as much as possible going forward. And in my opinion, we greatly achieved though still, some work needs to be done.” With six years of execution and a significant project objective being Architectural Modularity, one would expect this factor to be high if the project has been successful. Respondent A confirmed the high level of Architectural Modularity, stating, “there was a clear separation of responsibilities.”

Degree of Dispersion

Degree of Dispersion is the separation of time and distance between the teams. With project leadership co-located with the customer in Texas and the development teams across two cities in India, Chennai and Coimbatore, ten and one-half hours of time spread are hard to ignore. It is, therefore, quite understandable why the leadership team identified the Degree of Dispersion as one of the most impactful factors, as shown in Table 59 - Leadership Response Regarding Degree of Dispersion.

Table 59: Leadership Response Regarding Degree of Dispersion

Tools for Mitigation Factor	Leadership			Leader (Avg)
	A	B	C	
Degree of Dispersion	1	1	1	1
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

The project team imposed a shift in the workday to handle the Degree of Dispersion by shifting the US and India teams' hours to force more overlap. The shifted workday is pictorially represented in Figure 86 - Adjusted Workday Overlap between Leadership and Development. The team members acknowledge this shifted workday in their responses, shown in Figure 87 - Team Survey Response Regarding Degree of Dispersion.

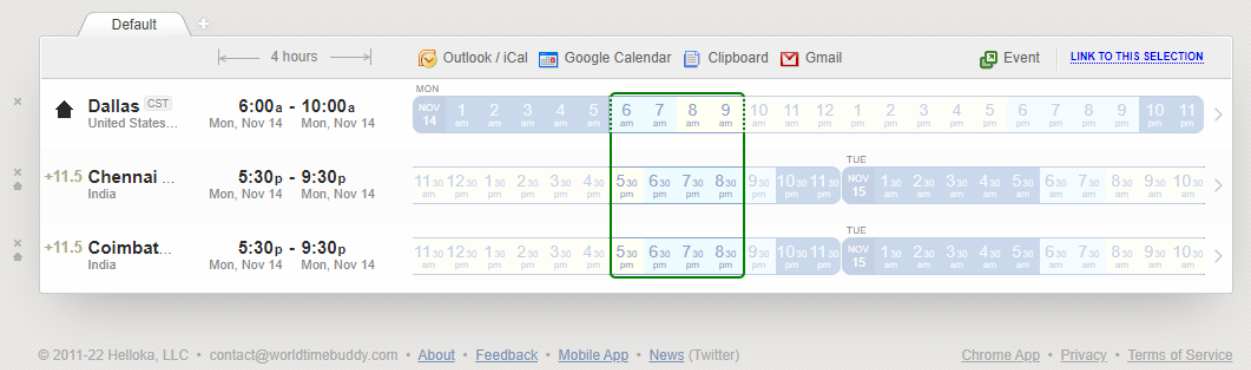


Figure 86: Adjusted Workday Overlap between Leadership and Development

Figure 87: Team Survey Response Regarding Degree of Dispersion

By shifting the workday of all parties, both leadership and development, both sides are equally impacted, with the overall team impact minimized. Respondent C describes the structure, “While the development team is in India, the client team is in the US. Both the teams agreed on a sync-up time such that the US team would start early and the Indian team would stay late than the regular working hours.” Shifting both sides of the whole team provides potentially the most sustainable mechanism for operating the team in the long term. The dual shift being the most sustainable approach is bolstered by the six-year run of the project and the long tenure of the leadership team members.

Media Richness

Media Richness is described by the bandwidth and tools to communicate over a medium. None of the respondents described the tools for Media Richness in ways that would indicate they failed to meet their desired functionality. The team began the project using Skype (IM Only). As the project progressed, they migrated to MS Teams, but all leaders indicated that video was still seldom used. Table 60 - Leadership Response Regarding Media Richness indicates that no leader felt that Media Richness played a significant role in the project’s success. The team response shown in Figure 88 - Team Survey Response

Regarding Media Richness shows that the team agrees that video is rarely used for conversations.

Table 60: Leadership Response Regarding Media Richness

Tools for Mitigation Factor	Leadership			Leader (Avg)
	A	B	C	
Media Richness	0	0	0	0
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

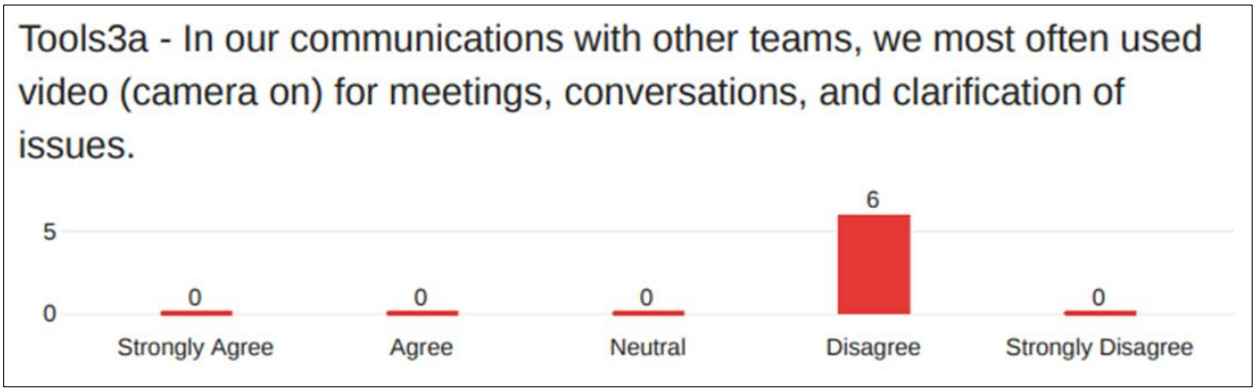


Figure 88: Team Survey Response Regarding Media Richness

With a longstanding team of over six years, the rapport developed will not likely change with or without video. Respondent A captured the overall sentiment, “Daily meetings were over IM with voice and screen sharing. Video was rarely required for communicating a concept. Whiteboarding and screen sharing were adequate.” Respondent C commented that the team felt the lack of video had begun to impact their team bonding. The team has adapted to starting to use video for meetings.

Cross-Team Leadership

Cross-Team Leadership is team management above the individual team leaders. Respondents across the group identified no specific issues relating to cross-team leadership. All respondents identified strong leadership, as seen in Table 61 – Leadership Response Regarding Cross-Team Leadership. Figure 89 – Team Survey Response Regarding Cross-Team Leadership shows that team members respond with similar strengths. The leadership team indicated that Cross-Team Leadership was one of the most impactful factors, along with the Degree of Dispersion.

Table 61: Leadership Response Regarding Cross-Team Leadership

Tools for Mitigation Factor	Leadership			Leader (Avg)
	A	B	C	
Cross-Team Leadership	1	1	1	1
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

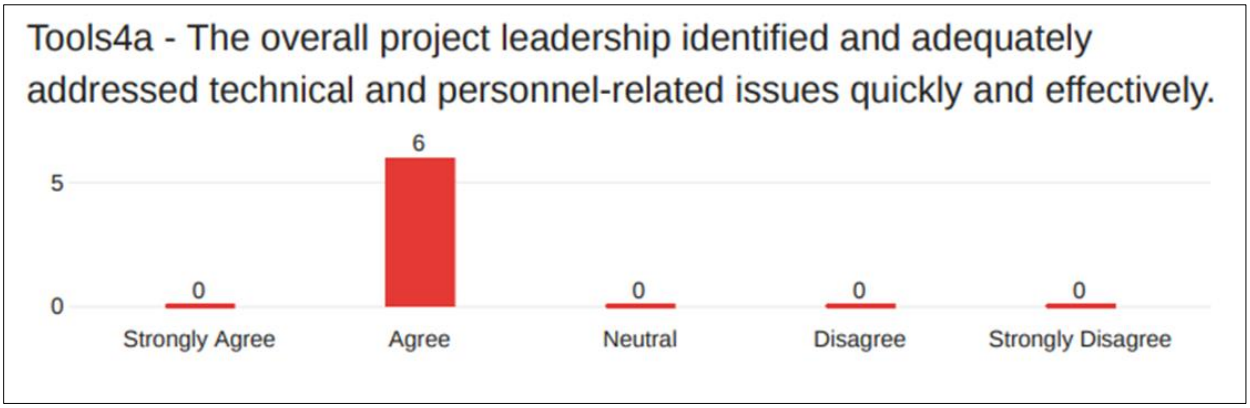


Figure 89: Team Survey Response Regarding Cross-Team Leadership

The leaders described various focal points and meetings conducted to support Cross-Team Leadership. These meetings included one-on-one meetings and team bonding

exercises. Respondent B summarized how much of Cross-Team Leadership was managed, “For technical matters, we have various focused calls like alerts review, Architecture review, project progress review, standups, etc. For personnel-related matters, the leader who is present locally along with the team does one-on-one meetings to attend to the needs and concerns.” Cross-Team Leadership is adaptive and responsive to the situations they encounter. The leadership team has shown strength through ever-adapting processes and regular meetings to discuss the project and personal alerts.

Process

The within-team processes seem to show no between-team conflict. The work performed within each team is similar in levels of completeness and testing. Teams and team members are taught the Software Development Life Cycle (SDLC). Table 62 - Leadership Response Regarding Process shows a positive factor impact. With very little to no Process Conflict identified by the leadership team and harmonized processes across the teams, one would conclude that this factor operates without substantial visibility. Figure 90 - Team Survey Response Regarding Process corroborates similar processes across teams with solid agreement to the team survey. One interesting aspect of this project was brought out by Respondent A, “The teams followed the same process. Automated testing scripts were shared and run by the different teams. Test results were recorded in Jira and validated independently before closing.” Not only do the teams follow the same process, but they share the automated testing scripts. This is a highly positive indication and reflects the team’s maturity.

Table 62: Leadership Response Regarding Process

Team Practices for Delivering Value Factor	Leadership			Leader (Avg)
	A	B	C	
Process	1	0	0	0.33
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

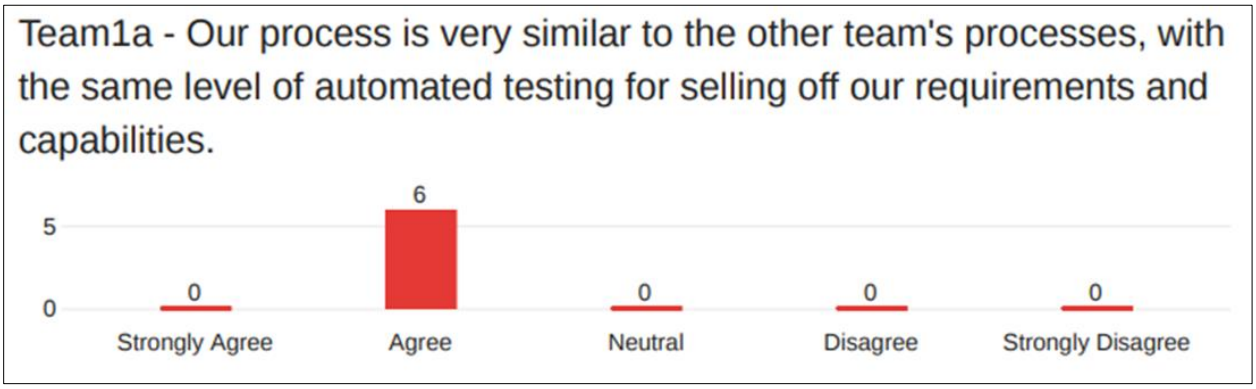


Figure 90: Team Survey Response Regarding Process

People

The People sub-factor describes the relationship on each team. Table 63 - Leadership Response Regarding People shows a positive impact on the project's success. The team confirmed the positive people factor impact on the project, as shown in Figure 91 - Team Survey Response Regarding People. The teams learned to adopt a Big Brother/Big Sister mentorship approach for new team members. They also interviewed internal candidates to ensure they would fit with their team.

Table 63: Leadership Response Regarding People

Team Practices for Delivering Value Factor	Leadership			Leader (Avg)
	A	B	C	
People	1	1	0	0.67
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

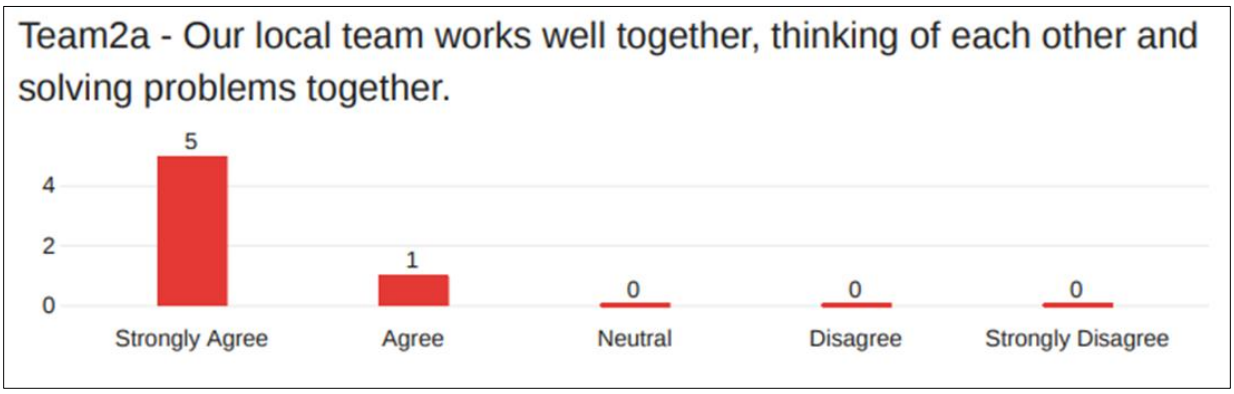


Figure 91: Team Survey Response Regarding People

The leadership team identified issues during COVID with the lack of human contact between team members. The relationship issues were raised by Respondent C, “During covid, the relationship was not there much except between the old-timers. Working from home has affected the personal relationship.” Building lasting relationships is difficult when starting remotely and being placed on a team. The difficulty seems to be exasperated by the lack of use of video, where possible, to help make a personal connection. The strong positive relationships driven by the “old-timers” seem to outweigh the COVID-related issues. The team members are now back to an in-person construct.

Organization

The Organization sub-factor describes how the organization supports the team. Table 64 - Leadership Response Regarding Organization shows a positive impact on the project. The team survey shown in Figure 92 - Team Survey Response Regarding Organization correlates this finding with mostly strong agreement. Organizational support has not been a leading factor in the success of the projects in this study. In this case, the organizational support seems strong with free online training, subscriptions to cloud resources, and

licenses for any needed software. The tools and training were identified as being provided from “day one.” Respondent A’s comments show organizational support’s strengths and limitations: “Most resource and training needs have been met. Online training/testing is made free for the team. Hardware needs are not always easily satisfied due to availability and ROI - such as testing on the latest iPhones or different versions of Android flagships.”

Table 64: Leadership Response Regarding Organization

Team Practices for Delivering Value Factor	Leadership			Leader (Avg)
	A	B	C	
Organization	0	1	0	0.33
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

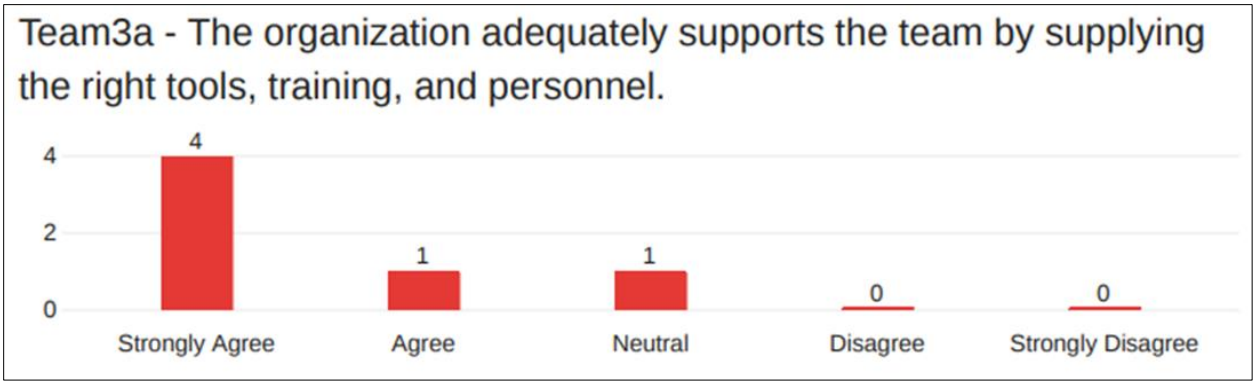


Figure 92: Team Survey Response Regarding Organization

Technical/Project

The Technical/Project factor includes the technical ability to execute the required work with the project or domain knowledge being the skill to understand the customer’s domain so that work performed meets the expectation of the unspecified requirements. Given that the teams have been together for six years, there are high expectations that the technical

and project knowledge are extremely high. Table 65 - Leadership Response Regarding Technical/Project shows only a moderate positive impact on the project's success. Respondent B explains, "We have gained tremendous domain knowledge by working with the customer for a longer period of time. Technical skills are not a challenge because we review and onboard any new member who is having adequate skillset. Other teams working on the project initially had a steep learning curve, but eventually, they caught up." Figure 93 - Team Survey Response Regarding Technical/Project shows that the team feels strongly that they adequately understand the customer's needs and have the technical skills to execute the project.

Table 65: Leadership Response Regarding Technical/Project

Team Practices for Delivering Value Factor	Leadership			Leader (Avg)
	A	B	C	
Technical/Project	0	1	0	0.33
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

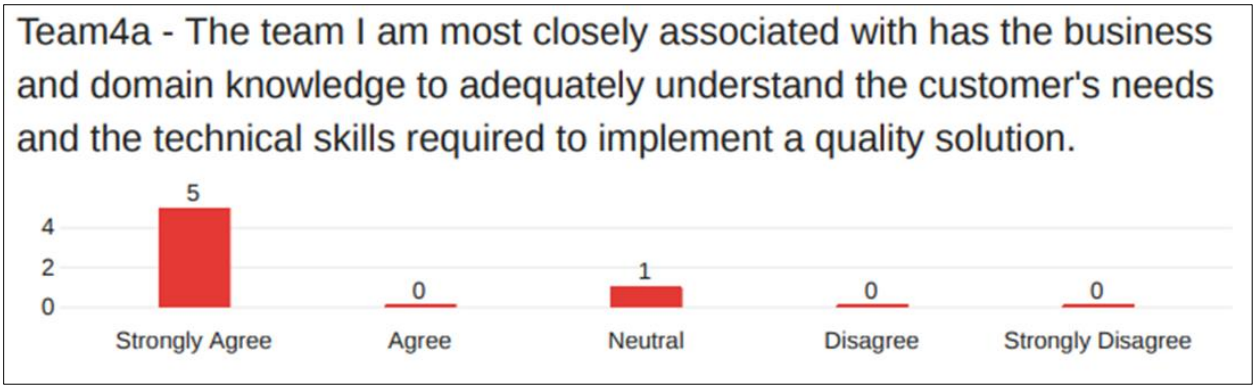


Figure 93: Team Survey Response Regarding Technical/Project

Team Leadership

Like Cross-Team Leadership, Team Leadership is about communicating with the team, understanding and resolving issues quickly, as well as communicating with other leaders across the complete team structure. Table 66 - Leadership Response Regarding Team Leadership only shows a mildly positive impact on the project. This should be compared and contrasted with Cross-Team Leadership. Figure 94 - Team Survey Response Regarding Team Leadership shows a strong impact. The strong impact on leadership shown in the team survey corresponds with scores for strong Cross-Team Leadership. Without additional data, it is difficult to determine why this factor and the Cross-Team Leadership do not have corresponding scores from leadership. Based on the qualitative responses from the individual leaders, the qualities and actions seem to match with the Cross-Team Leadership factor analysis. Respondent B supplied the most complete response, “I take part in the standup to know the issues first hand. I regularly interact with the leads to understand the team’s pulse and the issue. In addition, I also interact with the team members to have a good rapport and understanding. I roll the information to my top management on a weekly basis or sooner for critical matters, which in turn review and provide resolutions in a shorter turn around time.”

Table 66: Leadership Response Regarding Team Leadership

Team Practices for Delivering Value Factor	Leadership			Leader (Avg)
	A	B	C	
Team Leadership	0	1	0	0.33
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative				

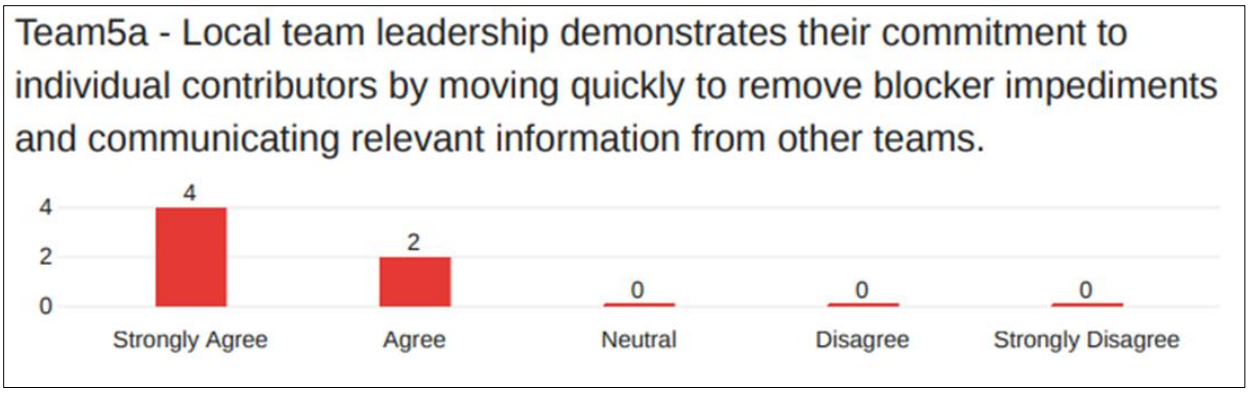


Figure 94: Team Survey Response Regarding Team Leadership

Within Case Summary

Summarizing Case V, the Degree of Dispersion and Cross-Team Leadership are the most substantial impacting factors as determined by the leadership team. Strong qualitative responses from the leaders and near-unanimous team survey data back the results. Surprisingly, Team Leadership, self-scored by leaders, is not identified with the same strength as Cross-Team Leadership. The Team Survey data seemingly contradicts the leaders' scores but corroborates the strength of the leaders.

With a long-running project, six years in this case, one would expect the process, people, organization, and technical/project factors to rate very high in strength. While they are all very strong, these are not the factors identified as making the most impact for this team.

Over the project period, the project adopted an agile process and used the retrospective process to improve the process for success. The teams learned to adopt a Big Brother/Big Sister mentorship approach for new team members. These significant changes to the operations flow of work had an additional positive impact.

Cross-Case Study Analysis

Cross-Case Study Reflections

The five projects compared in this study are, as close as possible, true replicants of each other. All five projects under study have multiple Agile Scrum teams. In all cases, the teams have a significant Degree of Dispersion where at least one of the teams is located nine-plus time zones away from the project leadership. For each project in the replicated case study, a team leader from each team and someone from the overall project leadership responded to the qualitative survey. Additionally, each project had the team respond to a confirmational team survey.

General Reflections

The Cross-Case analysis general reflections examine the five case studies to determine the common and unique factors impacting the various projects. The projects for Case Studies I and III were not successful, while the projects for Case Studies II, IV, and V could easily be considered successful. Case Study I is deemed not successful because the ongoing project is more than six months behind schedule, with clear signs that more project delays will arise. Case Study III is more clearly not successful since the project was canceled, preventing the case study from completing. As a reminder of the canceled project status regarding Case Study III, all tables including data for this case study are marked highlighted gray background to signify the incompleteness of the data.

Table 67 – Leader-Identified Dominant Factors by Case Study shows the most impactful factors by score identified by the team leadership. Strong leadership (individual and cross-team) is the overall strongest identified success factor across all successful and not successful projects. Whether Cross-Case Leadership or Team Leadership, this seems to

be a significant factor in the overall success of a project as identified by the leaders. Some aspects of the high leadership scores could be attributed to leaders evaluating themselves highly. Confirmational information in the team surveys aligns, for the most part, with the leadership response data.

All case studies identified the Degree of Dispersion as having a Strong Positive or Positive impact. While several teams used different strategies to account for the time zones, almost all teams tried to create a workday overlap spanning a significant number of hours. From the actions taken and high-level impact score, it is clear that the Degree of Dispersion and strategies to overcome it are key factors for success.

Table 67: Leader-Identified Dominant Factors by Case Study

Case I	Case II	Case III	Case IV	Case V
Task Conflict	People	Architectural Modularity	Cross-Team Leadership	Degree of Dispersion
Degree of Dispersion	Team Leadership	Degree of Dispersion	Team Leadership	Cross-Team Leadership
Cross-Team Leadership	Degree of Dispersion		Task Conflict	Architectural Modularity
People	Task Conflict		Affective Conflict	People
Architectural Modularity	Affective Conflict		Degree of Dispersion	Task Conflict
Media Richness	Architectural Modularity		Process	Media Richness
Organization	Technical Project		People	Affective Conflict
Team Leadership	Media Richness		Architectural Modularity	Process
Affective Conflict	Cross-Team Leadership		Media Richness	Organization
Technical Project	Process		Organization	Team Leadership
Process	Organization		Technical Project	Technical Project
Process Conflict	Process Conflict		Process Conflict	Process Conflict

Scale

Strong Pos	Positive	Neutral	Negative	Strong Neg
X > 0.7	X > 0.3	0.3 > X > -0.3	X < -0.3	X < -0.7

The following sections will break down the Cross-Case Analysis on a per-factor basis. The breakdown for each factor will identify common approaches in structure and action across cases. The analysis will additionally identify unique approaches to issues encountered with this factor.

Task Conflict

Task Conflict is the debating of how something should be designed or developed. The existence of Task Conflict is generally a positive attribute for most projects. The existence of Architectural Modularity can diminish or hide Task Conflict in many cases. Table 68 - Cross-Case Task Conflict Analysis depicts the thematic characteristics drawn from the leadership responses.

Table 68: Cross-Case Task Conflict Analysis

	Leadership Response				Team
Case	Positive	Negative	Mitigation Taken	Impact Score	Survey
I	Good Communications Regular Meetings Work Divided/Modular			1	4
II		Work Assigned Minimal Discussion Assigned by Experience		0.25	4.5
III	Regular Communications	Multiple Project Threads Team left to figure it out		N/A	N/A
IV	Regular Communication Scope Debate	Limited Debate Separation of Duties		0.67	3.3
V	Low task conflict Addressed Roadblocks High-Level task conflict			0.33	3.2
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

Regular communication is a clear theme across the cases. However, as shown in Case III, regular communication does not ensure positive Task Conflict. In this case, the team identified that multiple threads left teams to figure it out independently. It seems intentionality is also required in conjunction with regular communication to create Task Conflict. In Case Studies IV and V, the respondents described communication along some form of intentionality. In Case IV, they debated the scope, while in Case V, they discussed the tasks at a high level and allowed high Architectural Modularity to drive the

design to implementation. Some cases show a low Task Conflict due to the separation of duties or Architectural Modularity, as in Case V.

Across the Case Studies, Task Conflict seems to have only a small effect on the success or failure of a project. A high degree of Architectural Modularity seems to lessen the overall Task Conflict. The task debate and modularity are counterbalanced factors showing properties of being inversely proportional.

Process Conflict

Process Conflict occurs when teams that interact utilize processes that do not align. Process Conflict can have many causes and looks. Some common signs of Process Conflict are schedule misalignment, work completeness mismatch, and quality issues. Across the Case Study projects, Table 69 - Cross-Case Process Conflict Analysis, shows the positive and negative reported characteristics. When mitigations steps are taken, the table describes these steps. Elimination of Process Conflict is often achieved by either adapting the teams' processes or conducting training to bring the teams closer into alignment, as was accomplished with three of the five cases in the study.

Table 69: Cross-Case Process Conflict Analysis

	Leadership Response				Team
Case	Positive	Negative	Mitigation Taken	Impact Score	Survey
I		Process Differences No Backlog New to Agile	Training Process Adjustments	-0.5	3.5
II		Customer Process Issue Completion Status	Adapted Process	-0.5	3
III				N/A	N/A
IV	Linked Processes Dedicated Team	Process Delays People Not Available		0	3.3
V	Same Process for all Touchpoints Focus on Delivery		Adapted Process	0.33	3.5
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

The projects for Case Studies I, II, III, and IV showed how Process Conflict could impact the schedule, with each having an impact or delay. The project for Case Study I has the most considerable schedule impact exceeding six months. One way teams can mitigate the schedule delay impact of undefined system work is to have well-defined work ready to execute as a backlog. The project for Case I could not create the needed backlog. Work regularly came into the team not being well-defined, causing the work not to execute as desired. Training the product owners to define the work better helped minimize this issue, but the project delays were apparent when it was recognized.

The project for Case Study V is the best example of Process Conflict elimination. The team reported they used a waterfall process to start, having many issues during the delivery. During the execution of the project, the leadership team changed to an agile process, trained all teams on the process, and adapted the process based on the teams' feedback as the process matured. Since the team has been running the project for an

extended period, it has had time to adapt and see the positive results allowing it to recover from the schedule impacts.

Process Conflict in and of itself is not a cause of project success or failure. It is a symptom of an area to fix or a well-executed process. The lack of Process Conflict is a significant positive sign toward project success. The existence of Process Conflict is an obvious sign of project issues that generally lead to at least project delays, if not project failure.

Affective Conflict

Affective Conflict is the anxiety or hesitation in participation due to specific people being involved. Affective Conflict is the most destructive form of conflict that can impact a project. The hesitation or lack of trust caused by Affective Conflict can destroy morale, team cohesion, and Task Conflict if not addressed quickly and effectively. Affective Conflict can be pervasive in some situations. It appears in three of the five cases, as shown in Table 70 - Cross-Case Affective Conflict Analysis. The effects of Affective Conflict have been seen in Case Studies I, II, and III. Case Study I identified an individual as being domineering in meetings. The project leadership had to isolate the individual as he was considered to have critical knowledge for the project's success. The effects of the bad behavior lingered on this team for many months after the leadership's actions. Over time, the team seems to have gotten past the issues now that the individual does not interact with the broader team.

Table 70: Cross-Case Affective Conflict Analysis

	Leadership Response				Team
Case	Positive	Negative	Mitigation Taken	Impact Score	Survey
I	Leaders Isolated Contact	Isolated Conflicts	Minimized Contact	0	3.7
II	Full Trust	Lack of Communication Respect between Team Members	Resolved by talking	0.25	3
III		Aggressive Team Members Lack of Trust Minimized Interaction Missing Personal Relationships		N/A	N/A
IV	Close Relationships Bonded Team Shared Help Across Team Communication			0.7	3.7
V	Quick Resolution Candor Discussions Strong Rapport		Bonding Exercises	0.33	3.8
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

Case II shows Affective Conflict in a different form. Rather than one individual causing the issue, there is a lack of respect between individuals or teams. The cause of this situation is generally a lack of understanding of cultural norms or social structure amongst the team. As in Case II, a common resolution is to discuss the situation or gain a better cultural understanding of each other. Resolving this situation requires strong leadership in many cases where the leader has to be the forcing function to bring the conflict to light and work with the team members to drive it to resolution. Without continued leadership, weak attempts to fix the situation work for a short period and then relapse into old habits.

The form of Affective Conflict for Case III involves aggressive behavior. As Respondent A of Case III described, “Specific team members were aggressive and untrustworthy, so being minimal in interaction was the best path.” By ignoring the issue of aggression and lack of trust, the respondent describes the abdication of responsibility of leadership in this case.

Affective Conflict can have an impact to project success. More accurately, it can have an extremely negative effect on the project. Across the five case studies, three cases have negative impacts from Affective Conflict. Case Studies I and II made enough of an adjustment to isolate or eliminate the issue. Affective Conflict is not a root cause factor but rather a symptom of issues with other factors, usually social-emotional factors regarding people.

Architectural Modularity

Architectural Modularity is the ability to work independently from other teams as the design work progresses. Table 71 - Cross-Case Architectural Modularity Analysis shows the characteristics identified across the five cases. Across the five case studies, the leadership identified the work as generally highly modular. The team surveys for Case Studies IV and V disagree with the leadership assessment with scores in the 2-2.2 range. The team in Case Study IV may not see the modularity since they were divided into separate teams based on the modularity as articulated by Respondent B.

> Work was grouped among different categories called as ‘Extract’ based on Functionality/Features. It was divided into 4 extracts called Eligibility, Medical claims, Pharmacy claims and Provider Extracts. A set of teams was dedicated to implement each extract that includes different skilled resources who can help in requirement/design/development and testing.

Case V may have a similar view of modularity because some work flows through a chain of teams. The chain of teams causes changes in early systems to impact downstream teams.

Table 71: Cross-Case Architectural Modularity Analysis

	Leadership Response				Team
Case	Positive	Negative	Mitigation Taken	Impact Score	Survey
I	API-Driven Modularity Independent Operation			0.5	3.7
II	Intentional Work Separation			0.25	4
III	Highly modular work			N/A	N/A
IV	Continuous Integration Strong Modularity			0.3	2
V	Strong Modularity	Changes impact downstream teams		0.67	2.2
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

Architectural Modularity mitigates Task and Process Conflict. Demonstrated with Task Conflict in Case Study V, they identify minimal high-level task conflict while describing extremely high-level Architectural Modularity. In Case II, intentional work separation was used to help reduce the Process Conflict. Case IV had such strong Architectural Modularity that Respondent B described the Process Conflict as not existing.

Architectural Modularity impacts the project's success by reducing the Task and Process Conflict. Additionally, Architectural Modularity reduces the need for communication across teams which has been cited as a significant cause of project delay.

Degree of Dispersion

Degree of Dispersion is the separation of time and distance between the teams. All projects in the Mixed Methods Sequentially Replicated Case Study have a similar Degree of Dispersion of nine or greater time zones of separation. Most of the projects under study adjusted the working schedule in one way or another to generate more workday overlap.

As shown in Table 72 - Cross-Case Degree of Dispersion Analysis, Case III, the canceled case, was the only project not to adjust their schedule.

Table 72: Cross-Case Degree of Dispersion Analysis

	Leadership Response				Team
Case	Positive	Negative	Mitigation Taken	Impact Score	Survey
I	Only Team Lead crossed timezones	Turnover and burnout	Leader Adjusted Hours	0.75	3.4
II		Shifted Work Impact	Adjusted Work Schedules	0.25	4.5
III		Time Zones Challenges Elongated Workday No Workday Shift Limited Communications		N/A	N/A
IV	Shifted Workday Hours Blackout Times for Continuity	Working Hour Issues Language Barriers	Leads Shifted Hours	0.7	2.7
V	Shifted Workday	Shifted Workday	Adjust work hours on both sides	1	3.8
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

Each project seemed to take its approach to maximize the workday and communication overlap period. Case Study I adjusted just the leaders based in the US. As cited by the team, this leads to burnout and high turnover in these positions. Case Study II adjusted the distant team's working hours several times to find the right mix of workday overlap. Case Study IV worked through the uniqueness of their team to shift the workday for the remote teams and create blackout hours where the teams would not be disturbed. With this, the language barriers and shifted hours were still considered an issue for this project team. Case Study V is the only team to shift both the leadership's and remote team's workday. While this seems to be the most sustainable solution, it was also cited as having a negative impact on individual participants.

The Degree of Dispersion has a clear impact on a project's success. Whether shifting the workday of the local team, the remote team, or both, the impact on the team and people, in general, is clear. Looking into the root reason for shifting the workday may add insights into alternative solutions. The need to communicate, ask and answer questions regarding the design of the product or project seems to be the root reason for shifting the workday. Finding ways to improve communication and reduce communication could improve project execution and success.

Media Richness

One of the natural ways to improve the situation created by the Degree of Dispersion is the utilize the connectivity and tools available to the fullest extent possible, as well as find new tools that can make the world a smaller place. Table 73 - Cross-Case Media Richness Analysis shows the characteristics and actions taken by project teams in the replicated case study. Do people have a phobia regarding being on camera? Potentially, but that will have to be a topic for future research. Regardless all five project teams neglected to use the available video to improve the communication among the dispersed teams. Only Case Study IV had team members where cameras were not available for use due to the technology being deployed.

Table 73: Cross-Case Media Richness Analysis

	Leadership Response				Team
Case	Positive	Negative	Mitigation Taken	Impact Score	Survey
I	Plenty of Capabilities Media Windows	Video Not Used		0.5	2.8
II	Video used for team building	Video not used in Meetings		0	4.5
III		Limited Video Usage		N/A	N/A
IV	Set Standards for Interactions Daily Sync Calls Onsite Call Mostly Video Video Calls Helped Frequent Video Usage	Other Groups No Video Citrix Prevented Cameras		0.3	2.3
V	Whiteboarding Screensharing	No Video	Upgraded Tools	0	1
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

Case Study II specifically called out video usage to build teams during the COVID period impacting the project's success. The team score shows that the team valued the usage of video for team building. However, the team did not feel the need to use video for regular meetings or to maintain relationships with distant team members.

Case Study I used Zoom for meetings and calls. Even though Zoom supports whiteboarding, the team cited this as a drawback to being more effective. The team also was either unaware or did not use Zoom's IM feature outside of meetings. The organization could have rectified the lack of knowledge of the tools if it had been identified by leadership. Case Studies IV and V utilized the tools more fully. Case IV set standards for meetings and interactions, while Case V used the whiteboard and screen-sharing features extensively.

Media Richness can have a positive impact on a project's success. Media Richness was initially hypothesized to be able to mitigate the degree of dispersion. However, based on

the responses in the study, it is not as significant as initially hypothesized. The leadership must measure the team's shared mental model to determine if forcing more media usage can provide a desirable benefit.

Cross-Team Leadership

Cross-Team Leadership is the person or people who lead the work across the set of teams for the project. In the projects selected for study, the project or Cross-Team Leadership was chosen from multiple angles, the overall project leadership and the individual team leadership. The goal of selecting multiple people from various levels was to collect data from different perspectives to support the elimination of self-promotion bias (Yin, 2018).

The Cross-Team Leadership characteristics shown in Table 74 - Cross-Case Cross-Team Leadership Analysis demonstrate the quick identification and resolution of issues across the cases. The team score generally corresponds with the qualitative leadership response. Across the five cases, frequent communication, open discussion, and quick identification seem to be common characteristics of strong Cross-Team Leadership. An interesting difference emerges from Case Study IV and V when compared to Case Studies I, II, and III, which is ownership. The issues' ownership and resolution are demonstrated in Case Study IV and V. Case Study IV lays out an ownership path beginning with communication, identification, tracking, and reviewing all issues. Case V uses the example of Bonding Exercises and clear communication to demonstrate ownership of issues.

Table 74: Cross-Case Cross-Team Leadership Analysis

	Leadership Response				Team
Case	Positive	Negative	Mitigation Taken	Impact Score	Survey
I	Recognized Conflict Open Discussions		Minimized Contact	0.75	4
II	Conflict Resolution Issue identification	Technical Approach Issues Project Manager Issues	Replaced Leadership	0	4
III	Responsive Elevation No Affective Conflicts Raised Quality Issues	Team Members Stretched Across Multiple Teams Assignments Muddy Not Raised Lack of Ownership		N/A	N/A
IV	Leadership Action Tracking Clear Communication Project Issue Tracking Regular Review of Issues Regular Meetings Personnel-Related Issues			1	3
V	Frequent Contact Quick Resolution One-on-Ones		Bonding Exercises	1	3
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

There are a large number of characteristics that go into Cross-Team Leadership. To be effective, Cross-Team Leaders must communicate well, uncover issues, drive them to closure, and maintain a focus on the goals to complete the project successfully. Case Study IV reflected the most structured approach to leadership with numerous meetings, tracking lists, and related events. However, Case Study II and V seem to provide the best leadership from a team bonding perspective. Following the replacement of the project leader in Case II, the team bonded and formed an effective operation as identified by the team members and other leaders. Case V was the only Cross-Team Leader identified as conducting specific bonding exercises for the leadership. Some other team leaders conducted this type of exercise for their teams, but it was not identified by leaders for leaders.

Cross-Team Leadership seems to have a significant impact on the project's success. Where this leadership is lacking, issues can go unsolved, problems can arise to impact the project, Affective Conflict can grow due to personality differences, and the team's direction can falter.

Process

The Process factor of the Team Practices for Delivering Value consists of the documented methodology used by the team to achieve the goal. Table 75 - Cross-Case Process Analysis shows the characteristics that are identified as impacting each project's process. An expectation was to have several case studies self-identify as having an automated testing solution and a sophisticated DevSecOps solution. The exact opposite was found with almost no automated testing and no sophisticated DevSecOps solutions across the case studies. As is intended with Agile processes, each of the studies projects teams identified that they are or have adapted their process to better operate within their system. Case Studies I and II specifically called out that teams were operating different processes during the execution of their project. Harmonizing the processes across teams was one of the adaptations for these cases. The result lessened the Process Conflict and was stated as having a better outcome.

Table 75: Cross-Case Process Analysis

	Leadership Response				Team
Case	Positive	Negative	Mitigation Taken	Impact Score	Survey
I	Shared Integration Plan	Mainly Manual Testing Differences in Processes	Creating Automation	-0.25	3.3
II	Workflow Based	Different Processes	Adapted Process	-0.25	4.5
III		Communications Issues Process Conflict Process Issues		N/A	N/A
IV	Standardized Processes	No QA	Process Adjusted to Fit	0.7	2.7
V	Same Process Shared Testing		Adapted Process	0.33	3
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

Case Studies IV and V identified that they had standardized their processes across the teams. Case Study V was one of the few teams with some automated testing. This project shared the automated tests across the teams as part of their process adaptation.

The process used to execute a project does not seem to impact the project's success as long as the process does not create significant Process Conflict. Each of the five case studies adapted slightly different Agile processes to fit their business situation.

People

The People factor of Team Practices for Delivering Value includes a team's cultural, social, and emotional interactions and understanding. Table 76 - Cross-Case People Analysis describes the characteristics identified by the respondents as impacting the People factor. Across the five case studies, the teams have not identified a single method for bonding or forming a cohesive team. In Case I, one team bonded by working closely together while needing to understand the new product they were modifying, which could be identified as a shared mission or goal. The Case II team conducted virtual get-to-know-

you meetings via Microsoft Teams during the COVID remote work period. The team bonding exercises were among the few times the team communicated via video. The Case V team described a shared social background and culture across the team. The team identified remote workers as having issues bonding with the team until the remote COVID work period was complete. To help support these workers, the team created a new “big brother/big sister” system to support new developers on the team. The team survey results roughly support these conclusions.

Table 76: Cross-Case People Analysis

	Leadership Response				Team
Case	Positive	Negative	Mitigation Taken	Impact Score	Survey
I	Trust within Team Shared Goals Cooperation			0.75	4.4
II	Strong Chemistry		Video Bonding	0.75	4.5
III				N/A	N/A
IV	Great Synergy in Team Proactive Support Team Success Model Appreciation Trust within Team Good Comradery			0.7	3.7
V	Shared Social Background and culture	Remote-Only failed relationships	Big Brother Big Sister	0.67	3.8
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

The People factor of Team Practices for Delivering Value may be the single most crucial factor for success. People working as an effective team solve the issues encountered, as shown in Case Studies II and V. Case Studies IV and V are the longest-running teams in the replicated case study research and have built strong teams over time while developing mechanisms to strengthen the team project.

Organization

The Organization sub-factor describes how the organization supports the team. Organizational support includes people, software, equipment, network, training, facilities, and other organizational support items. Table 77 - Cross-Case Organization Analysis shows the characteristics identified in the leadership responses. Across the case studies, the teams mentioned that the organizational support was sufficient but also mentioned where improvements could have been made.

Table 77: Cross-Case Organization Analysis

	Leadership Response				Team
Case	Positive	Negative	Mitigation Taken	Impact Score	Survey
I		Limited Agile Training No Resources Available	Resource Issues Overcome	0.5	4.1
II	Supportive Organization	No Development Staffing Mentality Individual Isolation	Video Meetings	-0.25	5
III				N/A	N/A
IV	Resource Encouragement			0.3	3.3
V	Needs Met Free Online Training Empowered Leaders	Limited HW for Team	Upgraded Tools	0.33	3.5
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

Case Study I required all teams to execute an Agile process but did not provide Agile Process training or did not dictate the process to be utilized. The general sentiment from Case Study II was that the organization did just enough and no more. Case Study III indicated that the organization conducted the desired and needed training but forced the project to fund it, which did not meet the customer's expectations. Case Studies IV and V responded significantly more positively to the organizational support.

Organizational support can negatively impact the project's success when the needed support is not provided. However, as the case studies show, organizational support does not seem to drive a project to success once the threshold has been met for sufficient support.

Technical/Project

The Technical/Project factor includes the technical ability to execute the required work with the project or domain knowledge being the skill to understand the customer's domain so that work performed meets the expectation of the unspecified requirements. Table 78 - Cross-Case Technical/Project Analysis shows the characteristics of the response collected from the leadership of all case studies. In all cases across the replicated case study, the technical skills were more than adequate for the project. At the same time, the domain knowledge of the technical contributors was lacking at the project start. As the projects progressed, the technical contributors gained sufficient domain knowledge to achieve positive results, as reported in the responses. The project for Case Study I indicated that the lack of domain knowledge caused re-work, re-design, and increased the project scope, resulting in some project delays. However, because the team stayed together, over time, the teams gained the needed domain knowledge and were better equipped to implement the needed features.

Table 78: Cross-Case Technical/Project Analysis

	Leadership Response				Team
Case	Positive	Negative	Mitigation Taken	Impact Score	Survey
I	Highly skilled	Scope Creep Schedule Creep	Kept the same team	0	4
II	Strong Technically	Growing Domain Weak Domain		0.25	4.5
III	Technically Adequate Business Knowledge Acceptable			N/A	N/A
IV	Clear Requirements Strong Domain Knowledge Good Technical Knowledge			0.3	3.3
V	Strong Domain Knowledge Strong Technical Knowledge		Six years on the project	0.33	3.7
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

As with the organizational support factor, once the Technical/Project factor reaches a satisfactory or sufficient threshold, the project does not seem to benefit significantly from more Technical/Project ability or knowledge.

Team Leadership

The Team Leadership factor of Team Practices for Delivering Value differs from Cross-Team Leadership in that it refers to the local team. Like Cross-Team Leadership, Team Leadership is about communicating with the team, understanding and resolving issues quickly, as well as communicating with other leaders across the complete team structure. Table 79 - Cross-Case Team Leadership Analysis shows the characteristics identified through the Leadership Response. With positive characteristics for all case studies, one might wonder about self-reporting bias. The Team Survey scores seem to correspond with and validate the team leadership characteristics.

Table 79: Cross-Case Team Leadership Analysis

	Leadership Response				Team
Case	Positive	Negative	Mitigation Taken	Impact Score	Survey
I	Open Leadership Rapid Response			0.25	4
II	Quick Response Eliminating Conflicts Team Resolution			0.75	4
III				N/A	N/A
IV	Raised Issues Addressed Proactive Communication			1	3.3
V	Daily Standups Quick Resolution Strong Rapport Communication Up and Down			0.33	3.7
Impact Score: 1 = Positive, 0 = Neutral, -1 = Negative Team Survey Score: 1=Strongly Disagree to 5=Strongly Agree					

Through the Cross-Team Leadership responses, there is evidence that each leader did react quickly to issues raised. Specific issues raised to team leadership were not solved. For Case Study I, issues were raised regarding insufficient work coming into the team to fill the Agile Sprints. This condition is referred to as scrum team starvation. While the issue was raised, the team leadership did not adequately solve the issue, which caused delays in execution over several months. Case Studies II and V seem to have extremely active and strong team leaders. Their actions and changes to processes positively impacted their project's execution.

The Team Leadership factor of Team Practices for Delivering Value can impact the project's success. From the evidence indicated by the case studies, it is more likely that poor team leadership can make a project fail rather than strong team leadership driving success. The simple reason for this conjecture is that a team leader is one of many leaders impacting the overall project performance. One good strong leader may have a positive impact but will not likely drive the project to success. At the same time, a poor

team leader can significantly impact the entire project, causing schedule delays, significant quality issues, or not resolving issues regarding Affective Conflict. These potential issues can cause any project to fail from just one team of several.

Cross-Case Summary

Different factors have had a more significant role across each of the five projects in the replicated case study project. When negative conflict, such as process or affective conflict, exists on a project and is not addressed, the consequences are significant. The Cross-Team and Team Leadership must recognize and address these issues. Cross-Team Leadership skills are identified as strong in case studies where project success is suggested (Cases II, IV, and V). In Case Study I, the project had issues, and the Cross-Team Leadership recognized the issues. However, without fully resolving the issues, they could not keep the project on schedule.

Four of the five projects in the study have successfully dealt with the Degree of Dispersion. While the project teams dealt with the Degree of Dispersion in different ways, if it works sufficiently for that team, it should be considered a successful method of dealing with the issue. Only Case Study V adjusted the work schedule of both sides of the interface. Impacting the leaders and the team reduced the impact on a single group of people. Project run-time and retention of impacted individuals will clearly indicate if one method is more effective than others. Ultimately, it comes down to choosing the right people who what to work a shifted schedule or have a limited personal impact that best fits into the desired project structure.

Choosing the right people that adapt to the Degree of Dispersion is just part of what makes Case Studies II, IV, and V projects successful. The People factor of Team Practices for Delivering Value seems to be a key to project success. In these cases, the Team Survey data strongly agrees with the Leadership Response data confirming the people for a strong team. Case Studies II, IV, and V specifically call out steps they took to build teams. The People factor is not just the leaders taking some steps to arrange bonding exercises, as in Case Study II and IV. It is not just the Big Brother/Big Sister mentorship program created by Case Study V. Case Studies II, IV, and V are successful because the team members trust each other. With trust established, the team builds a shared mental model of teammates. Themes of trust are spread throughout the successful teams in these case studies with statements such as “great synergy in team,” “good comradery,” “trust within team,” “shared social background and culture,” “our local team is very friendly,” and “great team chemistry.” The strong teams of people with trust and an emotional bond help to drive the teamwork to successful conclusions.

Cross-Case Team Survey Analysis

The research conducted herein is a Mixed Method Sequentially Replicated Case Study conducted by executing three layers of research. Triangulation Layer One consists of choosing the appropriate leadership representatives to achieve a cross-section of the whole team. These leaders represented either the whole team or their individual team. Layer Two consists of the case study procedure itself. Layer Two includes the qualitative Leadership Response, the Leadership Interview, and the Leadership Impact Scoring. With Layer Two, an additional information source was collected, the Team Survey, which is used for confirmation of the qualitative responses provided by the leaders. Layer Three

is the five-times replicated. In this layer, the case study procedure is replicated across similarly structured projects, five in the case. As a confirmation of the data collected in layer two, a Team Survey was conducted of the development team members. The primary purpose of the Team Survey was to provide confirmational information for the within-case analysis.

The Team Survey was collected as Confirmational information rather than statistical information. In Chapter 3: Research Design and Methodology, the following was stated regarding the intent and goal of the Team Survey information.

> Due to the small population being surveyed, external validity is not a goal of the survey. Instead, the goal of the Team Survey instrument is to identify corroborating and contrasting trends between the leadership team and the software development team.

No statistical generalizations were planned as part of the research design and methodology. No statistical generalizations are being claimed using the Team Survey data. The current survey results would not be sufficient if statistical generalizations were being sought. Research concerning the number of samples for statistical relevance varies. In the article “Sample Size in Factor Analysis,” MacCallum cites several articles where the minimum sample size is between 100 and 250, with others going to 1000 samples (MacCallum, Widaman, Zhang, & Hong, 1999). Other articles have similar ranges for the required number of samples. Many articles suggest using the ratio of samples to factor (N/p) as a more accurate measure of the required samples. In these articles, the minimum ratio varies from 3-6, 5, or 10 (MacCallum et al., 1999) (de Winter*, Dodou*, & Wieringa, 2009).

The current model has 12 variables or factors (p). Table 80 - Sample Size for Case Studies shows the leadership and team survey sample counts. With only 22 Team Survey samples (N), calculating the ratio of 22 samples over 12 factors yield a ratio of 1.8. Therefore, the number of Team Survey samples across all cases is insufficient to perform an exploratory factor analysis using this data.

Table 80: Sample Size for Case Studies

	Case I	Case II	Case III	Case IV	Case V	Total
Team Survey	11	2	0	3	6	22

Hypotheses Testing

This section will use the conceptual model to identify and articulate the relevant high-level hypotheses. Each hypothesis will be discussed relative to the within and cross-case data collected. Figure 95 - Hypotheses Relative to Conceptual Model shows the conceptual model, hypothesis, and relevant areas of the model where the hypothesis covers. Building to project success to deliver value to the customer is easiest to understand if hypotheses are built from the bottom up, from H4 to H1. The following hypothesis analysis will begin with the lowest level hypothesis and build up to the customer value proposition.

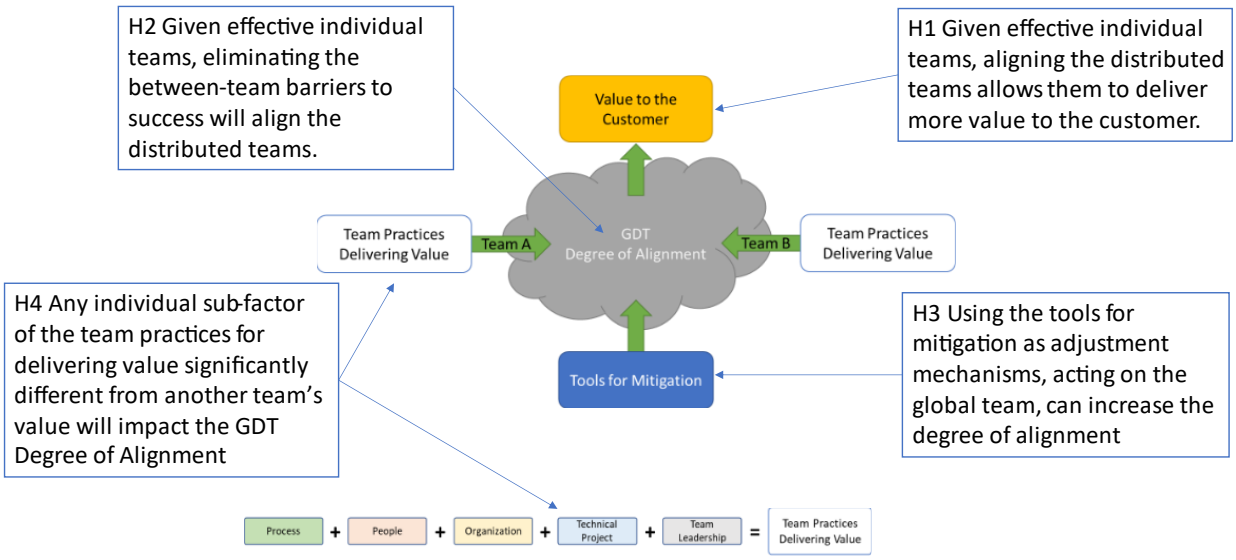


Figure 95: Hypotheses Relative to Conceptual Model

Hypothesis 4

H4: Any individual sub-factor of the team practices for delivering value significantly different from another team's value will impact the GDT Degree of Alignment.

The Mixed Methods Sequentially Replicated Case Study was executed as this report's research project. Across the five case study projects, there are several examples of individual factors of team practices for delivering value that run out of bounds and impact the Globally Distributed Team's Degree of Alignment. The projects in each of the five cases had process issues where Process Conflict was created. Four of the projects adapted their process to reduce the conflict. Case Studies I and V also included significant training and further process adaption to address the Process Conflict.

While most teams identified the People factor as a positive attribute, there are examples in Case Studies I, II, and III where people negatively impacted the execution of the project by creating Affective Conflict. Strong Cross-Team Leadership provided solutions in Case Studies I and II. Case Study V identified that during the COVID isolation period, the

remote team members who were new to the team could not create strong positive relationships resulting in Affective Conflict. The project team for Case Study V addressed this effectively by creating a mentorship program and bringing new team members together following the COVID isolation period.

Table 81 - Impact of Team Practices on Project (post mitigations) shows an assessment of each factor's impact on the project. Across the replicated case studies, the Technical/Project, Team Leadership, and Organization factors showed no direct negative signs of causing between-team barrier conflicts. The Technical/Project, Team Leadership, and Organization factors showed a neutral or positive impact on the project. At the same time, these factors are not out of bounds with regard to other teams. Conflicts from the People and Process factors caused verifiable impacts with the GDT's Degree of Alignment.

Table 80: Impact of Team Practices on Project (post mitigations)

	Case I	Case II	Case III	Case IV	Case V
Process	Positive	Positive	Negative	Positive	Positive
People	Positive	Positive	Negative	Positive	Positive
Organization	Neutral	Neutral	Neutral	Neutral	Neutral
Technical/Project	Neutral	Neutral	Neutral	Neutral	Neutral
Team Leadership	Positive	Positive	Negative	Positive	Positive
Overall Project Performance	Late	Success	Canceled	Success	Success

Conclusion: Individual sub-factors of the team practices for delivering value have been shown to impact the GDT Degree of Alignment. Once a sufficient level of Organizational support and the Technical/Project factor has been achieved, additional efforts do not

seem to provide equal gains in the GDT Degree of Alignment. For this reason, only a partial agreement has been achieved regarding the hypothesis.

- ✓ H4: (Partial Agreement) Any individual sub-factor of the team practices for delivering value significantly different from another team's value will impact the GDT Degree of Alignment.

Hypothesis 3

H3: Using the tools for mitigation as adjustment mechanisms, acting on the global team, can increase the degree of alignment.

The Tools for Mitigation include the Degree of Dispersion, Media Richness, Architectural Modularity, and Cross-Team Leadership. Media Richness is thought to be a critical factor in helping overcome the impact of time and distance (Daft & Lengel, 1986). Based on the evidence found across the five case studies in this replicated research, the impact of Media Richness is not a critical factor in increasing the degree of alignment. All five projects were identified using IM, chat, and email media. Some teams cited the use of video under limited circumstances. However, no team identified using more media or tools as having an impactful effect on the Degree of Dispersion. Media Richness is an essential factor, as shown by the usage of all five Case Studies. Once enough bandwidth and tool features are achieved, the incremental benefit does not appear to exist.

The Degree of Dispersion has been identified as highly impactful by the replicated case study participants. With 9.5 or greater hours apart from the project team to project team, some well-defined actions need to occur. Each case study project team accounted for the Degree of Dispersion, usually using different methods. Most projects adjusted the remote

work teams to create more workday overlap. One project shifted just the local team's workday. The final project team, Case Study V, shifted the local and remote teams' workday. Regardless of the method to create more workday overlap, the project team needs to exercise caution not to burn out the portion of the team creating the workday overlap. Burnout is the most significant drawback to the shifted workday for any individual. Creating workday overlap is critical between the customer-facing side of the project and the implementation team, so they have some time to communicate and work out issues.

Architectural Modularity impacts the hand-offs and interfaces between teams. All the projects in the case study identified a highly modular solution so that teams could work independently. As projects progress, many solutions get intertwined where the modularity is not maintained. The case studies consistently use highly modular architectures to maintain maximum independence.

Having the right leader in position is vital for successful Cross-Team Leadership. The leader must communicate up and down effectively, recognize issues quickly, and maintain open and transparent communications with the team. Case Studies II, IV, and V achieved results through effective team leadership.

Table 82 - Impact of Tools for Mitigation on Project (post mitigations) shows the assessed impact of factors relative to the degree of alignment on the global team. Degree of Dispersion and Cross-Team Leadership are the most impactful factors in the Tools for Mitigation, according to the responses in this replicated study. Architectural Modularity must begin with the project and must also be maintained throughout the project lifecycle.

Table 81: Impact of Tools for Mitigation on Project (post mitigations)

	Case I	Case II	Case III	Case IV	Case V
Media Richness	Neutral	Neutral	Negative	Positive	Neutral
Degree of Dispersion	Positive	Positive	Positive	Positive	Positive
Architectural Modularity	Positive	Positive	Positive	Positive	Positive
Cross-Team Leadership	Positive	Positive	Negative	Positive	Positive
Overall Project Performance	Late	Success	Canceled	Success	Success

Conclusion: The Degree of Dispersion, Cross-Team Leadership, and Architectural Modularity can increase the degree of alignment regarding global teams. Once a sufficient level of Media Richness has been achieved, additional efforts and features do not seem to provide equal gains in global team alignment. Due to Media Richness not being rated as an impacting factor, only partial agreement with the hypothesis.

✓ H3: (Partial Agreement) Using the tools for mitigation as adjustment mechanisms, acting on the global team, can increase the degree of alignment.

Hypothesis 2

H2: Given effective individual teams, eliminating the between-team barriers to success will align the distributed teams.

In order to evaluate the hypothesis, one first needs to identify where conflict has existed in the project, how it was mitigated, and the impact of the mitigation. From the within and cross-case analysis, it can be determined that five case studies contained some level or a significant level of Process Conflict when the teams initially started. Additionally, Case Studies I, II, and III were initially impacted by Affective Conflict.

Process Conflict cited by Case Study I was only partially addressed. The project identified process differences, no agile backlog, and team members being new to agile. Agile training was conducted to help the teams understand the agile framework. Process harmonization between the teams was completed to minimize the differences. While these steps helped the project operation, the Process Conflict was not entirely resolved. Case Study II identified Process Conflict mainly with the customer interfaces. The project team adapted the processes. Following these adjustments, the team no longer identified any Process Conflicts. Case Study III identified significant Process Conflict situations. However, mitigations could not be implemented before the project was canceled. Case Study IV identified Process Conflicts with delays due to people not being available. With this issue resolved, the team's dedicated team members and linked processes eliminated the Process Conflict issues. Case Study V identified significant Process Conflict issues early in the project's lifecycle. To eliminate the conflict, the team changed to an agile process. They adapted the process with feedback from the teams during execution. With all teams now running the same process, the project does not see Process Conflict.

The Affective Conflict cited by Case Study I was resolved quickly by the Cross-Team Leaders. The Cross-Team Leaders isolated the single individual identified as the source of the conflict. Based on the commentary and strong residual feelings several months later, the leaders waited too long to address the issue. With the issue resolved, the teams seemed to work well together toward the overall goal. Case Study II identified a lack of respect between the teams. This form of Affective Conflict is not as easily or quickly addressed in many cases. The Cross-Team Leader brought the teams together to talk out the issues. Addressing the issue seemed to resolve the issues as no residual

commentary was cited in responses, and no issues were identified with the Team Survey data. Case Study III identified team members as aggressive and lacking trust. Without appropriate mitigations, the project failed and was canceled.

Across the five case studies, Task Conflict was identified in appropriate proportions so that no issues were identified. Where Task Conflict was identified as low, Architectural Modularity was identified as High. No mitigations were identified regarding Task Conflict. Architectural changes to the projects were dealt with in scope to the technical aspects of the project.

Given the identified issues combined with the late schedule for Case Study I, no accurate conclusions can be drawn directly. Table 82 - Impact of Conflict Resolution on Project (post mitigations) shows the positive, neutral, or negative impact of the conflict mitigations on the project's success.

Table 82: Impact of Conflict Resolution on Project (post mitigations)

	Case I	Case II	Case III	Case IV	Case V
Process Conflict	Neutral	Positive	Negative	Positive	Positive
Affective Conflict	Positive	Positive	Negative	Positive	Positive
Task Conflict	Positive	Positive	Positive	Positive	Positive
Overall Project Performance	Late	Success	Canceled	Success	Success

Conclusion: Across the cases studied, removing the conflict from the between-team barriers positively impacts all projects that identified and implemented mitigations.

✓ H2: (Agreement) Given effective individual teams, eliminating the between-team barriers to success will align the distributed teams.

Hypothesis 1

H1: Given effective individual teams, aligning the distributed teams allows them to deliver more value to the customer.

Project success is defined for this study as the project delivering the desired functionality essentially on-time and within budget as reported by the Leadership Responses. Table 83 - Impact of Degree of Alignment on Project Success (post mitigations) shows the Degree of Alignment for each project. The values for the Degree of Alignment are derived from the cross-case conflict analysis. Across the case studies, Case Studies II, IV, and V are identified as successful. Case Studies IV and V have additional evidence of success, while Case Study II is listed based on self-reported information. Case Study I delivered more than six months late and is expected to see more delays in the integration and testing phases. Case Study I has several mitigations that reduced or eliminated the Process and Affective Conflict. However, by the time the impact of these changes was recognized on the project, significant schedule delays had been incurred. Case Study III was canceled before completion, so it is not listed as a success. Case Studies II, IV, and V did have to make some adaptions to eliminate Process and Affective Conflict, but as described, the adjustments or mitigations were much more minor than Case Study I's required changes.

Table 83: Impact of Degree of Alignment on Project Success (post mitigations)

	Case I	Case II	Case III	Case IV	Case V
Project Success	Negative	Positive	Negative	Positive	Positive
Degree of Alignment	Neutral	Positive	Negative	Positive	Positive
Overall Project Performance	Late	Success	Canceled	Success	Success

Conclusion: Given the correlation between the Degree of Alignment and Project Success for the three cases that succeeded, one can reasonably conclude that eliminating the conflict impeding the Degree of Alignment also impedes project success.

- ✓ H1: (Agreement) Given effective individual teams, aligning the distributed teams allows them to deliver more value to the customer.

Validity and Reliability

Chapter III discussed the proposed validity and reliability of the research project to be followed. This section will discuss how the research project was executed, including variations from the proposed project plan. Next, this section will describe how the project meets the expected construct, internal, and external validity requirements.

No variations or deviations from the proposed project plan should negatively impact validity and reliability. The research project plan called for conducting a three-phased process with a triangulated project leadership group. Phase I and Phase II were conducted as documented in the proposed plan. Phase I was to collect qualitative and survey data from the triangulated project leadership group. Between Phase I and II was a Thematic Analysis process. Phase II explored the answers provided through an interview process. The goal of Phase II was to gain a more complete understanding of the response and clarify any misconceptions from Phase I. These recorded sessions provided a second opportunity to execute the Thematic Analysis process. Phase III was intended to identify the most important factors impacting the project and was planned to be conducted as a group interview. When the Phase II interviews were being set up, the researcher received extensive feedback from the project team, the team's leadership, and

management regarding the time and interruption impact caused by the research. A new Phase III approach was created before executing the Phase II interviews. This new approach was created to minimize the touch time and the number of touches with the study subjects. The new approach modified Phase II, where for each factor, the respondent scored the factors as having the most positive, negative, or neutral impact on the project. The impact scores were translated into numerical values. An average impact score was created for each factor to be compared and contrasted against the other factors and the team survey.

Construct Validity

Construct Validity is the measure of quality showing how strongly the test predicts observed items of interest (Cronbach & Meehl, 1955). Construct Validity for this study, the case study contains multiple sources of evidence and maintains a chain of evidence (Yin, 2018). The research conducted herein is a Mixed Method Sequentially Replicated Case Study specifically designed to ensure Construct Validity. The research project ensures Construct Validity by executing multiple layers of multiple sources of evidence, all with a robust chain of evidence.

Layer One of the multiple sources of evidence is shown in Figure 96 - Triangulation of Sources Across Replicated Case Studies, with the green triangles showing the relationship of the leaders included in an individual case study. Evidence is collected from the overall project leader and each of at least two team leaders. The leadership data collection triangulates results from three project perspectives to ensure multiple sources and perspectives. Layer Two consists of the case study procedure itself. Layer Two includes the qualitative Leadership Response, the Leadership Interview, and the

Leadership Impact Scoring. With Layer Two, an additional information source was collected, the Team Survey, which is used for confirmation of the qualitative responses provided by the leaders. Layer Three follows the documented data collection procedure across five replicated case studies.

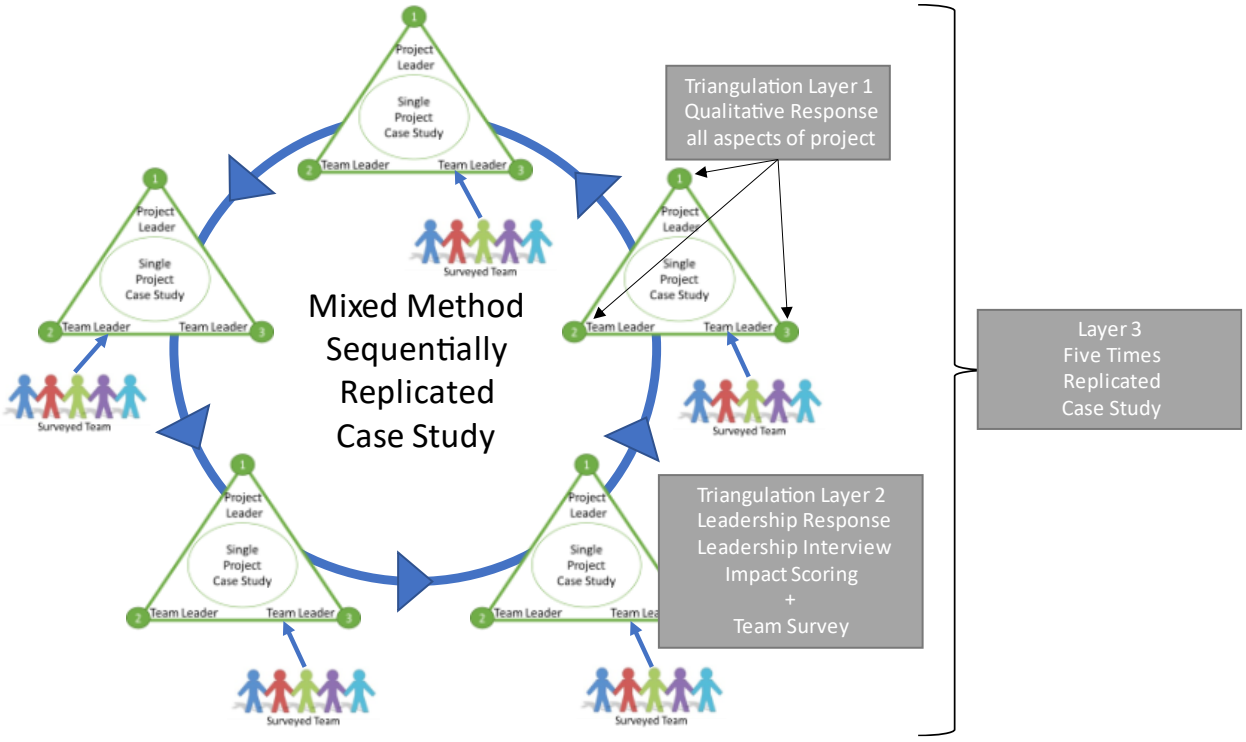


Figure 96: Triangulation of Sources Across Replicated Case Studies

Ensuring Construct Validity also requires a maintained chain of evidence. The replicated case study procedure was rigidly adhered to during the collection process. The procedural collection document is included as an appendix. The collected materials are encrypted at rest. All materials collected are available for review and inspection.

Construct Validity is created by following a documented procedure, collecting and storing the evidence of this procedure being followed, and collecting the study information from

multiple sources. With multiple sources and a rigid collection for a single source, the Construct Validity is enhanced by replicating the case study research over five cases.

Internal Validity

Internal Validity is used for explanatory case studies to show a causal relationship between conditions (Yin, 2018). Yin proposes four tactics for solidifying Internal Validity in the analytic phase of case studies, which include pattern matching, multiple exposures, rival explanations, and logical modeling (Yin, 2018).

We see the pattern matching explored in the cross-case analysis. In a factor-by-factor analysis, the within-case analysis is brought together to see where cases follow a pattern of direct or analogous actions. The same factor-by-factor analysis is conducted in the cross-case analysis, where patterns of similarity and difference between the cases are discerned.

Triangulation or Multiple exposures to the questions is achieved by executing the data collection procedure. In this procedure, the Leadership Response Survey is submitted to each team's project leader and individual team leaders. Phase II of the procedure is to interview the respondents. In the interview, the survey questions and responses are reviewed and scored. The Team Survey is the final step, where the same questions are asked of the team members to draw a comparison between leadership and team member.

Rival explanations are explored in the within and cross-case analyses. In analyzing the cross-case Process factor of the Team Practices for Delivering Value, a rival explanation was analyzed regarding automated testing and DevSecOps.

An expectation was to have several case studies self-identify as having an automated testing solution and a sophisticated DevSecOps solution. The exact opposite was found with almost no automated testing and no sophisticated DevSecOps solutions across the case studies.

The final tactic for solidifying Internal Validity is following a Logical Model. The conceptual model defined in Figure 11 of this document has held together through the literature review and refinement of factors. This conceptual model was the driving force for the research design, data collection, and analysis. The factor-by-factor breakdown and analysis for within and cross-case analysis provide a local model for conclusions.

External Validity

External Validity or Generalizability is restricted in case study based research. A case study is more analogous to an experiment than a sample in an experiment (Yin, 2018). Geldsetzer & Fawzi describe Quasi Experiments as an observational study with an explanatory variable that the research does not control (Geldsetzer & Fawzi, 2017). Yin describes case studies as quasi-experiments in experimental isolation, more so than randomized trials used in the medical industry (Yin, 2018). By executing a Mixed Method Sequentially Replicated Case Study with five replicants, the goal is to provide generalizability across the cases extending to all cases of a similar construct. Case study research is not intended to be statistically generalizable to a population. This Mixed Method Sequentially Replicated Case Study with five replicants intends to produce significant reliability such that it can be considered generalizable across the study and to theoretical propositions.

While each case study is viewed as a self-contained experiment, the replication across the set of cases provides analytic generalizability due to the similarity between the cases. All case studies follow a similar project structure, process, and degree of Dispersion.

Data Analysis Summary

The Data Analysis chapter presented the research conducted as a Mixed Method Sequentially Replicated Case Study project. The research methodology described in Research Design and Methodology chapter was followed, starting with a Pilot Study to refine the data collection process. Adaptations to the methodology were undertaken and documented. The documented process was followed to collect data through each of the five replicated case studies. Each case study was analyzed for within-case findings and compared and contrasted to the team member survey as a confirmational analysis tool. Following the execution of the five individual case studies and the corresponding analysis, a careful cross-case analysis was performed on the replicated case study dataset. Chapter V: Summary will explore the implications of the replicated case study results and provide recommendations for future research.

CHAPTER FIVE: SUMMARY

Introduction

The summary will provide conclusions drawn from the data analysis findings. The summary is expected to contain validated model(s) with failure signs, known causes, and corrective actions. Lessons learned through the execution of the research project will be discussed. The future work section will discuss possible theoretical research and practical applications that may be investigated as a result of this research.

Major Results and Conclusions

The Mixed Methods Sequentially Replicated Case Study research has been instrumental in developing findings and results. Table 85 – Hypothesis Conclusions and Results shows this study's summary-level set of results. Based on the study results, cases that follow the style and structure of cases within this study would be expected to find similar results.

Table 84: Hypothesis Conclusions and Results

	Results	Hypothesis
H1	Agreement	Given effective individual teams, aligning the distributed teams allows them to deliver more value to the customer.
H2	Agreement	Given effective individual teams, eliminating the between-team barriers to success will align the distributed teams
H3	Partial Agreement	Using the tools for mitigation as adjustment mechanisms, acting on the global team, can increase the degree of alignment
H4	Partial Agreement	Any individual sub-factor of the team practices for delivering value significantly different from another team's value will impact the GDT Degree of Alignment

Hypothesis One (H1) concludes that aligning the distributed teams allows them to deliver more value to the customer. The project delivered the specified value to the customer in

all three cases where mitigations resulted in the alignment of distributed teams. By contrast, in the cases where mitigations did not result in the alignment of distributed teams, the projects resulted in ongoing issues or complete failure, as in Case Study III.

Hypothesis Two (H2) concludes that eliminating the between-team barriers to success will align the distributed teams. Identifying, measuring, and eliminating process and affective conflict will make a project execute more smoothly, providing the team with a greater chance for success. Identifying Process Conflict is not always easy. It can seemingly hide in plain sight and be disguised as other issues, as was shown through the variations across the case studies.

Hypothesis Three (H3) concludes that using the tools for mitigation as adjustment mechanisms, acting on the global team, can increase the degree of alignment between teams. The partial agreement status was obtained due to Media Richness not showing the expected and scored impact. All other tools for mitigation showed the expected impact, with Cross-Team Leadership and the Degree of Dispersion having the most significant impact on projects.

Cross-Team Leadership shows up as the strongest impactor on projects. The authors, Shenhar and Holzmann, distilled managing complex projects into three key factors, “clear strategic vision, total alignment, and adapting to complexity” (A. Shenhar & Holzmann, 2017). While in agreement with Shenhar and Holzmann’s findings, there are subtleties that are not identified easily by these three factors. The Cross-Team Leader has to be able to see the issues, not just deal with them when brought to light.

As was found in Case Study IV, Architectural Modularity can lead to low Task Conflict. High Architectural Modularity begins to eliminate the need for implementation discussions

across the teams. While this is not an issue, individual and cross-team leaders must understand when Task Conflict is not present but should be present. In contrast, if Task Conflict is too high, the inverse relationship might indicate that the system architecture needs to be adjusted to be more modular.

The Degree of Dispersion is a well-known drawback to working on globally distributed teams (GDTs). Whether shifting the workday of one or all teams is key to mitigating this negative impact on GDTs. Media Richness has been sighted by numerous articles as a mitigation to the Degree of Dispersion (Daft & Lengel, 1986). The inverse relationship between the Degree of Dispersion and Media Richness has not been shown to be impactful to project success. Moving the team's workday so that there is some overlap of regular working hours shows, in the cases studied, to be significantly more impactful than Media Richness.

Hypothesis Four (H4) concludes that any individual sub-factor of the team practices for delivering value significantly different from another team's value will impact the GDT Degree of Alignment. The partial agreement status was obtained due to Organization and Technical/Project factors not showing the expected and scored impact. All other team practices for delivering value showed the expected impact, with people being the significant factor in the group.

People impacted each case study in positive and negative ways. Case Studies I, II, and III expressed issues due to Affective Conflict. Case Study V identified people issues due to COVID isolation. Case Studies I, II, and V overcame their people-related issues to improve the project. Case Study IV used bonding exercises to build a strong team. In these cases, the factor of people had a significant impact on the project.

As shown through this replicated case study, Process is not the answer. The cases in the replicated case study all had variations of some agile type of process. However, none of the cases used the same processes to manage their projects. The variations in processes studied are significant. The variations in the agile process demonstrate that the process itself did not significantly benefit the project's success. However, variations in between-team processes create Process Conflict. So as long as Process Conflict is not created within the project, the process does not seem to be a determining factor in success.

Implications of the Results

Research Question

In Chapter One, the challenge of why projects fail was expressed. This challenge developed into the following research question.

> What are the between-team barriers that impede the successful delivery of Agile software development in Globally Distributed Teams?

As shown in the replicated case study, the between-team barriers can be expressed in terms of Conflict (Task, Process, and Affective Conflict). These between-team barriers are eliminated or mitigated using the Tools for Mitigation and the Team Practices for Delivering Value. The research question asks, what are the between-team barriers? The answer is simple and complicated at the same time. The answer is that **People** are the barrier.

On a team, the People form the team. As teammates, People gain a shared mental model of each other. As teammates, People share their knowledge with teammates to help them grow. As teammates, People learn from their teammates and grow. People choose to

follow a process or not. People choose to adapt their processes to better fit with other teams. Therefore, People cause Process Conflict, requiring People to see and fix it. People acting poorly create Affective Conflict. Without a strong individual or Cross-Team leader, the Affective Conflict eats away at the relationships that make the team effective. The best recommendation to break down the between-team barriers is to find the right people to place in the right positions to eliminate the most Process and Affective Conflict while effectively executing the individual teams.

Theoretical Implications

The Theoretical Implications of this research show that Media Richness is not an influencing factor for project success as it was perceived coming into the research. While further focused research should be conducted on the impacts of Media Richness, the implication from this research is that the value of Media Richness plateaus. Once the plateau is reached, no additional value is achieved from increasing media usage.

Managerial Implications

Understanding what makes projects fail remains a burning question for managers running projects. Providing a better understanding through this research will help managers understand what properties to look for in existing and new projects. Using the conceptual model as a visual representation will give managers a pictorial mechanism to understand where issues are likely to arise. Finally, using the replication case study analysis will allow managers to draw conclusions compared to their projects.

Lessons Learned

Research Topic

The research for this project began in 2019, before the COVID pandemic. The serendipitous timing of the study, publications, and research have forced a high level of engagement. While this has been individually useful, it also has made the topic relevant to the industry. As the world seemingly gets smaller, research of this type becomes more significant for many to understand.

Literature Review

Researching topics using Forward Citation Expansion or Backward Citation Expansion can significantly broaden the research on a specific topic. These methods can be slow and require extensive reading and re-reading of each article. A Google Scholar search returns millions of articles, books, and citations. The Feedback Research Process described in Chapter Two: Literature Review was highly effective in finding relevant articles for this research project. The process was a natural extension of the manual search process. The next step will be to create a software version of the Feedback Research Process along with better tools for curating original articles.

Research Methodology

The Research Methodology was developed and focused on validity. While the methodology seems valid and robust, it is also complicated to execute and time-consuming for participants. The participant's time is a significant impact on collecting good research data. Without their time, the input would not have the desired value. Meeting with a study participant three times while they are pushing to meet deadlines and

objectives is ineffective. The adaptation made during Case Study I was necessary and prudent. In hindsight, the third interview should have been reworked and eliminated prior to the pilot and case study execution. While minor, the leadership survey (Likert questions) was redundant and not value-added. There are insufficient respondents to be statistically significant, especially with only one question per factor.

The replicated nature of the methodology made acquiring appropriate cases to study difficult. The projects were much more complicated to get onboard than expected. Multiple approval tracks had to be pursued in parallel. Track one is the company approval track, where the company is concerned with intellectual property and donating people's time to support the research effort. This track had to start with an initial contact and work up to an executive with approval authority. Track two is the project track, where the project leadership team has to commit to executing the study in parallel with their other objectives. Time is the paramount consideration for this track. In many efforts, the company approval was gained only to be refused by the project team or vice versa.

Future Research

Media Richness was expected to help shrink the world by bringing team members closer through email, chat, and video meetings. The promise of tools such as MS Teams, Slack, Zoom, and others has fallen short. Additional research into the reasons should be investigated as well as exploration of new areas which might be expressed as follows: Is there a reluctance to people being on camera? Is the video experience not accurate enough (not true to life)? Does Virtual Reality (VR) provide options to bring the world closer, helping to solve this problem? These questions and more need to be answered to understand why Media Richness's properties do not effectively close the social gap.

Future research that is a direct outcome of this work could be conducted to support managers of projects. Researched work products to help managers create globally distributed teams would significantly improve the Adhoc methodology used by most organizations today. Once a project is running, providing researched work products to evaluate the current status of teams and the between-team barriers would support the effective operation of projects.

Final Thoughts

The Mixed Methods Sequentially Replicated Case Study research was chosen as the form for this research to provide the needed validity for qualitative case study research. While acquiring the desired five replicated case projects was challenging, 4-6 case studies were needed to achieve case study external validity, as defined by Robert Yin (Yin, 2018). A conceptual model was developed through this research. While more research is needed, the model was validated, providing a reasonable starting point for future work.

APPENDIX A: PILOT STUDY NOTES AND COLLECTED DATA

Pilot Case Study Notes

Date	Notes	Action
3.20.22	Sent "Program Introduction Email" for Leadership	
	Feedback: Email was well understood by all Comments and questions arose when the survey did not appear with in a day or two of the program email	Consider timing the Program Introduction Email with the Qualtric begin survey email.
3.23.22	Held leadership team introduction meeting Described research by showing the conceptual model and hypotheses to the leadership team. This was done becuase the consists of very experience project leaders. The ask will not be directly to execute the process. Rather, the ask will be to analyze the questions for what they mean. This was a necessary step so that we could drive to consensus via the Delphi process.	Send the slides shown to the leadership team, per their request.
3.24.22	Email NOT Received While I recevied the email from qualtrics to my CTG account, none of the study participants received it. After checking the email addresses, I believe the CTG spam filter blocked the receipt of the email.	I will have to ensure all parties receive the email from Qualtrics
3.24.22	The planned Team Survey has to be postponded due to the email issue list above.	
3.25.22	Sent "Program Introduction Email" for Team Survey This was sent from within the network to ensure everyone received it.	
3.25.22	Sent Qualtrics Team Survey email expecting the team to not receieve the email due to firewall filtering rules	
3.25.22	Sent an internal email to all Team Survey participants to supply them the survey link in case they did not receive the original email. Planning a Zoom meeting to collect feedback form Team Survey participants.	checked with internal sources to see if everyone has the survey
3.25.22	Bill's Leadership response indiciated that GDT was not used in the description until Arch. Mod.	Need to Clarify all acronyms before usage. Double check.
3.25.22	Bill suggested making the questions mandatory so one cannot move on from Q1 to Q2 with some answer	Thought about this, decided against it. I can re-ask the question in the interview
3.25.22	John responded to the pilot by emailing me back rather than filling out the survey. He rewrote all of the questions	Some of the rewrites are worthwhile and will be used. In the interview, I will ask him why he didn't fill out the everything in qualtrics
3.28.22	Matt told me that he will fill out the survey today	Matt is always late with responses, not sure if he has too much to do, is disorganized, or procrastinates.
3.28.22	Scheduled Phase II interviews today	
3.28.22	Scheduled catch up meeting with Team Survey group	This meeting is to collect feedback on the survey from the Team Survey group.

Date	Notes	Action
3.28.22	The blocked qualtric email showed up in the email filter today	Planning to use annomymous link so that it can be shared from the inside and proxied from the team/program leadership to the individuals beign asked to participate.
3.30.22	One pilot participant clicked past the end of the response and couldn't get back.	Suggest putting a All Done, and Thank you at the end. this would allow any to back up to other questions.
3.30.22	All Leadership participants have now responded.	Getting ready for Phase II
3.30.22	Matt replied with a comment about the definitions.	Regarding the definitions I don't think they were strictly necessary. I believe the questions could stand on their own without the definitions but I will say that having the definition on a page seemed like additional context to guide or direct understanding of a question. So to me if someone reads the definition for page, then that definition will cause them to interpret the question through the lens of that definition thus giving your greater clarity in understanding the question.
4.1.22	Conducted Phase II Delphi Case Study Interviews with all three respondants	Found some good insights and issues with the process, need to move step 7 up, validate name before closing PowerPoint screenadd more clarity to "the team" - the respondant could not easily distinguish between global team and local team. Arch Mod - even small changes impact how a team has to react depending upon the timing of the changetask conflict - New narrowing question... Was task conflict a neutral effect on the project from a system level perspective2 of the 3 respondants suggested including the definitions in the interview phase.

Leadership Survey – Respondent A

Name	**John F**

	The **theme statements** are used only as guideposts to the discussion. They are not intended as conclusions or results of project status for a factor.
GDT Degree of Alignment – Task Conflict	
Regarding system-level features or capabilities, explain how work was divided amongst teams and who executed what portion of the design.	The meaning of this question seems pretty straight forward to me. No suggestions for improvement. Think you have nailed it.
Which of the following statements best describes the project condition at a system level?	
+	There were clear boundaries between teams with verification standards for each team.
=	There were clear boundaries between teams, but verification standards were not clear.
-	There were not clear boundaries articulated between teams
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
GDT Degree of Alignment – Process Conflict	
Explain how differences in processes between your and other teams impacted the integration, testing, and delivery of modules and the system.	Explain how the differences in the process your team followed as compared to the processes other teams followed impacted the integration, testing, delivery of modules, and the overall system delivery.
Which of the following statements best describes the project condition at a system level?	
+	The teams delivering into system integration delivered on similar schedules and had verification testing that demonstrated the interfaces were compatible with the design and requirements.
=	All of the teams followed a similar development schedule, but the automated testing and verification standards varied from team to team.
-	The development and verification processes were so different that no one was really sure how system integration would come together.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice

Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
GDT Degree of Alignment – Affective Conflict	
From a perspective of trusting, getting along, and being of similar thinking, please explain your interactions with counterparts on other teams.	From a perspective of trust, ability to get along with and being likeminded, please explain your interactions with counterparts on other teams.
Which of the following statements best describes the project condition at a system level?	
+	At the cross-team level, we share similar thinking and trust each other.
=	We had no issues with cross-team relationships, but we didn't anticipate each other's thinking and trusted each other somewhat.
-	We had some personality issues between teams
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Architectural Modularity	
From your perspective, describe how the architectural changes during the execution of the project impacted or affected the teams.	We run independently from other teams while being able to develop to our goals and mission. [JLF] We execute independently from other teams while developing to our desired goals and mission I like it - as is
Which of the following statements best describes the project condition at a system level?	
+	We operated very independently of other teams due to our well-defined interfaces.
=	We had to regularly check in or sync with other teams to ensure we were ok.
-	Our shared work approach was not separated architecturally between the teams.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice

Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Degree of Dispersion	
Describe the impacts and adjustments made to your team from having another team in a different time zone	Describe the impacts and adjustments made by your team from having another team separated by time or distance. [JLF] Describe the impacts and the adjustments made by your team from having other teams on the same project geographically disbursed
Which of the following statements best describes the project condition at a system level?	
+	We altered our start and end times for the day so that we could interact with another team.
=	We made adjustments to provide more time to work with another time.
-	We kept our schedule the same.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Media Richness	
With regard to the method (IM, Video, voice) and frequency, describe how your team communicates with other teams and identify the impact these actions had on your ability to communicate with another team?	In our communications with other teams, we mostly use video (camera on) for meetings, conversations, and clarification of issues. [JLF] In our communications with other teams we typically use video for our meetings, team collaboration and issue resolution Note: Suggest removing “camera on” on this one because you will likely have folks taking part in this survey that aren’t even aware you can have a video meeting w/o the camera on. With regard to the method (IM, Video, voice) and frequency, describe how your team communicates with other teams and identify the impact these on your team? [JLF] In regards to the meeting format (Instant Messaging, Video or Voice) and frequency thereof, describe how your team communicates with other teams and identify the impact these various meeting formats have on your team?
Which of the following statements best describes the project condition at a system level?	

+	We used mostly video (camera on) calls for communication between teams.
=	We mostly sent messages (email and IM) between teams but used video for meetings.
-	We communicated via email and IM.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Leadership	
Explain how the leadership identified and resolved technical and people-related issues.	The overall project leadership identified and addressed technical and people related issues effectively and quickly. [JLF] The overall project leadership identified and adequately addressed technical and personnel related issues quickly and effectively Explain how the leadership identified and resolved technical and people-related issues. [JLF] Explain how the project leadership identified and resolved technical and personnel related issues.
Which of the following statements best describes the project condition at a system level?	
+	The other team leaders reacted quickly to resolve issues, communicated thoroughly about the vision, and valued people as individuals.
=	We had regular meetings with other team leaders, but issues seemed to take a long time to resolve.
-	The other team leaders did not respond to issues we identified
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score, which might be driving your choice in variance with the team score.
Team Practices for Delivering Value - Process	
Explain the general process with a focus on testing and validation.	

Which of the following statements best describes the project condition at a system level?	
+	The team was able to deliver a tested system in a production-like environment every two weeks.
=	The teams were able to provide periodic deliveries that were mostly tested.
-	The teams seldom delivered to integration, where many portions were not tested prior.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value - People	
Describe the relationship you have with your teammates (positive and negative).	I'm not sure I fully understand this question? Seems difficult to quantify the team as a whole and how "they" collectively interact with other teams. To me – some of the team members I've been associated with communicate well across a broad spectrum of technical ability and personalities of other teams in which we interact – and I've also seen teams members that can't get along with anyone.
Which of the following statements best describes the project condition at a system level?	
+	The inter-team communication went very well, and all teams really seemed to work well together.
=	None of the teams raised issues with their internal team, and inter-team interactions were always acceptable.
-	There were people on a team that caused disruptions within the project to the point that action had to be taken.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value - Organization	

Describe how the organization has met your team's tools, people, and training needs.	The organization supports the team by supplying the right tools, training, and people for the project. [JLF] The organization adequately supports the team by supplying the right tools, training and personnel Describe how the organization has met (or not) your team's training, tools, and resource needs. [JLF[Describe how the organization has met (or not met) your team's training, tools, and resource needs.
Which of the following statements best describes the project condition at a system level?	
+	The organization went out of its way to ensure everyone was trained and everything needed was provided for our team.
=	The tools and people needed for our team were sufficient for our needs.
-	At times our team did not have the tools and/or people needed to get the job accomplished on time.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value – Technical/Project	
Relative to your project, describe the technical skills and business/domain knowledge of the team.	The team I am on has the business/domain knowledge to directly understand the customer's needs as well as the technical skills to implement the solution. [JLF] The team I am most closely associated with has the business and domain knowledge to adequately understand the customer's needs as well as the technical skills required to implement a quality solution. Relative to your project, compare and contrast the team's technical skills and business/domain knowledge to other teams on the project. [JLF] Relative to your project, compare and contrast the team's technical skills and domain knowledge to other teams on the project. Just looking to narrow the focus on this one
Which of the following statements best describes the project condition at a system level?	

+	Compared to the other teams, our team was much more prepared regarding domain knowledge and technical skills to execute the project.
=	Compared to the other teams, our team was on a level playing field regarding domain knowledge and technical skills.
-	Compared to the other teams, our team was lacking in domain knowledge or technical skills to a point where it was noticeable by the other teams.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value – Team Leadership	
Explain how you feel about your leadership, their response to issues, and how well informed you are with respect to program-related issues.	Local team leadership demonstrates their commitment to individual contributors by moving quickly to remove blocker impediments and communicating relevant information from other teams.
Which of the following statements best describes the project condition at a system level?	
+	The team leader reacted quickly to resolve issues, communicated thoroughly about the vision, and valued people as individuals.
=	The team leader communicated regularly, but issues seemed to take a long time to resolve.
-	The team leader did not respond to issues we identified
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.

Leadership Survey – Respondent B

Name	**Bill C**
	The **theme statements** are used only as guideposts to the discussion. They are not intended as conclusions or results of project status for a factor.
GDT Degree of Alignment – Task Conflict	
Regarding system-level features or capabilities, explain how work was divided amongst teams and who executed what portion of the design.	Most people are non-confrontational so I'm curious to see the responses that you get regarding healthy debate. What I get out of this is discussion of responding to a customer need and the go in's and out's; hopefully, external vendors are brought up if applicable and the roles and responsibilities are highlighted.
Which of the following statements best describes the project condition at a system level?	
+	There were clear boundaries between teams with verification standards for each team.
=	There were clear boundaries between teams, but verification standards were not clear.
-	There were not clear boundaries articulated between teams
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
GDT Degree of Alignment – Process Conflict	
Explain how differences in processes between your and other teams impacted the integration, testing, and delivery of modules and the system.	Hopefully the impediments are highlighted here whether resource constrained, knowledge constrained or communication misalignment. Compare and contrast. If there weren't any apparent differences, you'll just get box above selected and if no comments are made, value will be difficult to measure of this important question
Which of the following statements best describes the project condition at a system level?	
+	The teams delivering into system integration delivered on similar schedules and had verification testing that demonstrated the interfaces were compatible with the design and requirements.
=	All of the teams followed a similar development schedule, but the automated testing and verification standards varied from team to team.

-	The development and verification processes were so different that no one was really sure how system integration would come together.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
GDT Degree of Alignment – Affective Conflict	
From a perspective of trusting, getting along, and being of similar thinking, please explain your interactions with counterparts on other teams.	This will be interesting. I don't have to have a rapport with someone as long as objective outcome is aligned; relationships do help to galvanize execution but perceived slights by individuals can have people withdraw a bit; if someone responds to this as "I am friendly with everyone" that will not be valuable. Hopefully examples are provided of positive outcomes are contrasting thoughts that led to a delay or multiple interactions to ensure alignment.
Which of the following statements best describes the project condition at a system level?	
+	At the cross-team level, we share similar thinking and trust each other.
=	We had no issues with cross-team relationships, but we didn't anticipate each other's thinking and trusted each other somewhat.
-	We had some personality issues between teams
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Architectural Modularity	
From your perspective, describe how the architectural changes during the execution of the project impacted or affected the teams.	Hopefully they describe integration examples; this is the first time that the term GDT is introduced in the survey but since it will be post program overview then I guess it doesn't need to be explicitly mentioned earlier
Which of the following statements best describes the project condition at a system level?	

+	We operated very independently of other teams due to our well-defined interfaces.
=	We had to regularly check in or sync with other teams to ensure we were ok.
-	Our shared work approach was not separated architecturally between the teams.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Degree of Dispersion	
Describe the impacts and adjustments made to your team from having another team in a different time zone	The pandemic definitely disputes the 50m claim but on the other hand, my old company mentioned that after a couple of months, productivity declined; zoom or teams coordination examples will hopefully be provided; I purposely did not select a box to see if the survey could be completed with data not checked
Which of the following statements best describes the project condition at a system level?	
+	We altered our start and end times for the day so that we could interact with another team.
=	We made adjustments to provide more time to work with another time.
-	We kept our schedule the same.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Media Richness	
With regard to the method (IM, Video, voice) and frequency, describe how your team communicates with other teams and identify the impact these actions had on your ability to communicate with another team?	Curious to see what comments will be or do people even care if someone never turns their video on during a meeting; I definitely agree with Daft & Lengel
Which of the following statements best describes the project condition at a system level?	

+	We used mostly video (camera on) calls for communication between teams.
=	We mostly sent messages (email and IM) between teams but used video for meetings.
-	We communicated via email and IM.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Leadership	
Explain how the leadership identified and resolved technical and people-related issues.	Self-explanatory in my honest opinion
Which of the following statements best describes the project condition at a system level?	
+	The other team leaders reacted quickly to resolve issues, communicated thoroughly about the vision, and valued people as individuals.
=	We had regular meetings with other team leaders, but issues seemed to take a long time to resolve.
-	The other team leaders did not respond to issues we identified
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score, which might be driving your choice in variance with the team score.
Team Practices for Delivering Value - Process	
Explain the general process with a focus on testing and validation.	self-explanatory
Which of the following statements best describes the project condition at a system level?	
+	The team was able to deliver a tested system in a production-like environment every two weeks.
=	The teams were able to provide periodic deliveries that were mostly tested.

-	The teams seldom delivered to integration, where many portions were not tested prior.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value - People	
Describe the relationship you have with your teammates (positive and negative).	This is very similar to the othe question about rapport and interaction under "Affective Conflict Definition" question but I think this is to facilitate repeatability and consistency?
Which of the following statements best describes the project condition at a system level?	
+	The inter-team communication went very well, and all teams really seemed to work well together.
=	None of the teams raised issues with their internal team, and inter-team interactions were always acceptable.
-	There were people on a team that caused disruptions within the project to the point that action had to be taken.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value - Organization	
Describe how the organization has met your team's tools, people, and training needs.	self-explanatory
Which of the following statements best describes the project condition at a system level?	
+	The organization went out of its way to ensure everyone was trained and everything needed was provided for our team.
=	The tools and people needed for our team were sufficient for our needs.
-	At times our team did not have the tools and/or people needed to get the job accomplished on time.
Team Score	

Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value – Technical/Project	
Relative to your project, describe the technical skills and business/domain knowledge of the team.	Will highlight confrontation if there is ineptitude....hopefully
Which of the following statements best describes the project condition at a system level?	
+	Compared to the other teams, our team was much more prepared regarding domain knowledge and technical skills to execute the project.
=	Compared to the other teams, our team was on a level playing field regarding domain knowledge and technical skills.
-	Compared to the other teams, our team was lacking in domain knowledge or technical skills to a point where it was noticeable by the other teams.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value – Team Leadership	
Explain how you feel about your leadership, their response to issues, and how well informed you are with respect to program-related issues.	self-explanatory
Which of the following statements best describes the project condition at a system level?	
+	The team leader reacted quickly to resolve issues, communicated thoroughly about the vision, and valued people as individuals.
=	The team leader communicated regularly, but issues seemed to take a long time to resolve.
-	The team leader did not respond to issues we identified
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice

Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.

Leadership Survey - Respondent C

Name	**Matt C**
	The **theme statements** are used only as guideposts to the discussion. They are not intended as conclusions or results of project status for a factor.
GDT Degree of Alignment – Task Conflict	
Regarding system-level features or capabilities, explain how work was divided amongst teams and who executed what portion of the design.	"In working with other teams, we debated the pros and cons of ways to implement system-level features or capabilities": This question means did the development team member debate the pros and cons of feature implementation details with other teams aside from the direct scrum team they are assigned to prior to deciding on a design decision or implementing a feature. My gut reaction to this question was that it implies other teams outside the immediate scrum team a member is assigned to since it is asked as an agree or not statement. "Regarding system-level features or capabilities, explain how interfaces and implementation work was discussed, divided, and executed amongst the teams." This question means how was the work to be done discussed and broken up within whatever teams (external to the immediate development team) or sub-teams within a scrum team based on the components designed to be worked on. It does not imply when the discussions take place in the process nor that the teams should be external or within an existing team. It is about what (formal or informal) methodology and/or tools were used or not to facilitate such discussions and collaborative design and decision making process.
Which of the following statements best describes the project condition at a system level?	
+	There were clear boundaries between teams with verification standards for each team.
=	There were clear boundaries between teams, but verification standards were not clear.
-	There were not clear boundaries articulated between teams

Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
GDT Degree of Alignment – Process Conflict	
Explain how differences in processes between your and other teams impacted the integration, testing, and delivery of modules and the system.	"In working with other teams, the differences in our processes impacted the implementation, integration, and testing of the project resulting in project delays." This question means did the differences between our team's full software development lifecycle process and other teams' processes cause negative impacts to the wholistic system delivery in terms of meeting the delivery date, releasing defect free software which meets the customer requirements and producing sufficient and consistent code, testing and documentation quality. "Explain how differences in processes between your and other teams impacted the integration, testing, delivery of modules, and the overall system delivery." This question means how did the differences between our team's full software development lifecycle process and other teams' processes cause negative impacts to the wholistic system delivery in terms of meeting the delivery date, releasing defect free software which meets the customer requirements and producing sufficient and consistent code, testing and documentation quality.
Which of the following statements best describes the project condition at a system level?	
+	The teams delivering into system integration delivered on similar schedules and had verification testing that demonstrated the interfaces were compatible with the design and requirements.
=	All of the teams followed a similar development schedule, but the automated testing and verification standards varied from team to team.
-	The development and verification processes were so different that no one was really sure how system integration would come together.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice

Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
GDT Degree of Alignment – Affective Conflict	
From a perspective of trusting, getting along, and being of similar thinking, please explain your interactions with counterparts on other teams.	"When working with other teams, I avoided interactions with one or more team members due to a lack of rapport with them." This question means did the survey responder avoid communicating with, depending upon, interacting with or believing in the capabilities of any other teams' members to avoid conflict or having to deal with a personality which is emotionally challenging or mentally draining for the team member. "From a perspective of trusting, getting along, and being of similar thinking, please explain your interactions with counterparts on other teams." This question does not specifically scope the response to a negative or positive outcome, however given the negative setup of the preceding question, this question will likely elicit responses involving negative interactions as opposed to negative or positive. It is trying to expose conflicts present with individual team members. Without the preceding question on the same page of the survey it would just seek to understand how aligned members across teams are in terms of culture, collaboration, mission focus and personableness.
Which of the following statements best describes the project condition at a system level?	
+	At the cross-team level, we share similar thinking and trust each other.
=	We had no issues with cross-team relationships, but we didn't anticipate each other's thinking and trusted each other somewhat.
-	We had some personality issues between teams
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Architectural Modularity	

From your perspective, describe how the architectural changes during the execution of the project impacted or affected the teams.	"We run independently from other teams while being able to develop to our goals and mission." This question means are the projects this team is working on at any given time are sufficiently isolated in terms of either architectural modularity or time and teams working on it such that the scrum team is able to make needed changes without being blocked nor causing internal conflict with other teams and interrupting deliveries of other teams. "From your perspective, describe how the architectural changes during the execution of the project impacted or affected the independent operation of the teams." This question means have changes to an existing or developing architecture simplified or made project development more complicated and if so what have been the consequences good or bad of such changes?
Which of the following statements best describes the project condition at a system level?	
+	We operated very independently of other teams due to our well-defined interfaces.
=	We had to regularly check in or sync with other teams to ensure we were ok.
-	Our shared work approach was not separated architecturally between the teams.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Degree of Dispersion	
Describe the impacts and adjustments made to your team from having another team in a different time zone	"We have adapted our workday to better sync with another team's workday." This question means have we changed our working hours for any team members to support the time needs of another team in order to answer questions or assist them in development, integration and testing activities. "Describe the impacts and adjustments made by your team from having another team separated by time or distance." This question means detail what changes have needed to be made by team members in terms of time and other adjustments (tools, methodology, chain of reporting) and what was the driving factors of those changes.

Which of the following statements best describes the project condition at a system level?	
+	We altered our start and end times for the day so that we could interact with another team.
=	We made adjustments to provide more time to work with another time.
-	We kept our schedule the same.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Media Richness	
With regard to the method (IM, Video, voice) and frequency, describe how your team communicates with other teams and identify the impact these actions had on your ability to communicate with another team?	"In our communications with other teams, we mostly use video (camera on) for meetings, conversations, and clarification of issues." This question is very clear. It means do we use web cams displaying our faces for meeting with other teams in or out of the company, having discussions and resolving understanding in unclear issues. "With regard to the method (IM, Video, voice) and frequency, describe how your team communicates with other teams and identify the impact these on your team?" This question means please list the forms of media used to communicate with other teams (internal or external to the company of the team), how often they are used and implies whether the use of these media for each interaction positively or negatively impact the communication between teams.
Which of the following statements best describes the project condition at a system level?	
+	We used mostly video (camera on) calls for communication between teams.
=	We mostly sent messages (email and IM) between teams but used video for meetings.
-	We communicated via email and IM.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice

Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Leadership	
Explain how the leadership identified and resolved technical and people-related issues.	"The overall project leadership identified and addressed technical and people related issues effectively and quickly." This question means in the scope of the project at hand, regardless of how many teams were involved, did the project leadership identify and help resolve technical and human related issues in and sufficiently fast and effective manner. "Explain how the leadership identified and resolved technical and people-related issues." This question asks the survey respondent what methods were used to identify and address both technical and human related issues. The question indirectly exposes examples of technical and people issues by asking how the issues were attempted to be resolved which necessitates describing an issue to some degree.
Which of the following statements best describes the project condition at a system level?	
+	The other team leaders reacted quickly to resolve issues, communicated thoroughly about the vision, and valued people as individuals.
=	We had regular meetings with other team leaders, but issues seemed to take a long time to resolve.
-	The other team leaders did not respond to issues we identified
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score, which might be driving your choice in variance with the team score.
Team Practices for Delivering Value - Process	

Explain the general process with a focus on testing and validation.	"Our process is very similar to the other team's processes, with the same level of automated testing for selling off our requirements and capabilities." This question asks if the team the respondent is a member of follows a similar software development lifecycle process to that of other teams within the company in terms of automated testing requirements and acceptance criteria for features developed. "Compare and contrast your process with other teams, with a focus on testing and validation." This question asks the respondent to state the similarities and differences with that of other teams within the company specifically including but not limited to automated testing and acceptance procedures and requirements.
Which of the following statements best describes the project condition at a system level?	
+	The team was able to deliver a tested system in a production-like environment every two weeks.
=	The teams were able to provide periodic deliveries that were mostly tested.
-	The teams seldom delivered to integration, where many portions were not tested prior.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value - People	

Describe the relationship you have with your teammates (positive and negative).	"Our local team works well together, thinking of each other and solving problems together." This question asks does our entire team which is physically located in the same general location (this physical office) is able to get along with each other and successfully deliver projects together across multiple sub teams. It also means do team members keep other members and teams in mind when thinking about how changes may impact others. Do they exhibit empathy as a part of their design process and involve others in the process, considering the impacts to others' deliveries, deadlines and resulting technology base as opposed to only their own or their own team. "Describe the relationship status across the local team (positive and negative) and how they interact with other teams." This question implies how do team members get along and work together at this physical location regardless of scrum team or logical project team delineation or whether someone is working from home part time. It also asks how does the team at this physical location interact with teams at another location. My first instinct was to assume this meant only how do they interact with other development teams within the company at other locations however I think it could also include collaborative teams between the company and its partners/customers.
Which of the following statements best describes the project condition at a system level?	
+	The inter-team communication went very well, and all teams really seemed to work well together.
=	None of the teams raised issues with their internal team, and inter-team interactions were always acceptable.
-	There were people on a team that caused disruptions within the project to the point that action had to be taken.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value - Organization	

Describe how the organization has met your team's tools, people, and training needs.	"The organization supports the team by supplying the right tools, training, and people for the project." This question asks does the company provide sufficient tools (both software, hardware and otherwise), training (whether guided or simply opportunities) and people in terms of quantity and possessing the correct skills to achieve the stated goals and delivery commitments of a project. "Describe how the organization has met (or not) your team's training, tools, and resource needs." This question asks for specific examples of how the company has or hasn't provided sufficient tools, training, training opportunities and resources in terms of team members, time, knowledge, access to business process expertise, and other unspecified resources.
Which of the following statements best describes the project condition at a system level?	
+	The organization went out of its way to ensure everyone was trained and everything needed was provided for our team.
=	The tools and people needed for our team were sufficient for our needs.
-	At times our team did not have the tools and/or people needed to get the job accomplished on time.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value – Technical/Project	
Relative to your project, describe the technical skills and business/domain knowledge of the team.	"The team I am on has the business/domain knowledge to directly understand the customer's needs as well as the technical skills to implement the solution." This question asks the respondent if the scrum or project team they are on has sufficient business or domain knowledge to understand the customer needs without having to go to other teams for insight, answers, explanations or understanding. It also asks if the scrum or project team the respondent is a member of has team members with sufficient technical skills to implement the needed projects. "Relative to your project, compare and contrast the team's technical skills and business/domain knowledge to other teams on the project." This question elicits determining for the project the

	respondent is answering in context of if their team is the best team to work on the project in terms of business knowledge and technical skills, but asks to just describe the knowledge and skills on this team in the context of the given project versus that of other teams.
Which of the following statements best describes the project condition at a system level?	
+	Compared to the other teams, our team was much more prepared regarding domain knowledge and technical skills to execute the project.
=	Compared to the other teams, our team was on a level playing field regarding domain knowledge and technical skills.
-	Compared to the other teams, our team was lacking in domain knowledge or technical skills to a point where it was noticeable by the other teams.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value – Team Leadership	

Explain how you feel about your leadership, their response to issues, and how well informed you are with respect to program-related issues.	"Local team leadership moves quickly to remove impediments, communicate information from other teams, and value us as individuals" This question means how quickly does team leadership at the local physical / geographical location resolve issues, communicate critical and/or helpful information between teams and from the business. The last statement "and value as individuals" should state "and values us". "Explain and describe how the leadership of your team responded to issues and how well informed you are with respect to program-related matters." This question asks the respondent how in terms of quality the team leadership responded to issues. Meaning were they successful and effective in alleviating the issues for the respondent and their team. It also asks to what degree the respondent feels well informed regarding program-related topics.
Which of the following statements best describes the project condition at a system level?	
+	The team leader reacted quickly to resolve issues, communicated thoroughly about the vision, and valued people as individuals.
=	The team leader communicated regularly, but issues seemed to take a long time to resolve.
-	The team leader did not respond to issues we identified
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.

APPENDIX B: RESEARCH DATA COLLECTION DOCUMENT

Table of Contents

Explanation of Research

Consent to Participate

The HRP-254 Form Explanation of Research document will be included in the initial email for Phase I Leadership Response and the team survey. The essential points of the HRP-254 are included below. Consent will be renewed before recording and proceeding at the beginning of Phase II Leadership Interviews and Phase III Leadership Consensus.

Your participation is vital to the validity and success of this research. Thank you!

All information you share during this research will be anonymized, held private, and stored encrypted. Your personally identifiable information will not be beyond collection and storage. This information is only collected for accuracy in data collection.

Research at the University of Central Florida is carried out under the oversight of the Institutional Review Board. Questions or concerns about research participants' rights may be directed to the UCF IRB office:

- Phone: (407) 882-2276 or (407) 823-2901
- Mail: University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246.

If you have any questions, concerns, or complaints about this survey or if you wish to withdraw your participation after submission, please contact Ben Park (BenPark@knights.ucf.edu) or Dr. Timothy Kotnour (Timothy.Kotnour@ucf.edu).

You must be 18 years of age or older to take part in this research study.

IRB contact about your rights in this study or to report a complaint: If you have questions about your rights as a research participant or have concerns about the conduct of this study, please contact Institutional Review Board (IRB), University of Central Florida, Office of Research, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901, or email irb@ucf.edu.

By completing the leadership response or survey and returning it, you are granting consent to the collection and reporting of the data provided in accordance with the above conditions.

Research Process Overview

The research design will employ a mixed-methods sequentially replicated case study design to achieve validity. Each case in the case study will follow a three-phased approach to reach a consensus regarding the impact of a factor amongst the interviewed respondents. The three-phased consensus approach will be followed up with a survey of each software development team providing an additional source of validation. The three-phases consensus approach is analogous to the Delphi-based estimation process used commonly in software development (Gordon & Helmer, 1964). Figure 1 – Overall Collection Process depicts the flow of mixed-methods sequentially replicated cases with a high-level view of how each case will be executed. Sometimes in case studies, validity is difficult to demonstrate and is a frequent criticism of case

study research. To address concerns regarding the validity, the comprehensive study consists of multiple cases replicated using multiple sources of evidence and a well-maintained chain of evidence (Yin, 2018).

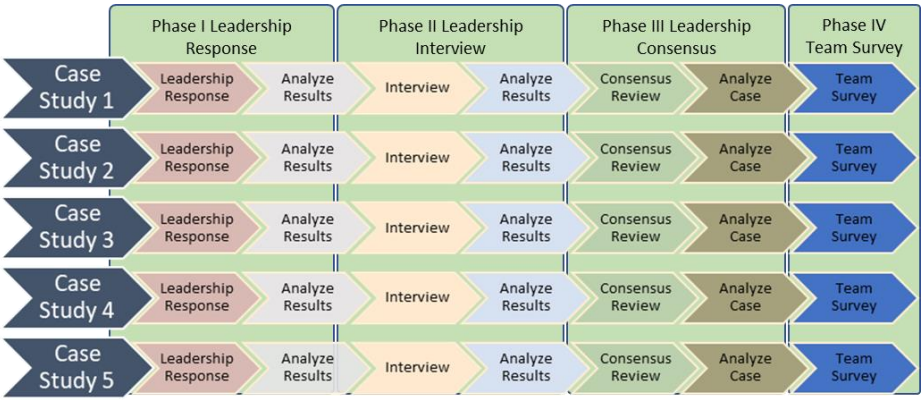


Figure 1 – Overall Collection Process

The overall case study approach will explore, in-depth, three to five historical cases of recently completed software development projects. Using the results of each case, the with-in-case findings will be determined. Analyzing all cases as a set will help determine the cross-case findings and cross-case generalizability compared to the conceptual model.

For each mixed-methods sequentially case in the study, a three-round approach will characterize the project. Round one begins with the leadership team consisting of product owners and scrum masters. They will complete a written explanation (qualitative responses) of program issues and mitigations during the project execution. For convenience, this written explanation also includes the team survey questions (Likert multiple-choice responses). The researcher will analyze each response for themes and interview the leadership team leaders with returned written explanations. Round two of the case study is a short interview. The brief interview intends to narrow the responses driving to consensus. Round three of the case study approach reconciles findings attempting to reach a consensus in a group meeting.

Leadership Case Study Process Overview

To put the bottom line up front, the research has four parts, as shown in Figure 2 below—a three-phase leadership process combined with a team survey. As part of the phase I leadership written response for convenience, we have included the survey (part IV). There is significantly more value to this research in the qualitative responses. Respondents will be encouraged to make every effort to answer each qualitative response as completely as possible.

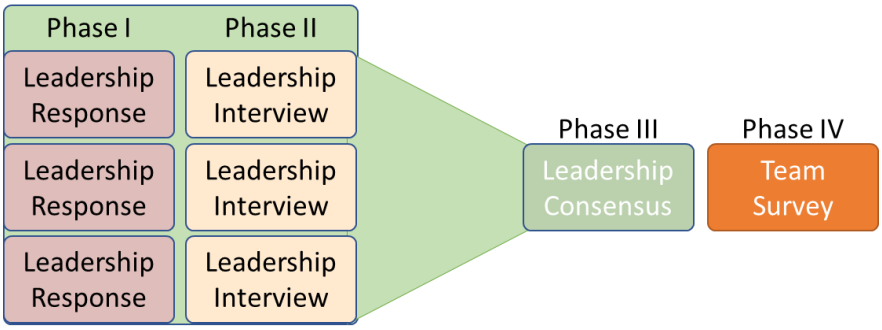


Figure 2 – Single Case Study Overview

The leadership response contains a series of questions to better understand the performance of distributed software development teams. Each question contains four parts: definition, survey question, survey answer choices, and a qualitative question. Each question begins with a definition to provide some guidance and context for the questions being asked. Parts two and three refer to the survey statement and Likert multiple-choice response. Respondents are to select the best response to the survey statement. The choices for all survey statements are shown below in Table 1 - Leadership Response Questionnaire. The final part is the qualitative response. As a person in a leadership role, this is an essential section of the question. The respondents will be encouraged to be as complete as possible in their responses. The follow-up interview will provide an additional opportunity to clarify responses.

Table 1 – Leadership Response Questionnaire

Definition:				
Survey Question:				
Answer Choices:				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Qualitative Question:				
Qualitative Answer:				

The Phase II Leadership Interview will be conducted via Zoom, recorded for transcription, and led by the researcher. The researcher will ask for verbal consent to record the interview. If consent is not provided recorded, the interviewee will not be able to participate in the study. The recording will only be maintained for the duration of the research. A transcript of the recording will be performed and stored in an encrypted file storage system.

The researcher will share the screen to verify the information collected by the interviewee. The leadership interview is round two of the case study process. The short interview intends to narrow the responses driving to consensus.

The Phase III Leadership Consensus will be conducted via Zoom, recorded for transcription, and led by the researcher. The researcher will share the screen to verify the information collected by the leadership team (you and the others responding to the leadership response). The

leadership consensus is round three of the case study process, the final round. The short meeting intends to gain consensus from the leadership team regarding the project's properties.

Survey Process Overview

The team survey contains a series of questions to better understand the performance of distributed software development teams. Each question contains three parts: definition, survey question, and survey answer choices. Each question begins with a definition to provide some guidance and context for the questions being asked. Parts two and three refer to the survey statement and Likert multiple-choice response. Respondents are to select the best response to the survey statement. The choices for all survey statements are shown below in Table 2 - Team Survey Questionnaire.

Table 2 – Team Survey Questionnaire

Definition:				
Survey Question:				
Answer Choices:				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

What are we studying?

Software projects fail to deliver, fall behind schedule, or never achieve their stated goal far too often for today's environment. How can we do better? Numerous external factors can cause project failure and are regularly studied. The focus of this research goes inside, as shown in the diagram below, to the set of teams that execute and how one can see, understand, and impact the success of these internal factors. The data being sought is Agile Software process, project process, and related data. There are questions regarding architectural modularity, but there is no desire to have technical data regarding the actual development.

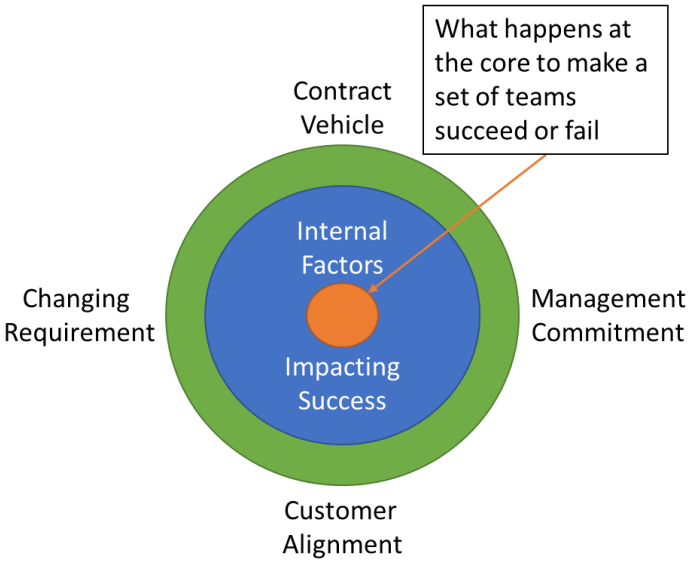


Figure 3 – Focus of Research

Leadership Case Study Execution

Overview of Case Study Execution

The Leadership Case Study will be executed using Qualtrics as a data collection tool. The steps outlined below provide the flow of execution for the study at a high level.

- Email to program leadership from Company Representative
- Email from program leadership to participants
- Email from Qualtrics (Ben Park) to begin Phase I of the Leadership Case Study
- Phase I Leadership Response executed by participants
- Audio Transcription and Theme generation by researcher
- Phase II Leadership Interview executed via Zoom for each leader
- Audio Transcription and Theme generation (if any) consolidation by the academic researcher
- Phase III Leadership Consensus executed via Zoom for the leadership team

Phase I Leadership Response Section

Leadership Response Overview

This section begins the leadership case study data collection and analysis process. In Phase I Leadership Response, the participants will be answering a qualitative response survey. This survey will be administered via Qualtrics. Qualitative responses will be scored, and themes generated as described previously. This phase begins with an email from Qualtrics to all participants in the leadership team.

Leadership Response Script

The following email will be generated directly from Qualtrics to each of the leadership participants. This will provide them with the link and necessary information to execute Phase I Leadership Response.

****** Qualtrics Email Template ******

Your company and program leadership have chosen you to participate in a Ph.D. research study. It is anticipated that the written response will take no more than 45 minutes to complete. You can save and come back, so there is no need to reserve a block of time.

Ben Park is conducting this study as part of doctoral research in the Department of Industrial Engineering and Management Systems at the University of Central Florida. The supervising faculty member for this research is Dr. Timothy Kotnour.

Follow this link to the Survey:

${l://SurveyLink?d=Take the Survey}

Or copy and paste the URL below into your internet browser:

${l://SurveyURL}

Thank you,
Ben Park
(sent from within Qualtrics)
****** End of Email Template ******

Qualtrics Leadership Response

Start of Block: Introduction

Your participation is vital to the validity and success of this research.

Thank you! All information you share during this research will be anonymized, held private, and stored encrypted. Your personally identifiable information will not be used beyond collection and storage. This information is only collected for accuracy in data collection.

Research at the University of Central Florida is carried out under the oversight of the Institutional Review Board.

Questions or concerns about research participants' rights may be directed to the UCF IRB office: Phone: (407) 882-2276 or (407) 823-2901 Mail: University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246.

If you have any questions, concerns, or complaints about this survey or if you wish to withdraw your participation after submission, please contact Ben Park (BenPark@knights.ucf.edu) or Dr. Timothy Kotnour (Timothy.Kotnour@ucf.edu). You must be 18 years of age or older to take part in this research study. IRB contact about your rights in this study or to report a complaint: If you have questions about your rights as a research participant, or have concerns about the conduct of this study, please contact Institutional Review Board (IRB), University of Central Florida, Office of Research, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901, or email irb@ucf.edu.

By completing the leadership response or survey and returning it, you are granting consent to the collection and reporting of the data provided in accordance with the above conditions.

○ I consent to this Research

End of Block: Introduction

Start of Block: Demographics Collection

Name

_____

Project Name

_____

Using the choices provided, which role most closely describes your latest position on the program/project?

- ○ Product Owner
- ○ Scrum Master
- ○ Team Member
- ○ Program Leader
- ○ Stakeholder

In what city was the core of the team you were most part of located

_____

From your perspective, the project was successful.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

From your perspective, your team delivered the desired value in a reasonable timeframe for the work needed.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

End of Block: Demographics Collection

Start of Block: GDT Degree of Alignment - Task Conflict

Task Conflict Definition: Refers to the alternatives to implementing a particular feature. Task conflict is essential as it shows the team members are safe to discuss alternatives to the current implementation or design. Task conflict also demonstrates that teams are relatively equal in their knowledge and ability to complete the work.

Section 1 of 12

In working with other teams, we debated the pros and cons of ways to implement system-level features or capabilities.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

Explain how interfaces and implementation work were discussed, divided, and executed amongst the teams regarding system-level features or capabilities.

_____

_____

_____

_____

_____

End of Block: GDT Degree of Alignment - Task Conflict

Start of Block: GDT Degree of Alignment - Process Conflict

Process Conflict Definition: Process Conflict focuses on each team's resources and members' roles and responsibilities. Process conflict demonstrates a lack of continuity regarding the development process, including completeness of testing. When process conflict exists, the outcome or completeness of work will often be significantly different between teams. This can cause defects, rework, issues with integration, and project delays.

Section 2 of 12

In working with other teams, the differences in our processes impacted the project's implementation, integration, and testing, resulting in project delays.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

Explain how the differences in the process your team followed compared to the processes other teams followed impacted the integration, testing, delivery of modules, and overall system delivery.

_____

_____

_____

_____

_____

End of Block: GDT Degree of Alignment - Process Conflict

Start of Block: GDT Degree of Alignment - Affective Conflict

Affective Conflict Definition: Affective Conflict is the anxiety or hostility along with the time and energy associated with emotional disagreements (Hinds & Bailey, 2003). Affective Conflict shows the personality issues between team members. Affective Conflict can stem from a wide

range of topics. Allowing this to exist can break down the overall team bonding, safety, and communication between the teams.

Section 3 of 12

When working with other teams, I avoided interactions with one or more team members due to a lack of rapport.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

From a perspective of trust, ability to get along with, and being like-minded, please explain your interactions with counterparts on other teams.

_____

_____

_____

_____

_____

End of Block: GDT Degree of Alignment - Affective Conflict

Start of Block: GDT Tools for Mitigation - Architectural Modularity

Architectural Modularity: Architectural Modularity promotes independence and parallelism without cross-coupling impacts. The computer science principles of tight cohesion and loose coupling applied at the system level provides modularity and reduces the number of interfaces

between Globally Distributed Teams (GDT). Architectural modularity reduces the required interactions between teams for technical reasons. This can change as design changes are required—the increased interaction when architectural modularity is low can cause significant interaction delay on a project.

Section 4 of 12

We execute independently from other teams while developing to our desired goals and mission.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

From your perspective, describe how the architectural changes during the execution of the project impacted or affected the independent operation of the teams.

_____

_____

_____

_____

_____

End of Block: GDT Tools for Mitigation - Architectural Modularity

---

Start of Block: GDT Tools for Mitigation - Degree of Dispersion

Degree of Dispersion Definition: Geographical dispersion of teams over time zones impacts the physical ability to communicate over time and distance (O'Leary & Cummings, 2007). Research shows that any distance of 50 meters diminishes interaction. Distances of different buildings, states, and time zones can increase the difficulty of getting to a shared mental model for smooth communication.

Section 5 of 12

We have adapted our workday to better sync with another team's workday.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

Describe the impacts and the adjustments made by your team from having other teams on the same project geographically disbursed.

_____

_____

_____

_____

_____

End of Block: GDT Tools for Mitigation - Degree of Dispersion

---

Start of Block: GDT Tools for Mitigation - Media Richness

Media Richness Definition: Richness differences in media include the medium's capacity for immediate feedback; chat is richer than email, video is richer than chat, and face-to-face reigns supreme (Daft & Lengel, 1986). The amount of data one can communicate over the media is vital to clear communication and conveying or interpreting emotion. The less you know someone you need to communicate with, the richer or more capable the media format required to achieve the same level of comprehension.

Section 6 of 12

In our communications with other teams, we mainly use video (camera on) for meetings, conversations, and clarification of issues.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

Regarding the meeting format (Instant Messaging, Video, or Voice) and frequency thereof, describe how your team communicates with other teams and identify these various meeting formats' impact on your team.

_____

_____

_____

_____

_____

End of Block: GDT Tools for Mitigation - Media Richness

Start of Block: GDT Tools for Mitigation - Cross-Team Leadership

Cross-Team Leadership Definition: Cross-Team Leadership identifies the level of leadership and distinguishes it from leadership as part of team practices. The leadership skills, traits, and variables are similar and inclusive of team practice leadership but focused on the cross-team or system level rather than the individual team. Good leadership is not about preventing the issue but handling it immediately, entirely, and transparently. The leader acts as the binding glue that works to recognize and eliminate conflicts and problems between the teams.

Section 7 of 12

The overall project leadership identified and adequately addressed technical and personnel-related issues quickly and effectively.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

Explain how the overall project leadership identified and resolved technical and personnel-related issues regarding the globally distributed team.

_____

_____

_____

_____

_____

End of Block: GDT Tools for Mitigation - Cross-Team Leadership

Start of Block: Team Practices for Delivering Value - Process

Process sub-factor Definition: The Process sub-factor relates to the processes and metrics that govern software development. The Process includes user story creation through feature sell-off in a production-like environment. The Process used, by name, is less important than its being consistent and compatible with all other teams in the system. Inconsistent processes by teams can cause issues between teams.

Section 8 of 12

Our process is very similar to the other team's processes, with the same level of automated testing for selling off our requirements and capabilities.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

Compare and contrast your process with other teams, focusing on testing and validation.

_____

_____

_____

_____

_____

End of Block: Team Practices for Delivering Value - Process

Start of Block: Team Practices for Delivering Value - People

People sub-factor Definition: The People sub-factor is the social and emotional aspects of the team, including items such as trust, customs, idioms, norms, etc. The most effective teams attain a shared mental model, allowing team members to know and anticipate team members' reactions.

Section 9 of 12

Our local team works well together, thinking of each other and solving problems together.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

Describe the relationship status across the local team (positive and negative) and how they interact with other teams.

_____

_____

_____

_____

_____

End of Block: Team Practices for Delivering Value - People

Start of Block: Team Practices for Delivering Value - Organization

Organization sub-factor Definition: The Organization sub-factor describes the support provided by the organization, including items such as network, office space, training, resources for the project, and management support. Organizational support is essential to provide the teams with the necessary support, training, and tools to accomplish the job.

Section 10 of 12

The organization adequately supports the team by supplying the right tools, training, and personnel.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

Describe how the organization has met (or not met) your team's training, tools, and resource needs.

_____

_____

_____

_____

_____

End of Block: Team Practices for Delivering Value - Organization

Start of Block: Team Practices for Delivering Value - Technical/Project

Technical/Project sub-factor Definition: The Technical/Project sub-factor is the technical ability to develop the software needed for the project at hand and the business domain knowledge regarding the project. The lack of knowledge of the business domain can cause adjustments to processes or may require additional support to be needed by other teams. The knowledge of what to build and the ability to complete the work is as key to the performance of each team.

Section 11 of 12

The team I am most closely associated with has the business and domain knowledge to adequately understand the customer's needs and the technical skills required to implement a quality solution.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

Relative to your project, compare and contrast the team's technical skills and domain knowledge to other teams on the project.

_____

_____

_____

_____

_____

End of Block: Team Practices for Delivering Value - Technical/Project

Start of Block: Team Practices for Delivering Value - Team Leadership

Team Leadership sub-factor Definition: Team Leadership is the strategic vision, communication skills, and emotional intelligence to know when issues arise. Good leadership is not about preventing the issue but handling it immediately, entirely, and transparently. The leader acts as the binding glue that works to recognize and eliminate conflicts and problems between the teams.

Section 12 of 12

Local team leadership demonstrates their commitment to individual contributors by moving quickly to remove blocker impediments and communicating relevant information from other teams.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

Explain and describe how the leadership of your local team responded to issues and how well informed you are concerning program-related matters.

_____

_____

_____

_____

_____

End of Block: Team Practices for Delivering Value - Team Leadership

Start of Block: Thank you

You are at the end of the data collection document.

Thank You!

Your participation was greatly appreciated. If you would like information regarding this research, please reach out to Ben Park (BenPark@knights.ucf.edu).

End of Block: Thank you

Phase II Leadership Interview Section

Leadership Interview Overview

This section is to be completed by the researcher

The Leadership Interview is a one-on-one conversation between the researcher and the leadership individual. The team leader has provided written responses to questions. The researcher has analyzed the responses to draw out themes using the thematic analysis process. The results are processed and logged in thematic analysis tables as shown in Table 3 – Thematic Analysis Response Table Template. The response text will be organized by the Factor and sub-factor(s) using thematic analysis. Responses that seem to not answer the question will be assigned to the appropriate question area. Responses that do not fit into any of the questions will be categorized as other.

The qualitative responses will also be categorized as positive, neutral, or negative to support the normalization process conducted during the leadership interview. The normalization scores are summed to combine the project scores of all interviewed team leaders. The positive response will have a value equal to 1, neutral = 0, and negative response = (-1). The combined score will guide the interview questions to work toward team consensus.

Table 3 – Thematic Analysis Response Table Template

1) Model Factor	2) Main Sub Factor	3) Minor Sub Factor	4) Qualitative Response
5)	6)	7)	8)

In Table 4 – Normalization Table, cells for the research to bring data in from the previous round and calculated data are highlighted in green. Cells, where new data will or can be generated from the interviewee are highlighted yellow.

Table 4 – Normalization Table

Factor	
Factor Definition	
Question	Response
Which of the following statements best describes the project condition at a system level?	
Positive +	Guiding statement
Neutral =	Guiding statement
Negative -	Guiding statement
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.

Before the interview, the researcher will perform the following tasks.

1. Score the response as positive, neutral, or negative
2. Create team scores for each response
3. Document the written response to each question in this section (green)
4. Record the team scores for each question in this section (green)

During the interview, the researcher will allow the interviewee to make choices from a fixed set of answers, then qualitatively explain why their score does not agree with the team score. The zoom meeting transcript will be utilized to capture the qualitative responses in this second round. Thematic analysis will be performed on any valid qualitative data received. The additional thematically collected data will be stored in similar tables and group with previous responses but identified as coming from the phase II interview.

Using the leadership responses, analysis of the responses must generate themes from each response. The normalization table, shown in table 4, demonstrates how response data will be collected, categorized, and normalized into a positive, neutral, or negative response to the question. This process will be repeated for each question.

Following normalization, the individual response scores will be combined with other leadership team members' scores to create a team combined score for each question. The team score and individual score will be used in the interview process to narrow the scope and better determine the impact of the factor on the overall project.

Leadership Interview Script

As part of the meeting invitation, the following will be included in the email for the Zoom virtual remote meeting.

***** Included Text for email *****

The Phase II Leadership Interview will be conducted via Zoom, recorded, and led by the researcher. The researcher will ask for verbal consent to record the interview. If consent is not provided, the interviewee will not be able to participate in the study. This should be discussed with the researcher. The recording will only be maintained for the duration of the research. A transcript of the recording will be performed and stored in an encrypted file storage system.

The researcher will share the screen to verify the information collected by the interviewee. The leadership interview is round two of the case study process. The short interview intends to narrow the responses driving to consensus.

***** End of text for email *****

1. Start Zoom meeting with the individual of the leadership team.
2. Start meeting with a Shared Full-screen image (PowerPoint title screen)
3. Recording consent:
   Researcher: "Before we begin, can I get your verbal consent to record our session for data collection purposes?"
   Interviewee: Wait for Consent
4. If consent is not provided, the researcher will confirm and terminate the interview.
5. Verify Individual's Name and Project Name before proceeding
6. End PowerPoint Title screen
7. Display project results for Phase II Leadership Interview
8. *Researcher: "*The information you provided in your response document is included in the green box. Which of the following statements best describes the project condition at a system level?"
9. *Interviewee:* Allow the interviewee to choose the best response from the three choices
10. *The researcher reads the agree or disagree choice based on the team score.*
11. *Interviewee:* Provide interviewee time to respond (captured by audio and transcribed by Zooms transcription feature).
12. This process repeats for each question until complete.
13. Wrap Up:
    a. *Researcher:* "Thank you for participating. Before we close, is there anything you would like to tell me about the project that you experienced and believe would be helpful?
    b. Interviewee provides response
14. Thank you for your time.
15. End Interview

Data Collection Phase II:

Name	
Project Name	
	The positive, neutral, and negative **theme statements** are used only as guideposts to the discussion. They are not intended as conclusions or results of project status for a factor.
GDT Degree of Alignment – Task Conflict	
Task Conflict Definition: Refers to the alternatives to implementing a particular feature. Task conflict is essential as it shows the team members are safe to discuss alternatives to the current implementation or design. Task conflict also demonstrates that teams are relatively equal in their knowledge and ability to complete the work. *Section 1 of 12*	
Regarding system-level features or capabilities, explain how work was divided amongst teams and who executed what portion of the design.	
Which of the following statements best describes the project condition at a system level?	
+	In working with other teams, we debated the pros and cons of ways to implement system-level features or capabilities.
=	In working with other teams, we did not debate ways to implement system-level features or capabilities.
-	In working with other teams, we were usually told how to implement our feature or capability.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.

GDT Degree of Alignment – Process Conflict	
Process Conflict Definition: Process Conflict focuses on each team's resources and members' roles and responsibilities. Process conflict demonstrates a lack of continuity regarding the development process, including completeness of testing. When process conflict exists, the outcome or completeness of work will often be significantly different between teams. This can cause defects, rework, issues with integration, and project delays. *Section 2 of 12*	
Explain how differences in processes between your and other teams impacted the integration, testing, and delivery of modules and the system.	
Which of the following statements best describes the project condition at a system level?	
+	The teams delivering into system integration delivered on similar schedules and had verification testing that demonstrated the interfaces were compatible with the design and requirements.
=	All of the teams followed a similar development schedule, but the automated testing and verification standards varied from team to team.
-	The development and verification processes were so different that no one was really sure how system integration would come together.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
GDT Degree of Alignment – Affective Conflict	
Affective Conflict Definition: Affective Conflict is the anxiety or hostility along with the time and energy associated with emotional disagreements (Hinds & Bailey, 2003). Affective	

Conflict shows the personality issues between team members. Affective Conflict can stem from a wide range of topics. Allowing this to exist can break down the overall team bonding, safety, and communication between the teams. *Section 3 of 12*	
From a perspective of trusting, getting along, and being of similar thinking, please explain your interactions with counterparts on other teams.	
Which of the following statements best describes the project condition at a system level?	
+	At the cross-team level, we share similar thinking and trust each other.
=	We had no issues with cross-team relationships, but we didn't anticipate each other's thinking and trusted each other somewhat.
-	We had some personality issues between teams
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Architectural Modularity	

Architectural Modularity: Architectural Modularity promotes independence and parallelism without cross-coupling impacts. The computer science principles of tight cohesion and loose coupling applied at the system level provides modularity and reduces the number of interfaces between Globally Distributed Teams (GDT). Architectural modularity reduces the required interactions between teams for technical reasons. This can change as design changes are required—the increased interaction when architectural modularity is low can cause significant interaction delay on a project. *Section 4 of 12*	
From your perspective, describe how the architectural changes during the execution of the project impacted or affected the teams.	
Which of the following statements best describes the project condition at a system level?	
+	We operated very independently of other teams due to our well-defined interfaces.
=	We had to regularly check-in or sync with other teams to ensure we were ok.
-	Our shared work approach was not separated architecturally between the teams.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Degree of Dispersion	
Degree of Dispersion Definition: Geographical dispersion of teams over time zones impacts the physical ability to communicate over time and distance (O'Leary & Cummings, 2007). Research shows that any distance of 50 meters diminishes interaction. Distances of different buildings, states, and time zones can increase the difficulty of getting to a shared mental model for smooth communication. *Section 5 of 12*	
Describe the impacts and adjustments made to your team from having another team in a different time zone	

Which of the following statements best describes the project condition at a system level?	
+	We altered our start and end times for the day so that we could interact with another team.
=	We made adjustments to provide more time to work with another time.
-	We kept our schedule the same.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Media Richness	
Media Richness Definition: Richness differences in media include the medium's capacity for immediate feedback; chat is richer than email, video is richer than chat, and face-to-face reigns supreme (Daft & Lengel, 1986). The amount of data one can communicate over the media is vital to clear communication and conveying or interpreting emotion. The less you know someone you need to communicate with, the richer or more capable the media format required to achieve the same level of comprehension. *Section 6 of 12*	
With regard to the method (IM, Video, voice) and frequency, describe how your team communicates with other teams and identify the impact these actions had on your ability to communicate with another team?	
Which of the following statements best describes the project condition at a system level?	
+	We used mostly video (camera on) calls for communication between teams.
=	We mostly sent messages (email and IM) between teams but used video for meetings.
-	We communicated via email and IM.

Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Leadership	
Cross-Team Leadership Definition: Cross-Team Leadership identifies the level of leadership and distinguishes it from leadership as part of team practices. The leadership skills, traits, and variables are similar and inclusive of team practice leadership but focused on the cross-team or system level rather than the individual team. Good leadership is not about preventing the issue but handling it immediately, entirely, and transparently. The leader acts as the binding glue that works to recognize and eliminate conflicts and problems between the teams. *Section 7 of 12*	
Explain how the leadership identified and resolved technical and people-related issues.	
Which of the following statements best describes the project condition at a system level?	
+	The other team leaders reacted quickly to resolve issues, communicated thoroughly about the vision, and valued people as individuals.
=	We had regular meetings with other team leaders, but issues seemed to take a long time to resolve.
-	The other team leaders did not respond to issues we identified
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score, which might be driving your choice in variance with the team score.
Team Practices for Delivering Value - Process	

Process sub-factor Definition: The Process sub-factor relates to the processes and metrics that govern software development. The Process includes user story creation through feature sell-off in a production-like environment. The Process used, by name, is less important than its being consistent and compatible with all other teams in the system. Inconsistent processes by teams can cause issues between teams. *Section 8 of 12*	
Explain the general process with a focus on testing and validation.	
Which of the following statements best describes the project condition at a system level?	
+	The team was able to deliver a tested system in a production-like environment every two weeks.
=	The teams were able to provide periodic deliveries that were mostly tested.
-	The teams seldom delivered to integration, where many portions were not tested prior.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value - People	
People sub-factor Definition: The People sub-factor is the social and emotional aspects of the team, including items such as trust, customs, idioms, norms, etc. The most effective teams attain a shared mental model, allowing team members to know and anticipate team members' reactions. *Section 9 of 12*	
Describe the relationship you have with your teammates (positive and negative).	
Which of the following statements best describes the project condition at a system level?	

+	The inter-team communication went very well, and all teams really seemed to work well together.
=	None of the teams raised issues with their internal team, and inter-team interactions were always acceptable.
-	There were people on a team that caused disruptions within the project to the point that action had to be taken.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value - Organization	
Organization sub-factor Definition: The Organization sub-factor describes the support provided by the organization, including items such as network, office space, training, resources for the project, and management support. Organizational support is essential to provide the teams with the necessary support, training, and tools to accomplish the job. *Section 10 of 12*	
Describe how the organization has met your team's tools, people, and training needs.	
Which of the following statements best describes the project condition at a system level?	
+	The organization went out of its way to ensure everyone was trained and everything needed was provided for our team.
=	The tools and people needed for our team were sufficient for our needs.
-	At times our team did not have the tools and/or people needed to get the job accomplished on time.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice

Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value – Technical/Project	
Technical/Project sub-factor Definition: The Technical/Project sub-factor is the technical ability to develop the software needed for the project at hand and the business domain knowledge regarding the project. The lack of knowledge of the business domain can cause adjustments to processes or may require additional support to be needed by other teams. The knowledge of what to build and the ability to complete the work is as key to the performance of each team. *Section 11 of 12*	
Relative to your project, describe the technical skills and business/domain knowledge of the team.	
Which of the following statements best describes the project condition at a system level?	
+	Compared to the other teams, our team was much more prepared regarding domain knowledge and technical skills to execute the project.
=	Compared to the other teams, our team was on a level playing field regarding domain knowledge and technical skills.
-	Compared to the other teams, our team was lacking in domain knowledge or technical skills to a point where it was noticeable by the other teams.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value – Team Leadership	

Team Leadership sub-factor Definition: Team Leadership is the strategic vision, communication skills, and emotional intelligence to know when issues arise. Good leadership is not about preventing the issue but handling it immediately, entirely, and transparently. The leader acts as the binding glue that works to recognize and eliminate conflicts and problems between the teams. *Section 12 of 12*	
Explain how you feel about your leadership, their response to issues, and how well informed you are with respect to program-related issues.	
Which of the following statements best describes the project condition at a system level?	
+	The team leader reacted quickly to resolve issues, communicated thoroughly about the vision, and valued people as individuals.
=	The team leader communicated regularly, but issues seemed to take a long time to resolve.
-	The team leader did not respond to issues we identified
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.

Phase III Leadership Consensus

Leadership Consensus Overview

This section is to be completed by the researcher

The Leadership Consensus is a group conversation between the researcher and the leadership team. The leadership team has provided written responses to questions, and interviews have been conducted and normalized to the responses. With written responses complete and individual interviews complete, round three is consensus for the case study methodology. In this round, the goal is to have all leaders together and gain consensus as to the factual status of

program execution. The consensus results in a positive, neutral, or negative response from the team of leaders. As with the previous phase, the normalized scores are summed. The positive response will have a value equal to 1, neutral = 0, and negative response = (-1). The combined theme score will guide the interview questions with the intent of working toward team consensus.

In Table 5 – Normalization Table, cells for the research to bring data in from the previous round, as well as calculated data, are highlighted in green. Cells, where new data will or can be generated from the interviewees are highlighted in yellow.

Table 5 – Normalization Table

Factor	
Factor Definition	
Question	
Which of the following statements best describes the project condition at a system level?	
Positive +	Guiding statement
Neutral =	Guiding statement
Negative -	Guiding statement
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.

Prior to the interview, the researcher will perform the following tasks.

1. Re-Score the response as positive, neutral, or negative
2. Create team scores for each response
3. Document the team scores for each question in this section (green)

During the team consensus interview, the researcher will provide the interviewees an opportunity to make choices from a fixed set of answers, then qualitatively provide an explanation.

Leadership Consensus Script

As part of the meeting invitation, the following will be included in the email for the Zoom virtual remote meeting.
***** Included Text for email *****

The Phase III Leadership Consensus will be conducted via Zoom, recorded, and led by the researcher. The researcher will ask for verbal consent to record the interview. If consent is not provided by any party, the interviewee will not be able to participate in the study. This should

be discussed with the researcher. The recording will only be maintained for the duration of the research. A transcript of the recording will be performed and stored in an encrypted file storage system.

The researcher will share the screen to verify the information collected by the interviewee. The leadership consensus is round three of the case study process. The short interview intends to achieve consensus amongst the team.

***** End of text for email *****

1. Start Zoom meeting with the leadership team.
2. Start meeting with a Shared Full-screen image (PowerPoint title screen)
3. Recording consent:
4. *Researcher:* "Before we begin, can I get your verbal consent from each of you to record our session for data collection purposes?"
5. *Interviewee:* Wait for Consent
6. If consent is not provided, the researcher will confirm and terminate the interview.
7. Verify Project Name before proceeding
8. End PowerPoint Title screen
9. Display project results for Phase II Leadership Interview
10. *Researcher: "*The information you provided in the interview process has been rated as positive, neutral, or negative. The score shown is the total of all scores combined. Which of the following statements best describes the project condition at a system level?"
11. *Interviewees:* Allow the interviewees to choose the best response from the three choices
12. *The researcher provides an opportunity for additional comments.*
13. *Interviewee:* Provide interviewees time to respond (captured by audio and transcribed by Zooms transcription feature).
14. This process repeats for each question until complete.
15. Wrap Up:
    a. *Researcher:* "Thank you for participating. Before we close, is there anything anyone would like to tell me about the project that you experienced and believe would be helpful?
    b. Interviewees provide response
16. Thank you for your time.
17. End Interview

Data Collection Phase III:

Project Name	
	The positive, neutral, and negative **theme statements** are used only as guideposts to the discussion. They are not intended as conclusions or results of project status for a factor.

GDT Degree of Alignment – Task Conflict	
Task Conflict Definition: Refers to the alternatives to implementing a particular feature. Task conflict is essential as it shows the team members are safe to discuss alternatives to the current implementation or design. Task conflict also demonstrates that teams are relatively equal in their knowledge and ability to complete the work. *Section 1 of 12*	
Regarding system-level features or capabilities, explain how work was divided amongst teams and who executed what portion of the design.	
Which of the following statements best describes the project condition at a system level?	
+	In working with other teams, we debated the pros and cons of ways to implement system-level features or capabilities.
=	In working with other teams, we did not debate ways to implement system-level features or capabilities.
-	In working with other teams, we were usually told how to implement our feature or capability.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
GDT Degree of Alignment – Process Conflict	
Process Conflict Definition: Process Conflict focuses on each team's resources and members' roles and responsibilities. Process conflict demonstrates a lack of continuity regarding the development process, including completeness of testing. When process conflict exists, the outcome or completeness of work will often be significantly different between teams. This can cause defects, rework, issues with integration, and project delays. *Section 2 of 12*	
Explain how differences in processes between your and other teams impacted the	

integration, testing, and delivery of modules and the system.	
Which of the following statements best describes the project condition at a system level?	
+	The teams delivering into system integration delivered on similar schedules and had verification testing that demonstrated the interfaces were compatible with the design and requirements.
=	All of the teams followed a similar development schedule, but the automated testing and verification standards varied from team to team.
-	The development and verification processes were so different that no one was really sure how system integration would come together.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
GDT Degree of Alignment – Affective Conflict	
Affective Conflict Definition: Affective Conflict is the anxiety or hostility along with the time and energy associated with emotional disagreements (Hinds & Bailey, 2003). Affective Conflict shows the personality issues between team members. Affective Conflict can stem from a wide range of topics. Allowing this to exist can break down the overall team bonding, safety, and communication between the teams. *Section 3 of 12*	
From a perspective of trusting, getting along, and being of similar thinking, please explain your interactions with counterparts on other teams.	

Which of the following statements best describes the project condition at a system level?	
+	At the cross-team level, we share similar thinking and trust each other.
=	We had no issues with cross-team relationships, but we didn't anticipate each other's thinking and trusted each other somewhat.
-	We had some personality issues between teams
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Architectural Modularity	
Architectural Modularity: Architectural Modularity promotes independence and parallelism without cross-coupling impacts. The computer science principles of tight cohesion and loose coupling applied at the system level provides modularity and reduces the number of interfaces between Globally Distributed Teams (GDT). Architectural modularity reduces the required interactions between teams for technical reasons. This can change as design changes are required—the increased interaction when architectural modularity is low can cause significant interaction delay on a project. *Section 4 of 12*	
From your perspective, describe how the architectural changes during the execution of the project impacted or affected the teams.	
Which of the following statements best describes the project condition at a system level?	
+	We operated very independently of other teams due to our well-defined interfaces.
=	We had to regularly check-in or sync with other teams to ensure we were ok.

-	Our shared work approach was not separated architecturally between the teams.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Degree of Dispersion	
Degree of Dispersion Definition: Geographical dispersion of teams over time zones impacts the physical ability to communicate over time and distance (O'Leary & Cummings, 2007). Research shows that any distance of 50 meters diminishes interaction. Distances of different buildings, states, and time zones can increase the difficulty of getting to a shared mental model for smooth communication. *Section 5 of 12*	
Describe the impacts and adjustments made to your team from having another team in a different time zone	
Which of the following statements best describes the project condition at a system level?	
+	We altered our start and end times for the day so that we could interact with another team.
=	We made adjustments to provide more time to work with another time.
-	We kept our schedule the same.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Media Richness	

Media Richness Definition: Richness differences in media include the medium's capacity for immediate feedback; chat is richer than email, video is richer than chat, and face-to-face reigns supreme (Daft & Lengel, 1986). The amount of data one can communicate over the media is vital to clear communication and conveying or interpreting emotion. The less you know someone you need to communicate with, the richer or more capable the media format required to achieve the same level of comprehension. *Section 6 of 12*	
With regard to the method (IM, Video, voice) and frequency, describe how your team communicates with other teams and identify the impact these actions had on your ability to communicate with another team?	
Which of the following statements best describes the project condition at a system level?	
+	We used mostly video (camera on) calls for communication between teams.
=	We mostly sent messages (email and IM) between teams but used video for meetings.
-	We communicated via email and IM.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Tools for Mitigation – Leadership	
Cross-Team Leadership Definition: Cross-Team Leadership identifies the level of leadership and distinguishes it from leadership as part of team practices. The leadership skills, traits, and variables are similar and inclusive of team practice leadership but focused on the cross-team or system level rather than the individual team. Good leadership is not about preventing the issue but handling it immediately, entirely, and transparently. The leader acts as the binding glue that works to recognize and eliminate conflicts and problems between the teams. *Section 7 of 12*	
Explain how the leadership identified and resolved technical and people-related issues.	

Which of the following statements best describes the project condition at a system level?	
+	The other team leaders reacted quickly to resolve issues, communicated thoroughly about the vision, and valued people as individuals.
=	We had regular meetings with other team leaders, but issues seemed to take a long time to resolve.
-	The other team leaders did not respond to issues we identified
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score, which might be driving your choice in variance with the team score.
Team Practices for Delivering Value - Process	
Process sub-factor Definition: The Process sub-factor relates to the processes and metrics that govern software development. The Process includes user story creation through feature sell-off in a production-like environment. The Process used, by name, is less important than its being consistent and compatible with all other teams in the system. Inconsistent processes by teams can cause issues between teams. *Section 8 of 12*	
Explain the general process with a focus on testing and validation.	
Which of the following statements best describes the project condition at a system level?	
+	The team was able to deliver a tested system in a production-like environment every two weeks.
=	The teams were able to provide periodic deliveries that were mostly tested.
-	The teams seldom delivered to integration, where many portions were not tested prior.

Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value - People	
People sub-factor Definition: The People sub-factor is the social and emotional aspects of the team, including items such as trust, customs, idioms, norms, etc. The most effective teams attain a shared mental model, allowing team members to know and anticipate team members' reactions. *Section 9 of 12*	
Describe the relationship you have with your teammates (positive and negative).	
Which of the following statements best describes the project condition at a system level?	
+	The inter-team communication went very well, and all teams really seemed to work well together.
=	None of the teams raised issues with their internal team, and inter-team interactions were always acceptable.
-	There were people on a team that caused disruptions within the project to the point that action had to be taken.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value - Organization	
Organization sub-factor Definition: The Organization sub-factor describes the support provided by the organization, including items such as network, office space, training,	

resources for the project, and management support. Organizational support is essential to provide the teams with the necessary support, training, and tools to accomplish the job. *Section 10 of 12*	
Describe how the organization has met your team's tools, people, and training needs.	
Which of the following statements best describes the project condition at a system level?	
+	The organization went out of its way to ensure everyone was trained and everything needed was provided for our team.
=	The tools and people needed for our team were sufficient for our needs.
-	At times our team did not have the tools and/or people needed to get the job accomplished on time.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value – Technical/Project	
Technical/Project sub-factor Definition: The Technical/Project sub-factor is the technical ability to develop the software needed for the project at hand and the business domain knowledge regarding the project. The lack of knowledge of the business domain can cause adjustments to processes or may require additional support to be needed by other teams. The knowledge of what to build and the ability to complete the work is as key to the performance of each team. *Section 11 of 12*	
Relative to your project, describe the technical skills and business/domain knowledge of the team.	
Which of the following statements best describes the project condition at a system level?	

+	Compared to the other teams, our team was much more prepared regarding domain knowledge and technical skills to execute the project.
=	Compared to the other teams, our team was on a level playing field regarding domain knowledge and technical skills.
-	Compared to the other teams, our team was lacking in domain knowledge or technical skills to a point where it was noticeable by the other teams.
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.
Team Practices for Delivering Value – Team Leadership	
Team Leadership sub-factor Definition: Team Leadership is the strategic vision, communication skills, and emotional intelligence to know when issues arise. Good leadership is not about preventing the issue but handling it immediately, entirely, and transparently. The leader acts as the binding glue that works to recognize and eliminate conflicts and problems between the teams. *Section 12 of 12*	
Explain how you feel about your leadership, their response to issues, and how well informed you are with respect to program-related issues.	
Which of the following statements best describes the project condition at a system level?	
+	The team leader reacted quickly to resolve issues, communicated thoroughly about the vision, and valued people as individuals.
=	The team leader communicated regularly, but issues seemed to take a long time to resolve.

-	The team leader did not respond to issues we identified
Team Score	
Agreement with Score	This choice agrees with the team score; what drove you to this choice
Disagreement with Score	This choice disagrees with the team score; what might be driving your choice in variance with the team score.

Team Survey Execution

Overview of Team Survey Execution

The Team Survey will be executed using Qualtrics as a data collection tool. The steps outlined below provide the flow of execution for the study at a high level.

- Email to program leadership from Company Representative
- Email from program leadership to software development team member participants
- Email from Qualtrics (Ben Park) to begin Team Member Survey

When complete, return the team survey document to the researcher.

Team Survey Question Section

The following email will be generated directly from Qualtrics to each of the leadership participants. This will provide them with the link and necessary information to execute the team survey.

****** Qualtrics Email Template ******

Your company and program leadership have chosen you to participate in a Ph.D. research study. It is anticipated that the survey will take approximately 15 minutes to complete.

Ben Park is conducting this survey as a portion of a larger research effort which is part of doctoral research in the Department of Industrial Engineering and Management Systems at the University of Central Florida. The supervising faculty member for this research is Dr. Timothy Kotnour.

Follow this link to the Survey:

${l://SurveyLink?d=Take the Survey}

Or copy and paste the URL below into your internet browser:

${l://SurveyURL}

Follow the link to opt-out of future emails:

${l://OptOutLink?d=Click here to unsubscribe}

Thank you,
Ben Park
(sent from within Qualtrics)
****** End of Email Template ******

Qualtrics Team Survey

Start of Block: Introduction

Your participation is vital to the validity and success of this research.

Thank you! All information you share during this research will be anonymized, held private, and stored encrypted. Your personally identifiable information will not be used beyond collection and storage. This information is only collected for accuracy in data collection.

Research at the University of Central Florida is carried out under the oversight of the Institutional Review Board.

Questions or concerns about research participants' rights may be directed to the UCF IRB office: Phone: (407) 882-2276 or (407) 823-2901 Mail: University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246.

If you have any questions, concerns, or complaints about this survey or if you wish to withdraw your participation after submission, please contact Ben Park (BenPark@knights.ucf.edu) or Dr. Timothy Kotnour (Timothy.Kotnour@ucf.edu). You must be 18 years of age or older to take part in this research study. IRB contact about your rights in this study or to report a complaint: If you have questions about your rights as a research participant, or have concerns about the conduct of this study, please contact Institutional Review Board (IRB), University of Central Florida, Office of Research, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901, or email irb@ucf.edu.

By completing the leadership response or survey and returning it, you are granting consent to the collection and reporting of the data provided in accordance with the above conditions.

○ I consent to this Research

End of Block: Introduction

Start of Block: Demographics Collection

Name

_____

Project Name

_____

Using the choices provided, which role most closely describes your latest position on the program/project?

- ○ Product Owner
- ○ Scrum Master
- ○ Team Member
- ○ Program Leader
- ○ Stakeholder

In what city was the core of the team you were most part of located

_____

From your perspective, the project was successful.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

From your perspective, your team delivered the desired value in a reasonable timeframe for the work needed.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

End of Block: Demographics Collection

Start of Block: GDT Degree of Alignment - Task Conflict

Task Conflict Definition: Refers to the alternatives to implementing a particular feature. Task conflict is essential as it shows the team members are safe to discuss alternatives to the current implementation or design. Task conflict also demonstrates that teams are relatively equal in their knowledge and ability to complete the work.

Section 1 of 12

In working with other teams, we debated the pros and cons of ways to implement system-level features or capabilities.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

End of Block: GDT Degree of Alignment - Task Conflict

Start of Block: GDT Degree of Alignment - Process Conflict

Process Conflict Definition: Process Conflict focuses on each team's resources and members' roles and responsibilities. Process conflict demonstrates a lack of continuity regarding the development process, including completeness of testing. When process conflict exists, the outcome or completeness of work will often be significantly different between teams. This can cause defects, rework, issues with integration, and project delays.

Section 2 of 12

In working with other teams, the differences in our processes impacted the project's implementation, integration, and testing, resulting in project delays.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

End of Block: GDT Degree of Alignment - Process Conflict

Start of Block: GDT Degree of Alignment - Affective Conflict

Affective Conflict Definition: Affective Conflict is the anxiety or hostility along with the time and energy associated with emotional disagreements (Hinds & Bailey, 2003). Affective Conflict shows the personality issues between team members. Affective Conflict can stem from a wide range of topics. Allowing this to exist can break down the overall team bonding, safety, and communication between the teams.

Section 3 of 12

When working with other teams, I avoided interactions with one or more team members due to a lack of rapport.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

End of Block: GDT Degree of Alignment - Affective Conflict

Start of Block: GDT Tools for Mitigation - Architectural Modularity

Architectural Modularity: Architectural Modularity promotes independence and parallelism without cross-coupling impacts. The computer science principles of tight cohesion and loose coupling applied at the system level provides modularity and reduces the number of interfaces between Globally Distributed Teams (GDT). Architectural modularity reduces the required interactions between teams for technical reasons. This can change as design changes are required—the increased interaction when architectural modularity is low can cause significant interaction delay on a project.

Section 4 of 12

We execute independently from other teams while developing to our desired goals and mission.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

End of Block: GDT Tools for Mitigation - Architectural Modularity

---

Start of Block: GDT Tools for Mitigation - Degree of Dispersion

Degree of Dispersion Definition: Geographical dispersion of teams over time zones impacts the physical ability to communicate over time and distance (O'Leary & Cummings, 2007). Research shows that any distance of 50 meters diminishes interaction. Distances of different buildings, states, and time zones can increase the difficulty of getting to a shared mental model for smooth communication.

Section 5 of 12

We have adapted our workday to better sync with another team's workday.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

End of Block: GDT Tools for Mitigation - Degree of Dispersion

Start of Block: GDT Tools for Mitigation - Media Richness

Media Richness Definition: Richness differences in media include the medium's capacity for immediate feedback; chat is richer than email, video is richer than chat, and face-to-face reigns supreme (Daft & Lengel, 1986). The amount of data one can communicate over the media is vital to clear communication and conveying or interpreting emotion. The less you know someone you need to communicate with, the richer or more capable the media format required to achieve the same level of comprehension.

Section 6 of 12

In our communications with other teams, we mainly use video (camera on) for meetings, conversations, and clarification of issues.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

End of Block: GDT Tools for Mitigation - Media Richness

Start of Block: GDT Tools for Mitigation - Cross-Team Leadership

Cross-Team Leadership Definition: Cross-Team Leadership identifies the level of leadership and distinguishes it from leadership as part of team practices. The leadership skills, traits, and variables are similar and inclusive of team practice leadership but focused on the cross-team or system level rather than the individual team. Good leadership is not about preventing the issue

but handling it immediately, entirely, and transparently. The leader acts as the binding glue that works to recognize and eliminate conflicts and problems between the teams.

Section 7 of 12

The overall project leadership identified and adequately addressed technical and personnel-related issues quickly and effectively.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

End of Block: GDT Tools for Mitigation - Cross-Team Leadership

---

Start of Block: Team Practices for Delivering Value - Process

Process sub-factor Definition: The Process sub-factor relates to the processes and metrics that govern software development. The Process includes user story creation through feature sell-off in a production-like environment. The Process used, by name, is less important than its being consistent and compatible with all other teams in the system. Inconsistent processes by teams can cause issues between teams.

Section 8 of 12

Our process is very similar to the other team's processes, with the same level of automated testing for selling off our requirements and capabilities.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

End of Block: Team Practices for Delivering Value - Process

Start of Block: Team Practices for Delivering Value - People

People sub-factor Definition: The People sub-factor is the social and emotional aspects of the team, including items such as trust, customs, idioms, norms, etc. The most effective teams attain a shared mental model, allowing team members to know and anticipate team members' reactions.

Section 9 of 12

Our local team works well together, thinking of each other and solving problems together.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

End of Block: Team Practices for Delivering Value - People

Start of Block: Team Practices for Delivering Value - Organization

Organization sub-factor Definition: The Organization sub-factor describes the support provided by the organization, including items such as network, office space, training, resources for the project, and management support. Organizational support is essential to provide the teams with the necessary support, training, and tools to accomplish the job.

Section 10 of 12

The organization adequately supports the team by supplying the right tools, training, and personnel.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

End of Block: Team Practices for Delivering Value - Organization

Start of Block: Team Practices for Delivering Value - Technical/Project

Technical/Project sub-factor Definition: The Technical/Project sub-factor is the technical ability to develop the software needed for the project at hand and the business domain knowledge regarding the project. The lack of knowledge of the business domain can cause adjustments to processes or may require additional support to be needed by other teams. The knowledge of what to build and the ability to complete the work is as key to the performance of each team.

Section 11 of 12

The team I am most closely associated with has the business and domain knowledge to adequately understand the customer's needs and the technical skills required to implement a quality solution.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

End of Block: Team Practices for Delivering Value - Technical/Project

---

Start of Block: Team Practices for Delivering Value - Team Leadership

Team Leadership sub-factor Definition: Team Leadership is the strategic vision, communication skills, and emotional intelligence to know when issues arise. Good leadership is not about preventing the issue but handling it immediately, entirely, and transparently. The leader acts as the binding glue that works to recognize and eliminate conflicts and problems between the teams.

Section 12 of 12

Local team leadership demonstrates their commitment to individual contributors by moving quickly to remove blocker impediments and communicating relevant information from other teams.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

End of Block: Team Practices for Delivering Value - Team Leadership

---

Start of Block: Thank you

You are at the end of the data collection document.

Thank You!

Your participation was greatly appreciated. If you would like information regarding this research, please reach out to Ben Park (BenPark@knights.ucf.edu).

End of Block: Thank you

Email Templates

Company Research Request

****** Introductory email requesting time to discuss research ******

This is an introductory email requesting <COMPANY'S> collaboration on a dissertation project. I am a Ph.D. student at the University of Central Florida. My research topic involves distributed software development using the Agile Scrum Methodology. More specifically, my topic is "Globally Distributed Teams: The Between Team Barriers That Impede The Successful Delivery Of Agile Software Development." As part of the program, I am conducting replicated case study involving a small number of the team's leadership (3-5 people). The set of replicated case studies will be followed up with a team survey of the software development team members on the program under study. The data being sought is Agile Software process, project process, and related information. **There are questions regarding architectural modularity, but there is no desire to access any technical data regarding the actual development.**

- Benefit to Your Company

    - A greater understanding of the between team barriers that impede the successful delivery of agile software development in Globally Distributed Teams
    - A greater understanding of the controlling factors that impact the performance, productivity, or effectiveness
    - A management report containing all case studies, results, analysis, and recommendations with an optional presentation
    - Project names, project details, company names, and individual names will be anonymized or not stated
    - At a company's discretion, a complete detailed review of all notes taken regarding the company-specific case study
- Time Commitment Requested:
    - The mixed-method sequential case study process should take approximately 1.5 hrs. Per person for an expected 4.5 hrs. total per case
    - The follow-up survey is expected to take approximately 15 min. per team member

As this is an introductory email, it is expected that you may have several additional questions. At a time convenient to you, could we schedule approximately 30 minutes to discuss this opportunity further?

Thank you,
Ben Park
UCF Ph.D. Research Student

Leadership Response – request to participate

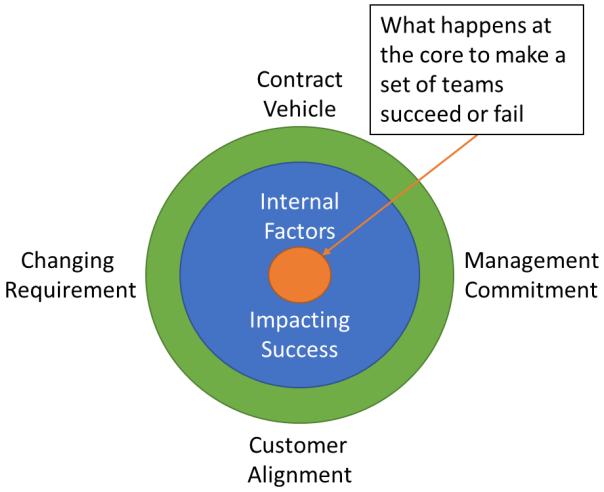
****** to be sent by the company representative (the person providing access) ******

Your company and program leadership have chosen you to participate in a Ph.D. research study. Your participation is voluntary, and you will incur no material benefit, penalty, or risk whether you agree or decline to participate. It is anticipated that the written response will take no more than 45 minutes to complete. Ben Park is conducting this study as part of doctoral research in the Department of Industrial Engineering and Management Systems at the University of Central Florida. The supervising faculty member for this research is Dr. Timothy Kotnour. The data below provides a quick overview of the research. The case study is a three-phase approach intended to reach a consensus conclusion for each factor impacting the project.

You will receive an email from “Ben Park <no-reply@qualtrics-research.com>” which will contain links to the survey. The survey URL will begin as follows: https://ucf.qualtrics.com. The information provided here is to assure you that when received, the email and links are safe.

What is the research being conducted? The following describes the research.

Software projects fail to deliver, fall behind schedule, or never achieve their stated goal far too often for today’s environment. How can we do better? Numerous external factors can cause project failure and are regularly studied. This research focuses on the set of teams that execute and how one can see, understand, and impact the success of these internal factors. The data being sought is Agile Software process, project process, and related data.



There are questions regarding architectural modularity, but there is no desire to have technical data regarding the actual development.

All researchers in this study are US Citizens.

Thank you,
Ben Park
UCF Ph.D. Research Student

Team Survey – request to participate

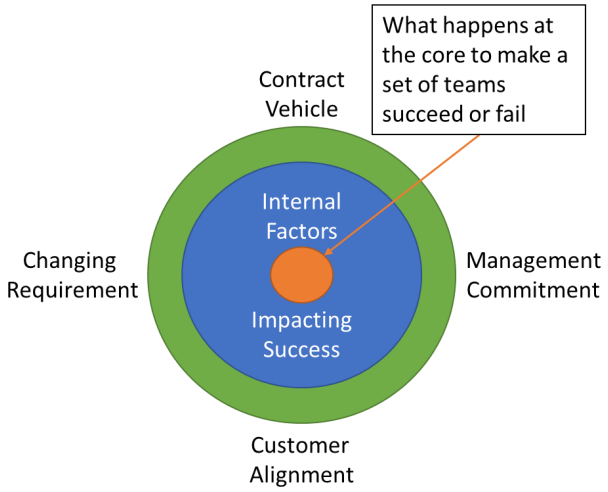
****** to be sent by the project leader (overall program manager) ******

We are participating in a research study sponsored by <COMPANY>. Program leadership has chosen you to participate in a Ph.D. research study. Your participation is voluntary, and you will incur no material benefit, penalty, or risk whether you agree or decline to participate. It is anticipated that the survey will take approximately 15 minutes to complete. Ben Park is conducting this study as part of doctoral research in the Department of Industrial Engineering and Management Systems at the University of Central Florida. The supervising faculty member for this research is Dr. Timothy Kotnour. The data below provides a quick overview of the research. It is our request that you participate in a short survey as part of this research.

You will receive an email from "Ben Park <no-reply@qualtrics-research.com>" which will contain links to the survey. The survey URL will begin as follows: https://ucf.qualtrics.com. The information provided here is to assure you that when received, the email and links are safe.

What is the research being conducted? The following describes the research.

Software projects fail to deliver, fall behind schedule, or never achieve their stated goal far too often for today's environment. How can we do better? Numerous external factors can cause project failure and are regularly studied. This research focuses on the set of teams that execute and how one can see, understand, and impact the success of these internal factors. The data being sought is Agile Software process, project process, and related data.



There are questions regarding architectural modularity, but there is no desire to have technical data regarding the actual development.

All researchers in this study are US Citizens.

Thank you,
Ben Park
UCF Ph.D. Research Student

Research Data Collection Documentation References

Daft, R. L., & Lengel, R. H. (1986). Organizational Information Requirements, Media Richness and Structural Design. *Management Science, 32*(5), 554.

Gordon, T. J., & Helmer, O. (1964). *Report on a long-range forecasting study*. Retrieved from

Hinds, P. J., & Bailey, D. E. (2003). Out of sight, out of sync: Understanding conflict in distributed teams. *Organization Science, 14*(6), 615-632.

O'Leary, M. B., & Cummings, J. N. (2007). The Spatial, Temporal, and Configurational Characteristics of Geographic Dispersion in Teams. *MIS Quarterly, 31*(3), 433-452. doi:10.2307/25148802

Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods* (G. Dickens Ed. 6e ed.). 2455 Teller Road, Thousand Oaks, California 91320 SAGE Publications, Inc.

APPENDIX C: THEMATIC ANALYSIS DATA

Case Study I – Thematic Analysis

Qualitative Response	Characteristics (sub-factors)	Model Factor
We would discuss the pros and cons of different alternatives in design sessions and align on a solution after weighing the pros and cons of each alternative.	Pros and Cons Discussions Communication	Task Conflict
We have a regular call to discuss system requirements and changes. In that call we would discuss how a change would impact each team and there are questions with regards to the requirements before we do the actual implementation	Communication Frequency	Task Conflict
Work was divided into sub modules / Interfaces. For every interfaces Field Mapping document and the Functional specification document was very critical which will be aligned by all teams. Source/Targets/Middleware etc Once FMD and FSD's are finalized team will start implementing it individually without dependency in agile approach	Modularity Work Divided Communication	Task Conflict
For this project, the division of work is well defined. Due to the nature of the changes, signficant discussion about how each side implements their changes has not been needed. When it is needed, typically our team asks questions to clarify a requirement or how some impact should be addressed (we have twice weekly 30 minute meetings scheduled with others scheduled as needed). However, there are a number of interfaces that are changing. Generally speaking, the owner of the interface provides an updated spec to meet the requirements, the proposed changes are investigated and then if needed a discussion is had with questions or any proposed alternative changes discussed. This has worked well so far.	Modularity Communication	Task Conflict
There were some delays but I would not say that the delays were the result of process conflicts.		Process Conflict
My team is following an agile process but other teams don't (although they organize their deliverables by Sprint). For instance, we do have a product backlog but other teams do not so we have to translate the requirements into our backlog/user stories. They also schedule their Sprints concurrent to ours and so we frequently experience delays in receiving the requirements (part of their sprint delivrables) for our own sprint.	Process Differences No Backlog Overlapping Work	Process Conflict
SAP team has some process like MVR, SDR. During these process other teams are not able to progress. This causes delay in delivery of modules. As PGT is a Global solution, SAP team always want to get the global alignment. Global teams are not aware of the local business process which are happening within the applications. This cause delay in the project deliverables.	Upstream Process not the same Lack of Domain Knowledge	Process Conflict Project/Technical

Qualitative Response	Characteristics (sub-factors)	Model Factor
PGT is one of the first projects using an agile approach so the process we are using is largely new for all involved. There has not been significant conflict so far. Required deliverables have been made on time thus far though the project is ongoing.	New to Agile	Process Conflict Organizational
The relations between teams were cordial for the most part but there have been a few individuals whose personality and attitude did cause conflicts. We tried our best to not let these conflicts affect our work and to focus on the deliverables.	Cordial relationships Isolated individuals conflicts Adapted conflict	Affective Conflict
I always have timely, open and productive discussions with my PM counterpart and other teams	Not answer for whole team	Affective Conflict
I have not faced these issues	Not answer for whole team	Affective Conflict
So far, communiation with counterparts has been easy and conflict free. All interactions have been very positive.	No Conflicts	Affective Conflict
Our deliverables were heavily dependent on interfaces with certain upstream systems (SAP) and lack of proper requirements and frequent changes in agreed upon behavior of upstream modules caused rework for our downstream modules.	Upstream is causing rework lack of requirements	Architectural Modularity
We execute independently but he coordinate with other teams frequently so there are no impacts that are not accounted for. There have been no issues so far on this.	Independent operation Coordinated operation	Architectural Modularity
This is based on the Case to Case basis, the objective is to reduce these kind of changes. But when needed we would propose many simple/effective solution with pro/con. Alignment would be required for all the knowledgeable person to move forward	Focused on interface definitions so all could run indendently	Architectural Modularity
Generally speaking, the teams work very independently. While we are working from a common set of requirements requiring a significant number of changes, beyond the specifics of the interface changes, how one team executes their changes has little or no affect on the other.	Run Indendently Common Requirements	Architectural Modularity
We had to cram most of our meetings between 7 AM and 11 AM Central Time, so development teams in India could attend the meetings. We also had 2 teams - one in Eastern Time Zone and another in Central Time Zone. Meetings around lunch hour always posed challenges and had to be adjusted because of lunch hour. Same issue at start and end of the work day. So, effectively, the number of hours available for meetings was significantly reduced.	Meeting Availabiliity window Cross-timezone support	Degree of Despersion

Qualitative Response	Characteristics (sub-factors)	Model Factor
We don't have any timing issues so far		Degree of Despersion
In order to provide the continuity during the testing golive and hypercare phases, overlap support is needed. During the critical handoff with the development activity, tools are available for the team members to utilize and deliver without project delay.		Degree of Despersion
So far, our interactions have primarily been made with teams no more than one time zone away. This hasn't required any significant schedule adjustments and we are able to communicate regularly by e-mail and Zoom.	1 timezone no adjustments	Degree of Despersion
We mostly used Zoom for communication. Chat was always the least effective. Communication significantly improved when we used Zoom voice meetings over Zoom chat. However, even in Zoom voice calls, most people (usually about 80%) would simply keep their camera turned off. I would say that turning off the camera did not noticeably decrease the quality of communication. The lack of a white board for face to face discussion was definitely felt.	Zoom Audio only, little chat Whiteboard would be nice	Media Richness
We usually use Zoom and Teams, there has not been any issues to our team cross-communication using these tools. Our communications have always been effective so far.	Zoom Audio only	Media Richness
		Media Richness
Typically we use Zoom for our meetings. While Zoom has video capability it is not typically used. However, screen sharing is often used. I don't find that the use of video has a positive impact and can be distracting, however the ability to share a computer screen and having good audio quality are very important. Audio quality can sometimes suffer when some team members are in a conference room and others connected via Zoom. In my opinion, it works better when either everyone is in a room together, or everyone is on the Zoom call. For us, it is almost always the case that everyone is on the Zoom call and I think this works well.	Zoom Audio only shared screen In person is best either everyone on Zoom or everyione in a room, not mixed	Media Richness
		Cross-Team Leadership
We always discuss any issues in our weekly calls and all are being addressed in a timely manner.	open discussion of issues	Cross-Team Leadership
		Cross-Team Leadership

Qualitative Response	Characteristics (sub-factors)	Model Factor
To this point, there have not been any personnel-related issues that I am aware of. Technical issues have mostly revolved around setup and testing of the software. When such an issue arises, the test team contacts project leadership who ensures the correct resource is assigned to investigate and resolve the issue.	Tech issues resolved	Cross-Team Leadership
		Process
In terms of testing and validation, our team have our own set of processes which might be different from other team's but if they find any issues in the product testing and test setup, they usually coordinates with us for investigation.	Lots of manual testing coordination through communication	Process
Other teams are only focused on their module testing but we are also more focussed on E2E scenarios.	Module only testing vs integration testing	Process
Our teams are using a similar agile process and same sprint schedule. However, unit testing and automated testing are handled independently from each other. There is a shared integration test plan for integration testing with several integration sprints scheduled throughout the project schedule.	Unit and automated testing not handled the same Shared integration plan	Process
There is substantial level of trust across the local team.	Trust	People
Our team have a great working relationship with each other. They help each other and also willing to help other teams if needed.	Cooporation Shared goals	People
		People
It's really been all positive so far. The team works well together and nobody hesitates to ask for help or to offer it. Discussions on how to solve problems, whether via face to face meetings, Zoom or text chat is positive and productive and everyone is very responsive. Interacting with other teams is much the same.	Vulnerablily Trust	People
		Organization
We communicate our training and resource needs to the organization. Sometimes it is not met right away because for example if we need additional developer, that would have to go through a hiring process.	No pool of free resouces	Organization
		Organization
Generally, I think we have had the personnel we have needed. Due to the complexity of the system and data needed for testing, I'm not sure there can ever be enough tools and training but that's something that is always being worked on.	Good but could use more training	Organization

Qualitative Response	Characteristics (sub-factors)	Model Factor
I feel the upstream teams (SAP) do not have adequate domain knowledge of Frito Lay Business Operations to implement the right solution for some of its unique operations. This results in redefinition of requirements, redesign, and rework for them and for the interfacing downstream teams. I feel the technical abilities are adequate.	Domain not adequate (upstream) requirements creep	Technical/Project
		Technical/Project
My team is comprised of relatively new engineers (who have been with the company for less than a year). But nevertheless, we are gaining domain expertise as we work on the project. The team is made up of highly skilled engineers who are eager to learn and improve their domain knowledge. I dont have much visibility to the other team's developers but their leadership are also competent and have the necessary domain knowledge required for the project.	New to Domain Highly skilled technically	Technical/Project
Technical skills are high across the team and there have not been any significant issues due to a lack of technical ability. Because most of the team members are relatively new, domain knowledge is probably not as high as would be desireable. Because of the large amount of work involved as a result of this project, other teams also have a number of relatively new people.	High skilled technically Domain not as high as desired	Technical/Project
I sometimes feel like there are so many issues for the leadership to deal with that they are forced to prioritize what they can address at any given moment. As a result, many key decisions tend to get put off on the back burner to be addressed down the road.	So many issues Issues tracked	Team Leadership
		Team Leadership
Team members are welcome to bring their questions/concerns to leadership either through in person conversation, Teams chat or call. These concerns are being addressed in a timely manner by leadership as they immediately work with internal or external resources to address any issues (either through calls, in person discussion, emails or other means).	Open Leadership Rapid response to issues	Team Leadership
I think we have been fortunate in that there have not been any significant conflicts between the teams. Blocking issues are generally resolved by a question to or conversation with another team. Any answers or new information from another team is communicated quickly, sometimes via daily stand up meeting or via Teams chat or e-mail depending on the specifics. Also, if developers have specific questions they can pose them directly during regularly scheduled meetings.	Good communication teams chat, email, voice open leadership communication ownership	Team Leadership

Qualitative Response	Characteristics (sub-factors)	Model Factor
Currently, I feel I am reasonably well-informed concerning program-related matters.		

Case Study II – Thematic Analysis

Qualitative Response	Characteristics (sub-factor)	Model Factor
no debate, handed items to most experienced. Handed items to what a person was good on.	No debate, handed items out	Task Conflict
Development is distributed amongst developers evenly through Dev lead and/ or Solution Architect.	work assigned	Task Conflict
We use Microsoft Teams for our discussions, leverage Azure DevOps to managed day-to-day work, and Microsoft Project to organize and adjust high level tasks and target dates.	work assigned	Task Conflict
First we will discuss the issue and from which team and solve the issue with suitable solution.	discussion of issue discussion of which team	Task Conflict
Work was divided based on the team members previous experience	Experience based	Task Conflict
Initially the project was run in full Agile in which the client did not want it to be leading to miscommunication and delays. Now the project is in an Agile/ Waterfall approach.	Customer Process Issue Adapted Process	Process Conflict
The client (Evergreen) stressed a waterfall-like process whereas my team stressed an agile methodology in order to complete the project as efficiently as possible.	Customer Process Issue	Process Conflict
working as a SharePoint tester, developers working on PowerApps would develop about 50% done with of the work and pass it to our team. When the developer would finish, everything would have to be retested. Many times features previously complete were then broken.	Completion Stutus Lack of Automation	Process Conflict
N/A		Process Conflict
There is full trust in each team member to complete tasks assigned on time and to the best of the abilities	Full Trust	Affective Conflict

Qualitative Response	Characteristics (sub-factor)	Model Factor
I did not have any significant issues communicating with or interacting with team members of the other team within CTG. Personality conflicts did occur and are still occurring with members on the client-side. I try to limit conflict with the client as much as possible while presenting my views and recommendations in a respectable manner.	Lack of Communication Resolved by talking Respect between teammembers	Affective Conflict
I used to Interact with each and everyone from other teams and used to the latest technologies and latest news.	Good interaction	Affective Conflict
Many on the team are of similar backgrounds, and similar ages, and we get along very good	similar likes and social background	Affective Conflict
Sometimes that happened. The other person didn't understand what I was saying. When I discussed with the superior guy my procedure was accepted	Lack of Communication Resolved by talking Respect between teammembers	Affective Conflict
Have interacted with other team members if I had doubts	trust	Affective Conflict
50/50 somethings linked with other items and some very independent		Architectural Modularity
As the lead architect, I decided to create a separate development environment in order to develop customizations separately from the migration sites. This allows the customization team to work in parallel with the migration team. Once the customizations are completed, it is staged and ported over once corresponding site is ready to be migrated.	intentional work seperation	Architectural Modularity
		Architectural Modularity
		Architectural Modularity
Used the timezones as an advantage, work, review, feedback over the timezone periods.		Degree of Despersion
The client is on west coast, PM and Solution Architect East coast and development overseas. We have a great schedule with development overnight, and reporting done to the client in the afternoon by our PM. The client is able to receive this and give feedback immediately	Workflow based schedule	Degree of Despersion

Qualitative Response	Characteristics (sub-factor)	Model Factor
Our developers in India adjust their shift to align as closely as possible to US time zones. The end of their shift aligns to 12pm noon Eastern Time. This allowed us to meet daily without much friction. We do adjust our migration cutover times and procedures so that the India team can start them at the beginning of their shift. This actually works perfectly for all involved.	Dev team shifted	Degree of Despersion
We work a shifted workday. Initially, we worked on a US schedule, but the work was inefficient. We had to shift the work to a more normal workday. This has helped a great deal. Our workday is now until 7PM	Dev team shifted	Degree of Despersion
Our project had members from India and US but no adjustments were made to our workday. We schedule meetings in our common workday time		Degree of Despersion
So here I face an issue, I started work and found that I had a login issue. With the time zones, I had to wait for the team in the US to come in to get help. …. We have a team call at 7:30 PM. Depending on the day, we start in the afternoon and complete in the night.	Workflow based schedule	Degree of Despersion
we have daily standups with dev team via Teams. with Monday/Friday meetings with the client via Teams as well.		Media Richness
We rarely use video in our meetings. We generally do not use email for team interactions. At times I do ask for video to be turned on during certain meetings to increase moral and to develop better relationships with the other team members.	Video sometimes	Media Richness
the team has taken steps to use video to build morale by having weekend get togethers. This was positively sighted by multiple people on the team as positive in team development.	Using Video to build team	Media Richness
we used to have voice calls		Media Richness
Project leadership identified scheduling issues by previous members. conflict resolved with the client what was actually needed/necessary and then successfully created a new project plan which we are ahead of schedule.	Conflict Resolution Issue identification	Cross-Team Leadership

Qualitative Response	Characteristics (sub-factor)	Model Factor
From a technical perspective, there were multiple points of contention regarding the approach to the migration. From a personnel perspective, there were issues with the project manager and how the overall project was being handled at a high level. The client has made it difficult make concreted decisions for certain situations. Overall, the project is running relatively smoothly now and most of these conflicts have been resolved.	Technical Approach Issues Project Manager Issues	Cross-Team Leadership
because of our leadership, we are ahead of schedule.	Good Mangagement	Cross-Team Leadership
Our team lead had addressed technical issues very quickly and effectively so that it didnt impact out work	Issue Identy	Cross-Team Leadership
I believe our process is very similar to other projects testing		Process
We use the same tool (Azure DevOps) to manage our work. The customization team uses a more Kanban approach while the migration team leverages a sprint-based approach. Peer review and testing along with client UAT testing is consistent across teams.	Different Processes	Process
Now because of the different time zones, the leadership has a client meeting. They post information in the team notes, in the morning we handle the task and pass the in information back to the team for review. We have issues with this about once a month.	Workflow Based Process	Process
		Process
We have a great team chemistry across the organization	Strong Chemistry	People
Overall the relationship has been positive both within the local team and other teams. We all work together nicely and treat each other with respect. In several occasions, we have worked together to solve problems related to customizations and migrations.		People
Our Local Team is very friendly.....We will solve problems together and we will chat very friendly because most of us are of same age group.	Team Resolution	People
We have a very good relationship in our local team. We interact via teams		People
we have all the tools necessary for everything needed for the project	Tools Necessary	Organization

Qualitative Response	Characteristics (sub-factor)	Model Factor
There are some struggles when it comes to the organization. There is no time for the dev team members to be dedicated to personal growth. Personal growth only comes through working on projects as opposed to formal education via training tools. The training tools provided are only as good as time allotted to actually use them.	No Development Staffing Mentality	Organization
The organization supports us by helping us with certifications which is nice. They could do better with leaves and vacations	Supportive Organization	Organization
The company has a staffing mentality and therefore does not support individuals with the desired growth.	Staffing Mentality	Organization
Our team has an amazing technical ability and has even had to assist our client team on some technical questions	Strong Technically	Technical/Project
The technical knowledge and domain knowledge grew over time. Some of the team members had some skill gaps but we closed them via guidance and practice.	Growning Domain	Technical/Project
The team is able to come up with the solutions needed but most of the time we have to be told how to implement the solution	Weak Domain	Technical/Project
project leadership immediately identifies concerns/issues and runs through different solutions to determine the best solution	Quick Response	Team Leadership
I tried my best to eliminate conflicts as the lead architect. I was however not in control over other decisions made which were made prior to when I joined the organization and joined the project.	Eliminating Conflicts	Team Leadership
When we found any issue in our work, If that work can handle by multiple people we will split that work and we will solve that issue.	Team Resolution	Team Leadership
If there are any impediments my local team lead responds immediately so that it doesnt effect the delivery time	Quick Response	Team Leadership
Other – we only see the work. We don't get a lot of interactions with others. We are working from home. We used to have get togethers and such. Now, it is only work.	Isolation	Organization
I think this exercise is something that I would recommend as a mid or post mortem as a project evaluation. I think this great. This is something that should be common practice within any company and could improve projects overall.		

Case Study III – Thematic Analysis

Qualitative Response	Characteristics (sub-factor)	Model Factor
Weekly team lead meeting where impediments and concerns were brought to leadership.	Regular Communications	Task Conflict
This is a difficult question to answer as there were many facets to this project. While there was standard SharePoint contact migration happening, the more interesting parts of the project Was that we were refracturing of InforPath and Nintex workflows to their M365 equivalents. The more interesting parts were the custom coated applications that were also part of the move. Some of these coated applications were coming up to 20 years old, and the client wasn't really thinking about this as a rewriting exercise when in fact it really was. So the team had to determine the requirements through reverse engineering for the most part. Identifying the target architecture was also difficult because the client really didn't have any internal experts, who would know what would work in their environment and what they could support. As such the team was left to try to find the best approach to meet timelines only.	Multiple Project Threads Team left to figure it out	Task Conflict
Client and SMEs were tense and unyielding.	Missing personal relationships	Process Conflict
Difference in the way the teams worked did not affect the development as much because items for the most part were not intertwined. It did affect communications and stakeholder management. As far affecting development, integration, testing, etc. we found just an overarching inconsistency in quality and results.	Highly modular work Inconsistent quality	Process Conflict
Specific team members were aggressive and untrustworthy, so being minimal in interaction was the best path.	Agressive team members Lack of trust Minimized interaction	Affective Conflict
I didn't experience this directly or indirectly with the team. Global team and time zones were the typical challenges.	Time zones challenges	Affective Conflict
N/A - Neutral		Architectural Modularity

Qualitative Response	Characteristics (sub-factor)	Model Factor
In regards to the custom applications, the architectural changes were largely happening on the front-end - switching from Power Apps to custom a web Parts. As a result, we found a gap in skillsets in the teams and we needed to swap members between the teams. Thereby team assignments became muddy.	Technical skill lacking Team members on multiple teams Assignments Muddy	Architectural Modularity
Meet with the offshore team towards the end of their day such that their updates were ready and fresh for the start of the north american day	elongated work	Degree of Despersion
I think this was more of an issue for the program leaders and it was for the teams. Program leadership had to make adjustments to meet with the teams, and at times it was hard to do within the first few hours in the morning.	No work shift Limited communications	Degree of Despersion
N/A - Disagree	Limited video usage	Media Richness
Teams would use MS Teams meetings, with voice and occasionally video. Meetings were generally ad hoc Communications in general were in all mediums. We had also had MS Teams with many channels in both our domain and in the clients. Multiple emails accounts for most folks. All of this was a challenge. I think it caused issues with everyone to keep track of or give up trying to.	Limited video usage Inconsistent Tool Usage	Media Richness
When technical issues were elevated, leadership did respond.	Responsive Elevation	Cross-Team Leadership
Development leads were very quick to raise issues and concerns for technical matters and never on personnel. Project manager was very concerned about personnel issues and usually coaching after escalations was enough. In one case, we did have to remove someone. That said, I think performance and quality issues were a bigger problem. While process were in place, I think teams went through the motion and didn't work with the rigor which eventually caught up to the team and program overall.	Responsive Elevation No Affective Conflicts Raised Quality Issues Not Raised Lack of Ownership	Cross-Team Leadership
We were more agile, and the other teams were forcefully waterfall.	Process Conflict Process Issues	Process
There were effectively two ways of working and again led to stakeholder management issues more than development.	Communications Issues Process Conflict Process Issues	Process
N/A - Agree - Our local team works well together		People
Each team worked well within itself for the most part.		People
N/A - Agree - Organization adequately supports the team	Adequate Support	Organization

Qualitative Response	Characteristics (sub-factor)	Model Factor
For most part resources all worked remotely. We did find out that's that some didn't have dual monitors and such, but generally was remedied. Training was a major issue. Too much time was spent on training and onboarding and charged to the client. Evidently, this was not well planned or communicated.	Remote Team Training Issues Onboarding Issues Equipment Issues	Organization
N/A - Neutral - Has the business and technical knowledge to adequately understand and deliver	Technically Adequate	Technical/Project
N/A - Neutral - Had business and technical knowledge	Technically Adequate Business Knowledge Acceptable	Technical/Project
N/A - Neutral - by moving quickly to remove blocker		Team Leadership
N/A - Agree - Leader moved quickly to resolve issues	Raised Issues Resolved Issues	Team Leadership

Case Study IV – Thematic Analysis

Qualitative Response	Characteristics (sub-factor)	Model Factor
During project team weekly meetings, teams were identified to focus on capabilities and would meet separately and come back to the meetings and give updates.	Regular Communication Separation of Duties	Task Conflict
Work was grouped among different categories called as 'Extract' based on Functionality/Features. It was divided into 4 extracts called Eligibility, Medical claims, Pharmacy claims and Provider Extracts. A set of team was dedicated to implement each extract that includes different skilled resources who can help in requirement/design/development and Testing.	Separation of Duties Limited Debate	Task Conflict
A discovery effort was completed to identify and agree to scope. Team members worked together to determine ownership of features and tasks within	Scope Debate	Task Conflict
Company identified QA team was not able to participate in the project. The Line of Business Business Analyst / SME took on the QA role which at times caused delays due to workload.	People Not Available Process Delays	Process Conflict

Qualitative Response	Characteristics (sub-factor)	Model Factor
Our processes are well designed/defined in such a way that it complements other team rather than creating process conflict. For example, process being followed by Dev team doesn't create any negative impact on process being followed by Testing team. They are well linked and coupled with each other	Linked Processes	Process Conflict
The PPF team is fully allocated to the project so there are no conflicts with other work and also the hierarchy of responsibilities are followed	Dedicated Team	Process Conflict
The project participants were very easy to work with. A small team allowed for closer relationships and bonding.	Close Relationships Bonded Team	Affective Conflict
My interactions with counterparts on other teams were very fruitful and played a key role in success of the project. Each team/Team member tried to help each other and came forward for meetings/calls whenever needed to support each other. Example: solving any defect/issue	Shared Help Across Team	Affective Conflict
As Program lead I hold 1on1s and skip level meetings with the team members.	Communication	Affective Conflict
N/A - Neutral		Architectural Modularity
N/A - Disagree		Architectural Modularity
Implementing processes the the ability to promote as needed versus waiting for scheduled releases improves delivery	Continuous Integration	Architectural Modularity
Covid forced our organization to think and work differently. There have been outsourced IT resources from other countries, again our organization has adopted to this. For SME's that are not always working with IT on projects there may be some language barriers and understanding of working hours in the beginning of a project.	Language Barriers Working Hour Issues	Degree of Despersion
Offshore team workday hours overlap with onsite team members workday hours. It gives opportunity to different team members to sync up with each other.	Shifted Workday Hours Workday Overlap	Degree of Despersion
Development leads make themselves available in evenings to answer questions. Hand offs occur during shift changes to ensure continuity	Leads Shifted Hours Blackout Times for Continuity	Degree of Despersion

Qualitative Response	Characteristics (sub-factor)	Model Factor
It is "highly recommended" for my team to always have their cameras on. Groups like IT, claims etc. typically tend to have their cameras off. When people opt to have their cameras off the perception may be that they are not fully engaged in the meeting and more easily multitasking.	Set Standards for Interactions Other Groups No Video	Media Richness
There was daily sync up call between onsite and offshore covering various agenda like status call, defect/clarification call etc. These calls were mostly audio call as team knew each other very well. At onsite, calls with Business and other stakeholders were mostly video. Video calls helped in better interaction with Business.	Daily Sync Calls Onsite Call Mostly Video Video Calls Helped	Media Richness
Video chat is used frequently although not all resources are able to due to gaps in functionality using citrix	Frequent Video Usage Citrix Prevented Cameras	Media Richness
The Project Manager, who is the leader in many meetings, kept great notes and was able to refer to them if needed for clarity and also reviewed roles and responsibilities at the beginning of the project to make sure everyone knew their role along with others.	Leadership Action Tracking Clear Communication	Cross-Team Leadership
On project level, different trackers were being maintained and tracked on daily basis. It includes query tracker, defect tracker, Observation tracker etc. These trackers had been reviewed regularly and appropriate action had been taken as needed. In addition to it, Risks/issues were also maintained and tracked so that mitigation plan could be created to mitigate it. Leadership and Team Members connect also happened regularly that helped to address personnel-related issues quickly and effectively.	Project Issue Tracking Regular Review of Issues Regular Meetings Personnel-Related Issues Resolved Quickly	Cross-Team Leadership
The organization supports making sure we have tools needed to succeed. On shore and offshore leadership support on another to insure issues are addressed appropriately	Issues Addressed Quickly	Cross-Team Leadership
The LOB BA needed to test, this is not normal behavior so it is an outlier in this project.	Process Adjusted to Fit	Process
There is a standard process that every team follows at IH whether its development or testing. As it's a standard process, hence, it helps across different teams as every team follows the standard process/template. E.g. test plan design/execution, defect logging etc.	Standardized Processes	Process

Qualitative Response	Characteristics (sub-factor)	Model Factor
Automated testing has not been available until recently. Testers reporting to the team makes it easier to collaborate and reacte to changes		Process
As stated prior, this was a very small team so it was easy to get to know each other rather quickly. There were a good amount of weekly meetings so this was helpful in terms of creating and maintaining relationships	Good Comradery	People
Team members shared a great and healthy relationship with each other. It helped to create a great synergy among the team. This was well reflected with many examples like how team members proactively came forward to help each other incase any issue surfaced in the project. People went beyond their area to extend the support. Team strongly believed that individual success doesn't matter until Team gets success.	Great Synergy in Team Proactive Support Team Success Model	People
All local team members appreciate and trust each other and work together to ensure project success.	Appreciation Trust within Team	People
N/A		Organization
Organization provided all logistics whether its Laptop/Desktop, all necessary software etc. so that a resource could perform his/her work. As few new resources were added to the team, they went through onboarding training and Knowledge Transition program so that they could have performed their job smoothly. Resources were also encouraged to enroll to Technical/Functional training if it was needed or could have helped them to deliver the assigned task.	Resource Encouragement Everything They Need	Organization
The team is provided what is needed to be successful including piloting testing tools to drive automation. Callaboration tools continue to be implemented and mature in use	Collaboration Tools Maturing	Organization
Myself and My BA were the business experts that worked with the overall technical team. We were clear and documented our requirements.	Clear Requirements	Technical/Project

Qualitative Response	Characteristics (sub-factor)	Model Factor
Comparing between Development and Testing teams, Development Team was more technical and when it came to Domain knowledge they got support from Architect and Business analysts. Few team members were good in domain even being developer. If we compare it with Testing team then in addition to their technical skill sets to perform their job , they were good in domain. Business Facing team Members were expert in Domain knowledge.	Strong Domain Knowledge Good Technical Knowledge	Technical/Project
Most Team members have domain and business experience and share their knowledge with those who do not	Good Domain Knowledge	Technical/Project
N/A		Team Leadership
There were issues those surfaced during offshore time zone and local leads acted very diligently and spontaneously. E.g. Job not triggering in Testing region. Lead reached out to IT Operation Support team and worked with them to get this issue resolved. Leads connected with me and were very proactive in communication about any issue specially impacting timeline or our deliverables.	Raised Issues Addressed Proactive Communication	Team Leadership
Weekly 1on1's, status reporting and check ins are avenues for communication and collaboration.	Regular Communication	Team Leadership

Case Study V – Thematic Analysis

Qualitative Response	Characteristics (sub-factor)	Model Factor
Discussed via MS Teams meetings and roadblocks addressed during daily standups. Usually the person with prior experience in the area will take up the task	Low task conflict Addressed roadblocks High-Level task conflict	Task Conflict
We have our Business Analyst work at the Customer office. He gathers the inputs for the features and discuss with our team during the overlap hrs. Team then split the task between the UI, Development, and Network teams. The end product of each team get checked into a repository for consolldation and shared with the QA team for testing	High-level task conflict Strong Arch Modularity	Task Conflict

Qualitative Response	Characteristics (sub-factor)	Model Factor
Team members were divided based on number of features to be implements and are encouraged to come up with design for their own work. Such designs would be discussed among the teams under a supervision of a team lead. Teams are encouraged to debate and agree on a best design.	strong arch modularity high-level task conflict	Task Conflict
Product team was trained in the SDLC process and our process was adapted based on their feedback, so that all teams were using more or less the same process. There was minimal impact	same process for all teams adapted process over time	Process Conflict
Between the teams there are tocuhpoints and handshake where we exchange the information and work products.. We were focused more on meeting those timelines and followed our own processes. Other teams processes did not create any impact or roadblock to our progress.	touchpoints and handshake meeting timelines minimal process conflict	Process Conflict
We did not have any significant process conflict between this team and other teams which impacted the delivery	no delivery impacts	Process Conflict
Concerns were brought up early and with candor. Disagreements were resolved through consensus based on cost/effeciency or time.	quick and candor disucssion and consensus	Affective Conflict
We been working together for many years. Language is not a barrier in our case so we communicated with each other comfortably and established a rapport.	strong rapport years being together	Affective Conflict
as a leader for this project i did not encounter any affective conflict with other project's team leaders. I also ensured that we don't have such conflict within the team by having regular team bonding exerices	regular bonding exercises	Affective Conflict
There was a clear separation of responsibilities between the hardware and the software teams and architectural changes had minimal impact.	high arch modularity	Architectural Modularity
Architectural changes resulting in varied output or handshake impacted the downstream teams. We communicate the changes and the timelines so the teams work together to acheive the milestone.	Architectural changes impacting downsteam teams	Architectural Modularity

Qualitative Response	Characteristics (sub-factor)	Model Factor
The nature of the project itself was to bring architectural modularity allowing individual teams can work independently as much as possible going forward. And in my opinion we greatly achieved though still some work needs to be done.	high arch modularity	Architectural Modularity
The teams hours were adjusted to increase the overlap between timezones. The India team started later and scheduled meetings towards EOB. The US team started early and met with the offshore team in the mornings.	adjusted hours on both sides	Degree of Despersion
We start late and finish late. Wo we have ample time overlap with other teams for discussions and clarifications	adjusted hours on both sides	Degree of Despersion
While the development team is in India, the client team is in US. Both the teams agreed on a sync up time such that the US team would start early and the indian team would stay late than the regular working hours.	adjusted hours on both sides	Degree of Despersion
Daily meetings were over IM with voice and screensharing. Video was rarely required for communicating a concept. Whiteboarding and screensharing was adequate	no video whiteboarding screenshare	Media Richness
We used Skype for weekly status meeting. And Teams for standup calls and for other internal meetings and do Screen shares. We did not find a need to go into the Video calls	no video whiteboarding	Media Richness
The team usually used instant messenger to communicate without video. This especially during covid times impacted team bonding. We've recently started using video conferencing.	no video whiteboarding	Media Richness
Daily scrum meetings within the team and scrums between teams quickly resolved technical issues. Personnel issues were resolved locally by and between the individual scrum masters	freq contac t quick issue resolution	Cross-Team Leadership
For technical matters we have various focused calls like alerts review, Architecture review, project progress review, standups, etc.. For personnel related matters, the lead who is present locally along with the team does one on one meetings to attend to the needs and concerns.	targeted reviews regular contact	Cross-Team Leadership

Qualitative Response	Characteristics (sub-factor)	Model Factor
the team was mainly distributed across two locations in India and only the client partners are in US. the technical and personal issues within team members in India were addressed by having 1-0-1 meetings and team bonding exercises	one-on-ones team bonding exercises	Cross-Team Leadership
The teams followed the same process. Automated testing scripts were shared and run by the different teams. Test results were recorded in Jira and validated independently before closing	same process share testing ability independent verification	Process
Offshore team perform functional, regression and security testings for the web portals.. Onshore team does the User acceptance testing. We are in the process of automating the testing for mobile platforms which will be used by both the teams in future.	share testing ability	Process
We have a common testing team to be used across all the projects. So the processes were same across teams until unless there was a need to be different.	same process	Process
Local teams share the same cultural background and work in the same timezone. Dev and testing work is mostly face to face and very minimal changes to members, so they have a good rapport. Client partners and onsite POs work as the glue to ensure non-verbal cues are not missed.	shared social background and culture	People
We have a healthy relationship between the team members right from the onboarding sessions. For inital period, for the new members we assign a big brother/sister so they reachout to them to get the inputs on time. And we communicate the progress over standup daily. so we know if someone is struck and provide the required help from the very same day onwards.	big brother/big sister approach	People Process
During covid, the relationship was not there much except between the old timers. working from home has affected personal relationship. At the same time, it also helped in avoiding any personal conflicts. the teams worked professionally	remote only does not build relationships going remote does not destroy existing relationships	People

Qualitative Response	Characteristics (sub-factor)	Model Factor
Most resource and training needs have been met. Online training/testing is made free for the team. Hardware needs are not always easily satisfied due to availability and ROI - such as testing on the latest iPhones or different version of Android flagships.	needs met free online training limited HW for testing	Organization
Organization had provided the development and management tools right from day one. be it a license to the self study portal and cloud subscription for tryout they are available to all. There are process and approval mechanism in place for anybody to request for additional resources to meet the demand.	need met	Organization
Being a leader i have the authority to arrange necessary training, tools and resources. my mgmt empowered me to do that	organization has empowered leaders to meet the needs of the team	Organization
This team has been working on the project for over 6 years and so have a solid understanding of the technolgoies and domain knowledge. New personnel are interviewed by the leads before inducting (even within company)	6 years together - shared mental model strong domain knowledge strong tech knowledge	Technical/Project
We have gained tremendous domain knowledge by working with the customer for a longer period of time. Technical skills is not a challenge because we review and onboard any new member who is having adequate skillset. Other teams working on the project had a steep learning curve initially but eventually they catch up	tremendous domain knowledge strong tech knowledge	Technical/Project
The project is a one of a kind project. This team's domain knowledge will not be there with any other team. But the tech stack that is used in the team is same as that of being used by many other teams.	strong domain knowledge strong tech knowledge	Technical/Project
Daily meetings are a must and has worked well to address and remove any impediments quickly.	daily standups quickly resolved issues	Team Leadership

Qualitative Response	Characteristics (sub-factor)	Model Factor
I take part in the standup to the know the issues first hand. I regularly interact with the leads to understand the team's pulse and the issue. In addition I aslo interact with the team members to have a good rappot and understanding. I roll the information to my top management on a weekly basis or sooner for critical matters, who in turn review and provide resolutions in a shorter turn around time.	daily standups quickly resolved issues strong rapport with team communication up and down	Team Leadership
I have a weekly call with the team leads. I'm being kept in loop on all the times on any issues.	weekly calls quickly resolved issues	Team Leadership

APPENDIX D: IRB HUMAN SUBJECTS PERMISSION LETTER

UNIVERSITY OF CENTRAL FLORIDA

Institutional Review Board
FWA00000351
IRB00001138, IRB00012110
Office of Research
12201 Research Parkway
Orlando, FL 32826-3246

NOT HUMAN RESEARCH DETERMINATION

April 7, 2022

Dear Ben Park:

On 4/7/2022, the IRB reviewed the following protocol:

Type of Review:	Initial Study
Title of Study:	Globally Distributed Teams: The Between Team Barriers That Impede The Successful Delivery Of Agile Software
Investigator:	Ben Park
IRB ID:	STUDY00004139
Funding:	None
Grant ID:	None
Documents Reviewed:	• HRP-251- FORM - Faculty Advisor Scientific-Scholarly Review fillable form_TK_Signed.pdf, Category: Faculty Research Approval; • HRP-250-FORM- Request for NHSR.docx, Category: IRB Protocol

The IRB determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations.

IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are research involving human in which the organization is engaged, please submit a new request to the IRB for a determination. You can create a modification by clicking **Create Modification / CR** within the study.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu. Please include your project title and IRB number in all correspondence with this office.

Sincerely,

Katie Kilgore
Designated Reviewer

LIST OF REFERENCES

Abdalhamid, S., & Mishra, A. (2017). Factors in Agile Methods Adoption. *Tem Journal-Technology Education Management Informatics, 6*(2), 416-421. doi:10.18421/tem62-29

Blackburn, J. D., Hoedemaker, G., & Van Wassenhove, L. N. (1996). Concurrent software engineering: Prospects and pitfalls. *IEEE Transactions on Engineering Management, 43*(2), 179-188.

Boehm, B., & Turner, R. (2005). Management challenges to implementing agile processes in traditional development organizations. *IEEE Software, 22*(5), 30-39.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. doi:10.1191/1478088706qp063oa

Carmel, E., & Agarwal, R. (2001). Tactical approaches for alleviating distance in global software development. *IEEE Software, 18*(2), 22-29. doi:10.1109/52.914734

Charmaz, K. (2015). Grounded Theory: Methodology and Theory Construction. In (Vol. 10, pp. 402-407).

Cohen, S. G., & Bailey, D. E. (1997). What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management, 23*(3), 239-290.

Cohn, M. (2019). Mountain Goat Software. Retrieved from https://www.mountaingoatsoftware.com/agile

Commerce, U. S. D. o. (2020). *Export Control Regulations*. Washington, DC: US Government Retrieved from https://www.bis.doc.gov/index.php/regulations/export-administration-regulations-ear

Cronbach, L. J., & Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological bulletin, 52*(4), 281.

Daft, R. L., & Lengel, R. H. (1986). Organizational Information Requirements, Media Richness and Structural Design. *Management Science, 32*(5), 554.

de Winter*, J. C., Dodou*, D., & Wieringa, P. A. (2009). Exploratory factor analysis with small sample sizes. *Multivariate behavioral research, 44*(2), 147-181.

Dolman, R., & Spearman, S. (2017). AgileScaling.org.

Driskell, J. E., Salas, E., Goodwin, G. F., & O'Shea, P. G. (2006). What makes a good team player? Personality and team effectiveness. Group Dynamics: Theory, Research, and Practice.

Dudkowiak, M. (2020). Employment Law in Poland. ***Key rules and regulations of Polish Employment Law.*** Retrieved from https://www.hg.org/legal-articles/employment-law-in-poland-37567

Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative science quarterly, 44*(2), 350-383.

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *The Academy of Management Review, 14*(4), 532-550. doi:10.2307/258557

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry, 12*(2), 219-245.

Forsgren, N., Storey, M.-A., Maddila, C., Zimmermann, T., Houck, B., & Butler, J. (2021). The SPACE of Developer Productivity: There's more to it than you think. *Queue, 19*(1), Pages 10. doi:10.1145/3454122.3454124

Garousi, V., Tarhan, A., Pfahl, D., Coskuncay, A., & Demirors, O. (2019a). Correlation of critical success factors with success of software projects: an empirical investigation. *Software Quality Journal, 27*(1), 65. doi:10.1007/s11219-018-9419-5

Garousi, V., Tarhan, A., Pfahl, D., Coskuncay, A., & Demirors, O. (2019b). Correlation of critical success factors with success of software projects: an empirical investigation. *Software Quality Journal, 27*(1), 429-493. doi:10.1007/s11219-018-9419-5

Geldsetzer, P., & Fawzi, W. (2017). Quasi-experimental study designs series—paper 2: complementary approaches to advancing global health knowledge. *Journal of clinical epidemiology, 89*, 12-16.

Ghafoor, F., Shah, I. A., & Rashid, N. (2017). Issues in adopting agile methodologies in global and local software development: A systematic literature review protocol with preliminary results. *International Journal of Computer Applications, 160*(7).

Guzmán, J. G., Ramos, J. S., Seco, A. A., & Esteban, A. S. (2011). Success factors for the management of global virtual teams for software development. *International Journal of Human Capital and Information Technology Professionals (IJHCITP), 2*(2), 48-59.

Harwood, W. (2020). NASA outlines recommendations to clear path for Boeing to resume Starliner flights. Retrieved from https://spaceflightnow.com/2020/07/07/nasa-outlines-recommendations-to-clear-path-for-boeing-to-resume-starliner-flights/

Herbsleb, J. D., & Mockus, A. (2003). An empirical study of speed and communication in globally distributed software development. *IEEE Transactions on software engineering, 29*(6), 481-494.

Hinds, P. J., & Bailey, D. E. (2003). Out of sight, out of sync: Understanding conflict in distributed teams. *Organization Science, 14*(6), 615-632.

Hofstede, G., & Hofstede, G. J. (2005). *Cultures and organizations: software of the mind* (Rev. and expanded 2nd ed. ed.): McGraw-Hill.

Holmström, H., Fitzgerald, B., Ågerfalk, P. J., & Conchúir, E. Ó. (2006). Agile Practices Reduce Distance in Global Software Development. *Information Systems Management, 23*(3), 7-18. doi:10.1201/1078.10580530/46108.23.3.20060601/93703.2

Huber, G. P., & Lewis, K. (2010). Cross-Understanding: Implications for Group Cognition and Performance. *Academy of Management Review, 35*(1), 6-26. doi:10.5465/amr.35.1.zok6

Kim, G., Behr, K., & Spafford, K. (2014a). *The phoenix project: A novel about IT, DevOps, and helping your business win* (Second Edition ed.). 25 NW 23rd PL, Suite 6314, Portland, OR 97210: IT Revolution.

Kim, G., Behr, K., & Spafford, K. (2014b). *The phoenix project: A novel about IT, DevOps, and helping your business win*: IT Revolution.

Leedy, P. D., & Ormrod, J. E. (2020). *Practical research : planning and design* (12th ed. ed.): Pearson.

Lencioni, P. (2002). *The five dysfunctions of a team: a leadership fable* (1st ed. ed.): Jossey-Bass.

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P., . . . Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLoS medicine, 6*(7), e1000100.

MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological methods, 4*(1), 84.

McCaslin, M. L., & Scott, K. W. (2003). The five-question method for framing a qualitative research study. *The qualitative report, 8*(3), 447-461.

Misra, S. C., Kumar, V., & Kumar, U. (2006). Success Factors of Agile Software Development. *Software engineering research and practice, 1*, 233-239.

Newell, S., David, G., & Chand, D. (2007). An analysis of trust among globally distributed work teams in an organizational setting. *Knowledge & Process Management, 14*(3), 158-168. doi:10.1002/kpm.284

O'Leary, M. B., & Cummings, J. N. (2007). The Spatial, Temporal, and Configurational Characteristics of Geographic Dispersion in Teams. *MIS Quarterly, 31*(3), 433-452. doi:10.2307/25148802

Patterson, K. (2012). *Crucial conversations: tools for talking when stakes are high* (2nd ed. ed.): McGraw-Hill.

Sauser, B. J., Reilly, R. R., & Shenhar, A. J. (2009). Why projects fail? How contingency theory can provide new insights – A comparative analysis of NASA's Mars Climate Orbiter loss. *International Journal of Project Management, 27*(7), 665-679. doi:10.1016/j.ijproman.2009.01.004

Schneider, M. (2017). Google spent 2 years studying 180 teams. The most successful ones shared these 5 traits. *linked from the Inc. com Home Page, https://www.Inc.com/michael-schneider/google-thought-they-knew-how-to-create-theperfect. HTML (accessed March 23, 2018), 1*.

Schwaber, K. (2004). *Agile project management with Scrum*: Microsoft Press.

Schwaber, K., & Beedle, M. (2002). *Agile software development with Scrum* (Vol. 1): Prentice Hall Upper Saddle River.

Shenhar, A., & Holzmann, V. (2017a). The Three Secrets of Megaproject Success: Clear Strategic Vision, Total Alignment, and Adapting to Complexity. * Project Management Journal(6),* 29. Retrieved from https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search.ebscohost.com/login.aspx?direct=true&db=edsggr&AN=edsgcl.519900823&site=eds-live&scope=site

Shenhar, A., & Holzmann, V. (2017b). The Three Secrets of Megaproject Success: Clear Strategic Vision, Total Alignment, and Adapting to Complexity*(6),* 29. Retrieved from https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search.ebscohost.com/login.aspx?direct=true&db=edsggr&AN=edsgcl.519900823&site=eds-live&scope=site

Shenhar, A. J. (2004). Strategic Project Leadership® Toward a strategic approach to project management. *R&D Management, 34*(5), 569-578. doi:10.1111/j.1467-9310.2004.00363.x

Shenhar, A. J., & Holzmann, V. (2017). The Three Secrets of Megaproject Success: Clear Strategic Vision, Total Alignment, and Adapting to Complexity. *Project Management Journal, 48(6),* 29-46.

Sinek, S. (2009). *Start with why: How great leaders inspire everyone to take action*: Penguin.

Sink, D. S., & Smith Jr, G. L. (1994). Linkages And Profound Knowledge. *Understanding The Productivity Paradox*, 131.

Sink, D. S., & Smith Jr, G. L. (1994). *The Influence of Organizational Linkages and Measurement Practices on Productivity and Management*. Paper presented at the Panel on Organizational Linkages, Washington, D. C.

van Kelle, E., van der Wijst, P., Plaat, A., & Visser, J. (2015). *An Empirical Study into Social Success Factors for Agile Software Development*: IEEE.

Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods* (G. Dickens Ed. 6e ed.). 2455 Teller Road, Thousand Oaks, California 91320 SAGE Publications, Inc.