

Outsourcing in Global Software Development: Effects of Temporal Location and Methodologies

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Abstract

Developing software globally using outsourced resources has become a common practice, with project teams often distributed in different time zones. In this study, we focus on customers that contract software development to vendors in temporally near shore or far offshore locations. We conducted a survey to determine the effect of temporal distance on overall success, costs, project management effort, schedule, quality, communication problems, and other outcomes of interest to managers. In the survey of 80 customers and interviews with six of them, we also investigated the effect of software development methodology on the same outcomes. The results show that near shore development is advantageous for overall success, reduced PM effort, maintaining schedule, higher quality, and engendering fewer communication problems. Development methodology appears to only influence higher costs and is not a significant determinant of success in outsourced software development, while structured methodologies can be more effective at keeping costs aligned to budgets. Thus, managers should have tempered expectations about the broad applicability of Agile methods to outsourced farshore projects, since Agile requires intense synchronous communication. We assess our findings in the context of prior GSE research and provide practical advice for customers of outsourced global software development, chief of which is to favor nearshore for communication-intensive or Agile projects.

Keywords: Global software engineering; global software development; nearshore; farshore; offshore software development; agile methodology; software engineering

Introduction

Global Software Engineering (GSE) or Development (GSD) has been studied for more than 20 years; in 2014, a taxonomy to describe the various combinations was introduced by (Šmite, et al., 2014). Using the taxonomy, we study Offshore Outsourcing of software development in locations with small temporal distances (nearshore)¹ in comparison to locations with Large temporal distances (farshore) to a customer.

Global software development has been used by managers for several decades to gain the strategic advantages of lower costs, access to more readily available skills, and local market expertise (Moe, et al., 2014). Outsourcing of software development is yet another management strategy prevalent since the 1970's (Šmite, et al., 2010). These two strategies are often combined (Šmite, et al., 2014) so that by outsourcing to vendors operating offshore, companies are able to quickly scale up development. Thus, software teams are often composed of both insourced and outsourced resources, either of which can operate onshore or offshore. Today, software engineering supply chains circle the globe to feed the rising demand for more software, which though increasing complex, must be produced faster and cheaper. Boeing's 737 Max crisis was laid at the feet of outsourcing software development to "\$9-an-hour engineers" in India (Robison, 2019).

As the offshoring paradigm took hold and more locations for software development emerged, nearshore software development became an important variant. The rise of regional hubs and the desire to shorten supply chains (owing to trade wars and other geopolitical pressures) has underscored the merits of nearshore (Economist, 2019).

¹ The geographic distances could be Far (flying time greater than 2 hours) or Near (flying time less than 2 hours), but in this study, the temporal distance alone determines whether or not a location is nearshore (Šmite, et al., 2014).

From the simple world where all software development by employees occurs under one roof, managers now could choose from a dozen combinations of Sourcing, Location, Legal entity, Geographic distance, and Temporal distance (Šmite, et al., 2014). Compounding the complexity for managers was the rapid shift to Agile development methodologies. A review of research shows that “there is no standard or recipe for successful GSE performance” (Šmite, et al., 2010). How should a manager approach such bewildering choices?

This paper examines the circumstances under which offshore outsourcing to locations (geographically far or near) with small temporal differences (i.e., nearshore) should be preferred over far locations with large temporal distances (farshore). To address these questions, we review relevant current research in global software engineering as it applies to farshoring and nearshoring, then consider modern software practices such as Agile, and finally draw conclusions and recommendations based on our research. By design, we limit our study to offshore outsourcing patterns which are exclusively either nearshore or farshore (i.e., not a hybrid where a project might consist of both types of teams). The perspective of nearshore or farshore is exclusively from the point of view of the customer and the customer’s location. Thus, a typical scenario that falls into our study would be a US-based firm that contracts with a third-party vendor based either in Argentina (nearshore) or India (farshore).

The Challenge of Outsourced Global Software Development

Firms often use a combination of insourced or outsourced teams, located farshore or nearshore to build their software (EY, 2013). These choices could have an impact on project outcomes and the research evidence so far is not encouraging. There are many examples of failures (Moe, et al., 2014), no clear indications of practices correlated with success (Šmite, et al., 2010), while recommendations for GSD success are unclear (Anh, et al., 2012).

Nearshore outsourcing of IT software development projects is often presumed to come with better team communication, though higher costs, compared to farshore (Boersen, et al., n.d.). The geographic distribution and temporal distance of development sites have a significant impact on quality (Cataldo & Nambiar, 2009). Our research investigates if the amount of temporal distance can affect outsourced project outcomes.

Strategies for software development methodologies fall into two broad camps: Agile and Structured. Agile uses an iterative process in which specification is kept high-level until work starts, at which time intensive, real-time coordination resolves details. Structured is a process where the software interfaces and features are well-defined, and teams can work independently on system components without the need for constant, real-time interaction. Research has suggested that development methodology has had little or no effect on outcomes for projects delivered by globally distributed teams, both insourced and outsourced (Estler, et al., 2014). Still, Agile in just 20 years has become the de facto standard methodology. Such a widespread acceptance of its efficacy suggests it is a determinant of success. Muddying the waters further, quality from methodology improvements seem to diminish with distributed development (Cataldo & Nambiar, 2009). Taking a narrower view, could there be a difference in outcomes among outsourced-only GSD projects depending on methodology?

In our study, nearshore locations are within five hours’ time difference of the customer’s location, though they could be still more distant geographically or culturally. We define farshore locations as farther away in time zone than five hours. We have chosen five hours despite the fact that some of the literature defines a nearshore small temporal distance as four or fewer hours (Šmite, et al., 2014). From our experience, the actual time difference can vary by time of year owing to observance of Daylight Savings Time in the northern hemisphere; so, to count all of South America as nearshore to the continental USA all year, it’s useful to adjust the definition by one hour (i.e., Uruguay and Brazil are 4 hours ahead of Pacific Daylight Time but are 5 hours ahead of Pacific Standard Time). Even with this minor adjustment, there is usually a meaningful overlap in the business day at each location such that extended co-working is possible; usually, there can be a 4 or more hours overlap with small adjustments in work shifts. Given this adaptation, we utilize Šmite’s taxonomy otherwise unchanged and narrow our study’s context to temporal, not geographic distance (Šmite, et al., 2014). Thus, Argentina is geographically far from the US, but considered by US customers as nearshore, owing to temporal proximity.

Our research seeks to explore two questions: what is the effect of an outsourced temporal location (nearshore or farshore) on project outcomes in software development? And what is the effect of development methodology on project outcomes in outsourced offshore (far or near) software development?

Our research context—outsourced farshore or nearshore software development—avoids the broader categories of Information Technology Services (IT) or Business Process Outsourcing (BPO). We eschew considering insourced development whether offshore or not. By design, our inquiry sidesteps insourced and outsourced onsite software development, regardless of location or methodology. Thus, our focus is narrowed to outsourced software development in locations that are either temporally nearshore or farshore. The resulting context is still rich enough to gather data for our research. Though narrowed, these two management choices (location and methodology) confront managers regularly; we hope to provide them insights to help with these decisions.

Finally, our research focuses on the client or customer perspective exclusively (i.e., we eliminated survey data from vendors), something that most research does not sufficiently differentiate (Verner, et al., 2012).

This paper surveys relevant literature to review the research context, articulates the research questions, describes the investigation methodology, summarizes findings, discusses them, and makes recommendations for both customers engaging outsourced, offshore GSD and researchers.

Literature Review

In this section, we discuss the research context of outsourced offshore software development in both its variants, farshore and nearshore. We then pose our first question about the impact of outsourcing location on software development outcomes. Next, we introduce the concept of development methodologies most often used in software development and pose the second question—their impact on outcomes.

Outsourced Offshore Software Development

It is widely accepted that offshore software development, whether in-house or outsourced, is an arbitrage strategy aimed at lowering costs (Jiménez, et al., 2009) (Hanna & Daim, 2009), gaining access to skills, quality, and flexibility (Lacity, et al., 2016), or leveraging infrastructure without having to make a substantial investment (Khan, et al., 2010). Insourced offshore strategies tend to have better outcomes since internal teams emphasize minimizing cultural and trust barriers from the start, while overlooking them in offshore outsourcing (Prikladnicki & Audy, 2012).

Outsourced offshore development is not easy: it requires effective project management, relationship management, and cultural affinity (Khan, et al., 2012), while still encountering challenges such as cultural barriers, inadequacy of project management, weak IP protections, and technical capability (Khan, et al., 2011). National and organizational culture pose difficulties, too (Khan & Azeem, 2013). Top concerns identified by researchers are Communication, Group Awareness, Source Control, Knowledge Flow Management, Coordination, Collaboration, Project and Process Management, Process Support, Quality and Measurement, and Defects Detection (Jiménez, et al., 2009) (Jiménez & Piattini, 2008). Worse, the quality of outsourced offshore work is lower (Jabangwe, et al., 2015) and deteriorates the more distributed it is temporally and geographically (Cataldo & Nambiar, 2009).

As noted by Šmite, researchers have not always been careful about differentiating between offshore and farshore; and other terms in common industry parlance are used inconsistently, making the relevant correlations hard to identify (Šmite, et al., 2014). We intend to avoid this ambiguity to concentrate on a narrow, but important context.

Outsourced Nearshore Software Development

Outsourced nearshore software development is the practice of locating the outsource delivery center temporally nearer the client (Carmel & Abbott, 2007). Hubs to serve the major advanced economies have emerged in the Americas, Central and Eastern Europe, and East Asia (Carmel & Abbott, 2006). Indeed, temporal proximity, lower transaction costs, and geographic nearness are the main reasons cited for nearshore (Oshri, et al., 2009).

Surprisingly, the advantages of nearshoring are less than clear. While it may offer opportunities for more successful collaboration especially for Agile methodologies, cost savings could be eroded (Šmite, et al., 2010). The literature around determinants of outsourcing success includes cultural distance, but not nearshore or farshore location (Lacity, et al., 2016). An open question remains: does outsourced nearshore development affect outcomes such as overall success, quality, schedule, etc., in comparison to farshore?

Software Development Methodologies

Software development methodologies range from simple coding standards to practices that span requirements gathering, design, coding, testing, deployment, maintenance and support (Pressman, 2005).

By the 1980's structured software development methodologies had become the mainstay for software development. Most firms followed some form of waterfall or other similar "structured" methodology (DeGrace & Stahl, 1990)(Boehm, 1988), which often feature well-defined processes, extensive specifications, detailed architecture and design, planning and project management (Pressman, 2005). Common criticisms of structured approaches were its long project durations, opacity of work-in-progress, and the misalignment of delivered features to actual need (Cohen, et al., 2004).

Structured development continued to be refined by an industry of gurus who prescribed processes, best practices, standards and other ameliorations (McConnell, 1996)(Humphrey, 1989)(McCarthy, 1995). However, research suggested that non-agile methodologies caused development problems and that offshoring exacerbated them (Maxwell-Sinclair, 2016).

Agile software development methodologies were a response to these criticisms, for example SCRUM (Agile Alliance, 2018) (Schwaber, 2004). Agile approaches tend to emphasize frequent, informal, face-to-face communication among a small team of project members, including non-developers such as end users and product owners(Cohen, et al., 2004). They also avow incremental improvement centered around user scenarios, continuous delivery and a view that "working software is the primary measure of progress"(Beck, et al., 2001). Though articulated only in 2001, Agile quickly grew to 94% of all organizations reporting at least some use by 2017 (VersionOne, 2017).

Troubling signs emerged about the applicability of Agile in GSE. Jalili found that the Agile model had to be modified to accommodate GSE but was unsure if those modifications still preserved the ethos of true Agile (Jalali & Wohlin, 2010). And methodology alone could not sustain quality as development grew more distributed (Cataldo & Nambiar, 2009).

While the benefits and applicability of Agile, especially for co-located teams, were extensively researched and characterized (Estler, et al., 2014), in that same study of GSD, Estler concluded that there is "no significant difference between the outcome of projects following agile processes and structured processes ... for globally distributed development." And "the development process is not an independent variable"(Estler, et al., 2014). However, we suspect some aspects of the study may have contributed to these conclusions:

- Commingling of outsourced nearshore and farshore development projects
- Classification of a project into agile or structured by interpreting questionnaire answers
- Interviews of only Swiss companies

Given the Agile Manifesto's insistence on face-to-face meetings, the unimportance of location seems odd. What if we more narrowly confined our inquiry to purely outsourced software development projects where the customer is onshore, but the vendor is either farshore or nearshore? Could it then be that development methodology affects outcomes? Again, the literature around determinants of sourcing outcomes does not identify the role of development methodology (Lacity, et al., 2016).

In summary, our literature review shows that from the customer's point of view there are gaps in research about the effect of nearshore or farshore vendor locations on GSD outcomes and how methodology affects outsourced GSD outcomes.

Research Methods

Investigators in the literature cited have employed data collection methods ranging from semi-structured interviews (Weerakkody & Irani, 2009), surveys alone (Khan, et al., 2012), surveys with follow-up interviews (Estler, et al., 2014), content analysis (Carmel & Abbott, 2006)and systematic literature reviews (Khan, et al., 2011). As discussed in Methodology, our study utilizes surveys with follow-up interviews.

Research Questions

Offshoring in software development has been widely researched and analyzed. In a recent survey of software outsourcing literature,²⁷ determinants (or independent variables) were identified for outcomes (Lacity, et al., 2016). But the role of nearshore versus farshore as one of the 27 determinants were rarely studied—just five occurrences in the review of 174 papers from 2010 to 2014 (Lacity, et al., 2016). Similarly, development methodology as a determinant of outcomes was not often cited. Our research attempts to fill these gaps by investigating both outsourcing location and development methodology's effects on outcomes. An adjunct to the second question looks at only Agile development to see if there are any further locational effects.

RQ1: In the outsourced IT Software Engineering industry, what is the effect of outsourced development team location (nearshore vs. farshore) on:1) Meeting frequency; 2) Communication problems; 3) Business day overlap; 4)Asynchronous communication; 5)Collaboration types; 6)Methodology; 7)Ways to define products; 8)Project management effort; 9)Success; 10)Cost; 11)Schedule; 12)Quality.

RQ2: In the outsourced IT Software Engineering industry, what is the effect of software development methodology (Agile vs. Structured²) on: 1) Location (nearshore vs. farshore); 2) Meeting frequency; 3) Communication problems; 4) Business day overlap; 5) Asynchronous communication; 6) Collaboration types; 7) Ways to define products; 8) Project management effort; 9) Success; 10) Cost; 11) Schedule; 12) Quality.

RQ3: In the outsourced IT Software Engineering industry where the development methodology is Agile, what is the effect of outsourced development team location (nearshore vs. farshore) on: 1) Meeting frequency; 2) Communication problems; 3) Business day overlap; 4) Asynchronous communication; 5) Collaboration types; 6) Ways to define products; 7) Project management effort; 8) Success; 9) Cost; 10) Schedule; 11) Quality.

For the purposes of our research and in the survey, nearshore is defined as five or fewer hours away from the respondent's central project locale. Any outsourcing relationship greater than five hours is therefore farshore. This departs slightly from the definition provided by (Šmite, et al., 2014), because as stated above, to treat all of the Americas as one nearshore unit for customers in USA or Canada, it's necessary to allow up to a 5-hour time difference between Uruguay or Brazil and the Pacific Coast of North America (during the summer, this gap shrinks to 4 hours as the northern hemisphere observes Daylight Savings Time). Geographic and cultural proximity are not considered; nor are the use of multiple farshore and nearshore development locations in the same project.

The measures for our research questions reflect just a few of the "outcomes" (over 100) often studied in the literature; "outcomes" are usually characterized as dependent variables (Lacity, et al., 2016). However, one of our survey questions, "Ways to define products", is not often cited as a measure. We have reviewed these outcomes and used them in constructing the survey.

Methodology

Our research methodology consisted of a survey sent to subject-matter-experts with current or recent experience in the offshore outsourcing of GSD. After gathering and analyzing the responses, we interviewed some of them to discuss the quantitative findings to gain insights about motivations and underlying causes. Such a combination of quantitative and qualitative data gathering is a common methodology in social science research (Fowler, 2014).

Research Context

As described in the literature review, our overall research context is outsourcing; we narrow the context to IT and further still to GSD. This context is still broad enough for us to gather data fairly easily.

Our research was conducted with senior managers or technical specialists in firms that engage in significant global software development using internal, outsourced, nearshore and farshore teams. More than 60% of the surveyed reported titles that were senior, typically requiring 10 or more years professional experience. These respondents can be expected to understand the differences between development strategies in industries as diverse as consumer services, banking, finance, airlines, technology, marketing, retail, consulting, government and others. Geographically, they hailed from the Americas, Europe, Middle East and Asia. Our study sought input from a diversity of industries, geographies and professional roles because of the ubiquity of software in modern business and our intent to use a relativistic frame of reference for nearshore and farshore inquiry. That is, a nearshore team for a customer in Paris could well be farshore to a manager in Seattle; while the location of the team is invariant, the outcomes could differ depending, we postulated, on the location of the customer. With this approach, it is intended that the data reflect more than a particular local or national perspective. Thus, our research context should elicit results that are potentially applicable to different industries, geographies, and are somewhat culturally agnostic.

Hypotheses

We construct null hypotheses for each of the 3 research questions; a null hypothesis posits the lack of a correlation between outcome and temporal location or methodology. That is, the null hypothesis for our RQ1 is: H_0^i , location, $i \in \{1, \dots, 12\}$ for GSD nearshore or farshore projects, there is no difference in:

1. Meeting frequency
2. Communication problems
3. Business day overlap
4. Asynchronous communication
5. Collaboration
6. Methodology

² The terms "Agile" and "Structured" are capitalized when they are referring to the methodologies.

7. Ways to define products
8. Project management effort
9. Success
10. Cost
11. Schedule
12. Quality

So, for example, the formal expression of $H_0^1, location$ means: There is no difference in Meeting frequency for GSD nearshore or farshore projects.

RQ2 leads to another set of null hypotheses; $H_0^i, methodology, i \in \{1, \dots, 12\}$, for GSD projects developed using Agile vs. Structured methods, there is no difference in:

1. Location
2. Meeting frequency
3. Communication problems
4. Business day overlap
5. Asynchronous communication
6. Collaboration
7. Ways to define products
8. Project management effort
9. Success
10. Cost
11. Schedule
12. Quality

And, a third set of null hypotheses, $H_0^i, Agile \& location, i \in \{1, \dots, 11\}$, for Agile-only GSD projects done nearshore or farshore, there is no difference in:

1. Meeting frequency
2. Communication problems
3. Business day overlap
4. Asynchronous communication
5. Collaboration
6. Ways to define products
7. Project management effort
8. Success
9. Cost
10. Schedule
11. Quality

Our study then collected survey data that may falsify some or all of these null hypotheses, thereby asserting the alternative hypothesis: that location or methodology has an effect on outcomes in outsourced software development.

Survey Questionnaire

We asked survey respondents to consider outsourced software development projects that they are familiar with and that were developed either nearshore or farshore. We then asked them about the following management choices, processes or results:

- Software development methodologies
- Real-time meetings (e.g., video, audio or in-person)
- Collaboration type (e.g., asynchronous or synchronous)
- Asynchronous meeting adequacy
- Arbitrage outsourcing strategies
- Outcomes of project in question

The questions correspond to the null hypotheses and are reproduced in Appendix A: Survey Questions. They were selected to draw out responses to outcomes managers are most interested in. The survey can be completed in less than 5 minutes with an estimated 60% or greater completion rate. We followed common survey best practices (Looi, 2017) to encourage participation while forcing respondents to make clear, pre-

defined choices where required by our study (e.g., location). Some questions require respondents to rate an experience, like success, on a 5-point Likert scale. To improve validity, we piloted and tested the survey on three subjects familiar with survey design and software engineering before launching it to the target audience.

Selection of Participants

We chose participants who are qualified managers or software professionals functioning in a customer capacity (i.e., buyers of outsourcing software development services). Some participants had 30 years’ experience in the field; based on titles, they were senior staff. Using postings on social media (e.g., LinkedIn, Twitter), emails to professional networks, industry interest distribution lists, and personal contacts, we obtained 143 survey respondents from Asia, the Americas, and Europe. Of these, 63 self-disqualified because they could not abide the terms of the survey (e.g., they were not customers) or determined they didn’t have the knowledge to complete it. The survey was quite strict about ensuring that the respondents were in fact on the customer side of outsourcing and that they used either farshore or nearshore vendors. For example, a manager who only had experience with insourced farshore GSD would have their responses disqualified.

Figure 1 depicts the roles of qualified survey respondents; Figure 2 shows the firm size.

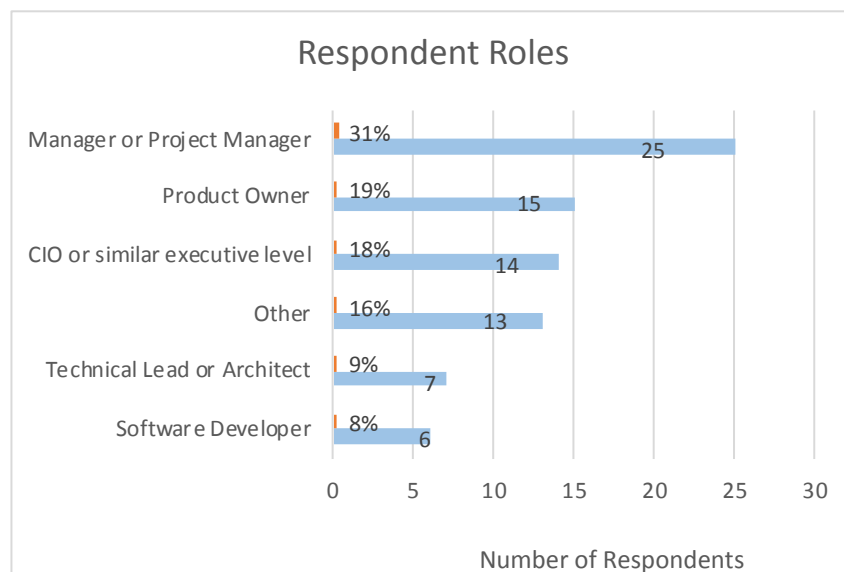


Figure 1: Respondent Roles

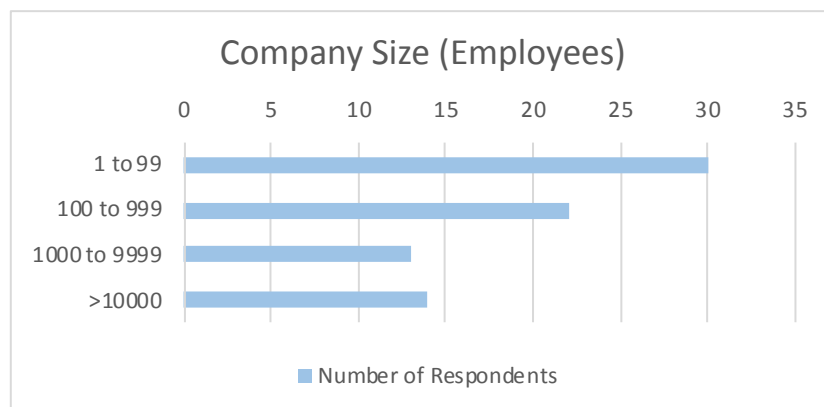


Figure 2: Respondent Company Size

Data Collection

Our online survey was open for two weeks during which time at least 2500 people were exposed to the survey request (there could have been many more because of the use of publicly visible hashtags). The survey could be completed using a Web or mobile browser or the Survey Monkey app.

The targeted cohort was reminded at least once. Data was collected using only SurveyMonkey, where the raw data is archived. The respondents were informed that the survey was in support of academic research at the University of Oxford.

In a follow-on step, we interviewed six of the survey-takers in person, videoconference, or teleconference. Interviewees had the following roles: Software Engineer, Senior Director, Senior VP, Managing Director, CEO, and Chief Data Officer. Their firms were located in Doha, Qatar; Toronto, Canada; Los Angeles, USA; Cheltenham, UK; Paris, France and Seattle, WA; London, UK. Interviewees' roles and locations were chosen to foster heterogeneity.

Data Analysis

We performed both correlation and hypotheses tests. The purpose of correlation tests is to see which variables might be predictive of each other and to check that they are internally consistent (Harmon, 2011)(Mood, et al., 1974). We can then concentrate on those hypotheses that are likely to yield interesting conclusions. Since we cannot assume a normal distribution of data, we use Kendall's τ correlation test (Padgett, 2011) (Wessa, 2018).

Hypotheses Tests

For null hypotheses, $H_0^i: P(x > y) = P(x < y)$, where $i \in \{1, \dots, N\}$ in the list of hypotheses and $(x, y) \in \{ (\text{Agile, Structured}), (\text{Nearshore, Farshore}), ((\text{Nearshore, Farshore}) | \text{Agile}) \}$, we use the χ^2 Test to reject any hypothesis where $p < \alpha$, the significance level. This test is used because our hypothesis data consist of dependent and independent variables with categorical data, (UCLA Institute for Digital Research and Education, 2017). For our tests we take $\alpha=0.05$, a value commonly used in social sciences (Fisher, 1934). For any rejected hypotheses, we accept their alternatives, $H_1^i: P(x > y) \neq P(x < y)$.

For each rejected hypothesis, to determine if differences between means are statistically significant, we apply a single tail, heteroscedastic T-Test (Hays & Winkler, 1970). However, the T-Test assumes normality; to ascertain that, we use the Shapiro-Wilk Test (Dittami, 2018) to examine if the response frequency counts are normally distributed; where there is a large enough sample size (above 30), we depend on the Central Limit Theorem to assume normality (Hays & Winkler, 1970).

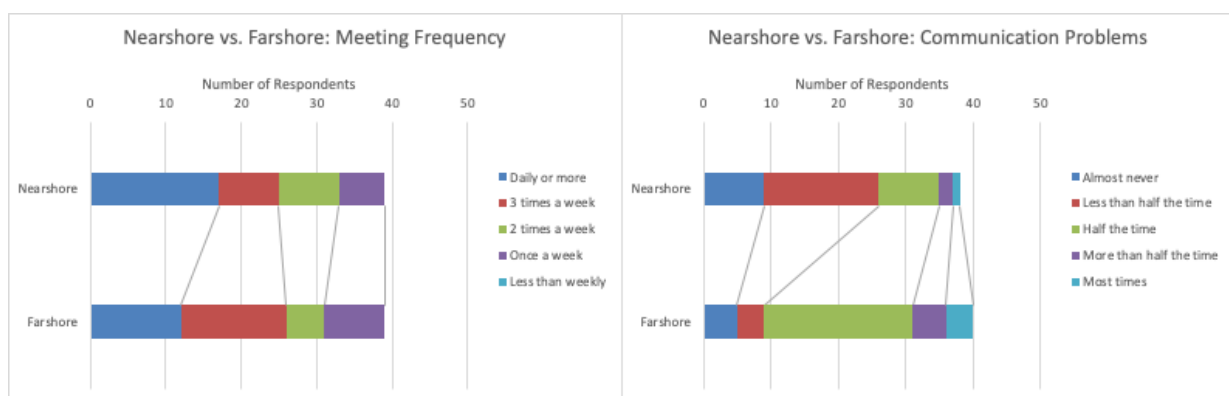
The analysis is then charted and summarized into tables. Microsoft Excel was used to perform most of the calculations, except where noted.

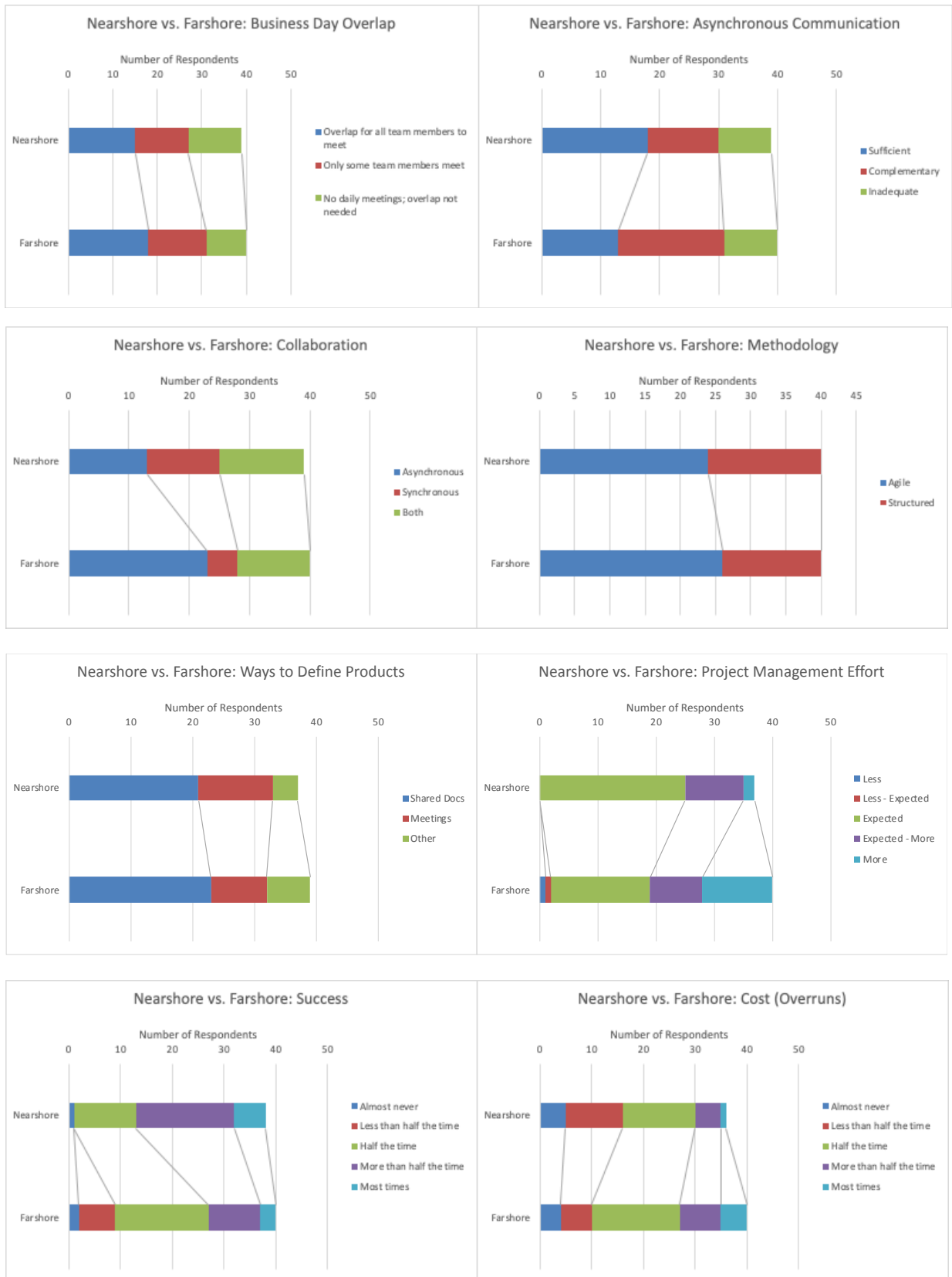
Findings

We analyzed the responses statistically, confirming or rejecting hypotheses. A further set of questions was constructed to elicit motivations or reasons for the survey results. We then interviewed some of the respondents to obtain clarification and detail around their experience with nearshore or farshore outsourcing and with development methodologies in the context of outsourcing. Our analysis showed that nearshore location has an effect on overall success, costs, Project Management (PM) effort, schedule, quality, and communication problems. Agile software development seems to increase costs. In this section, we summarize the data, describe the hypotheses tests results, present our quantitative conclusions, and describe the insights gained from interviews.

Data

We present the survey data in graphs, showing the number of responses by independent variables, nearshore and farshore, for each question in the survey in Figure 3. A perusal of the data suggests some marked differences between nearshore and farshore in measures such as collaboration type, but there are indications of a correlation between nearshore and success.





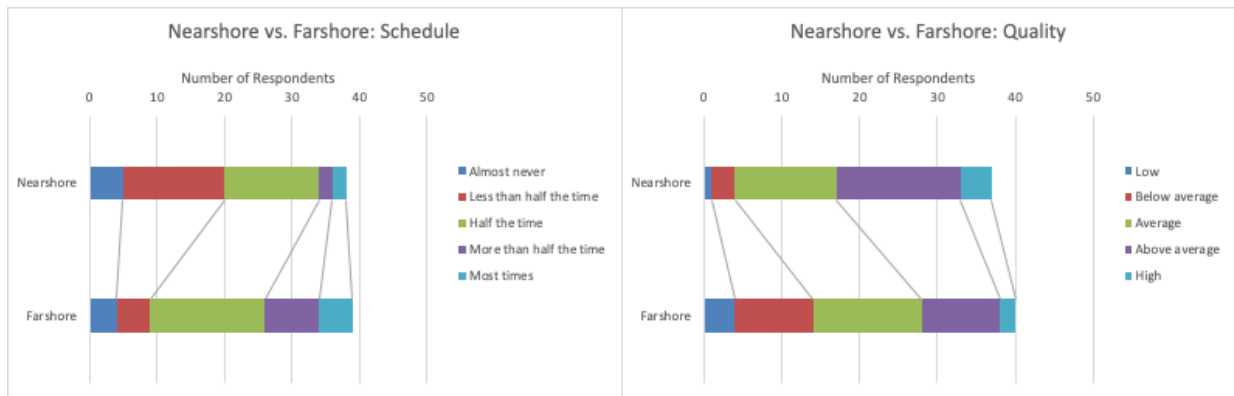
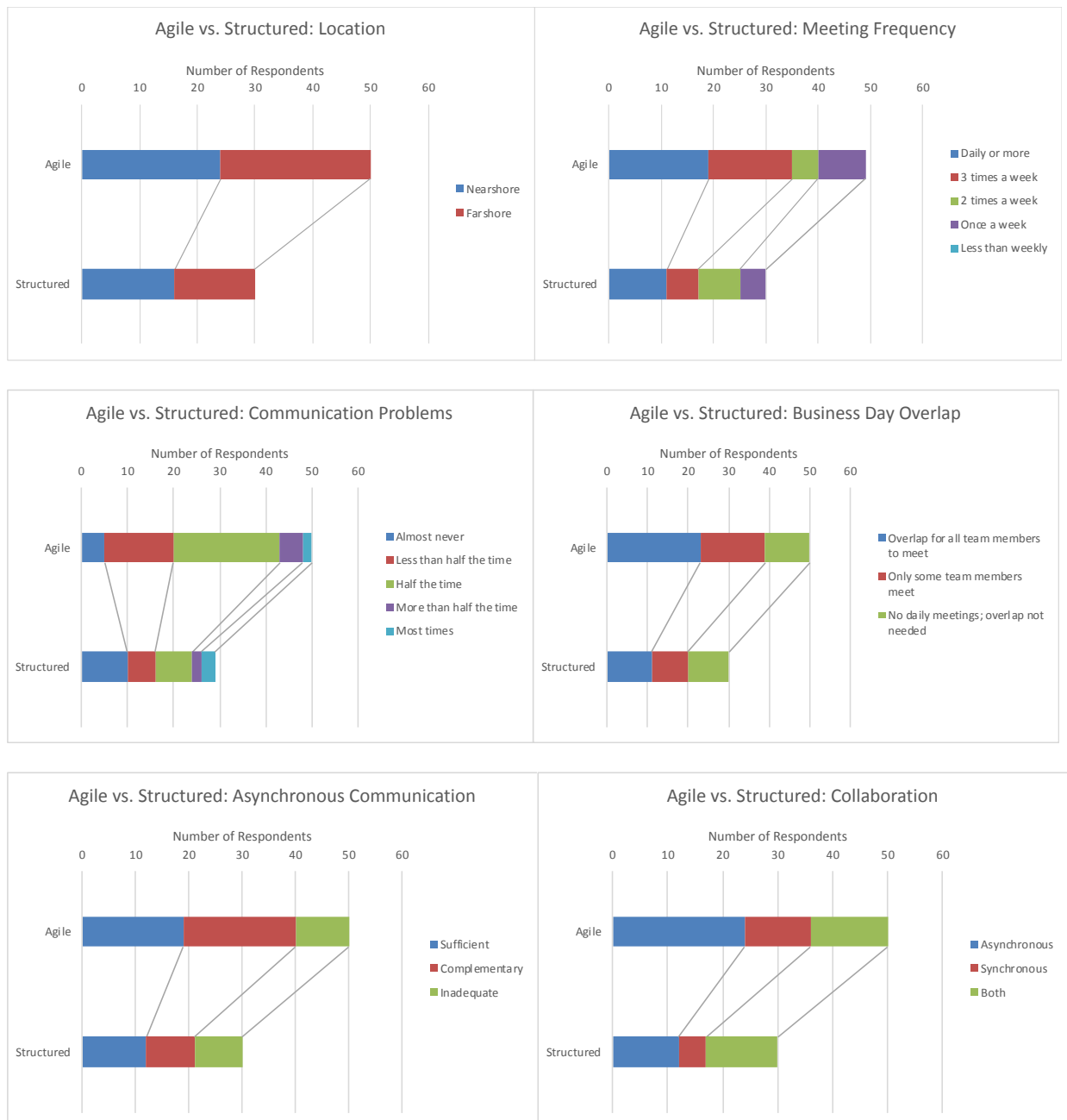


Figure 3: Data for Location Hypotheses

Figure 4 shows the same survey data graphed to show the relationship of methodology by various outcome measurements. Reflecting its ascendancy, there were substantially more respondents reporting the use of Agile methodologies. Given this asymmetry, it is not immediately obvious that there is much of a difference between the Agile and Structured across the various measures.



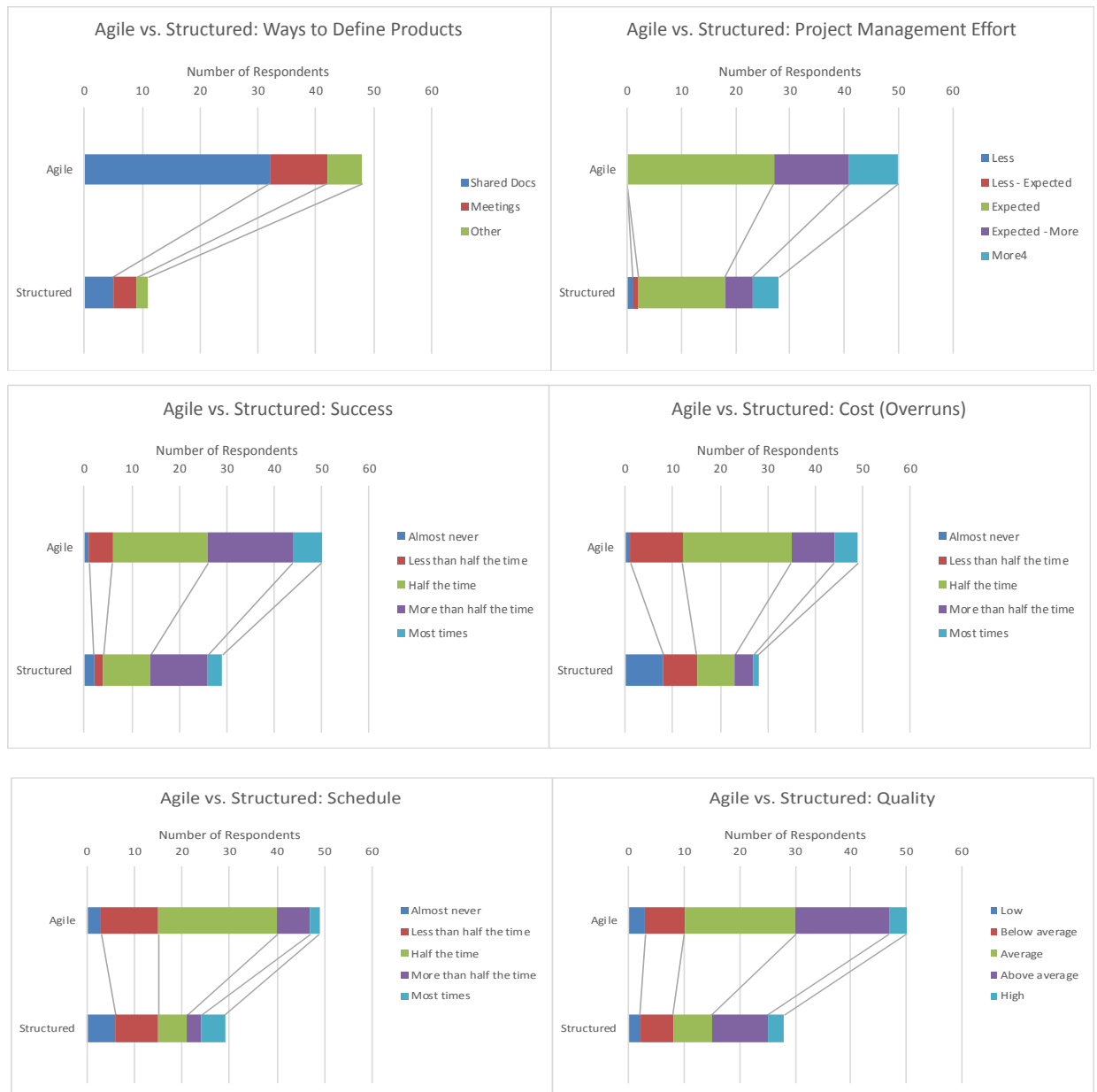


Figure 4: Data for Methodology Hypotheses

To see relationships more clearly, we must proceed to correlations and hypothesis testing.

Correlations

We begin by determining the correlation between some of the variables we have observed. Most of the variable pairs show no substantial correlation.

Table 1 shows the variable pairs that had correlation where $|\tau| \geq 0.3$ (Wessa, 2018).

Variable Pairs		τ	p
Success	Location: Farshore	-0.336	< 0.002
Success	Communication Problems	-0.335	< 0.001
Success	Schedule Problems	-0.328	< 0.001

Table 1: Kendall Correlation of Variable Pairs, $|\tau| \geq 0.3$

Of all the outcome-related measures, success summarizes other measures. Indeed, it correlates negatively with communication problems and schedule. These correlations are not surprising and serve as partial verification of the consistency of respondents' answers. Farshore location correlates negatively with success; it suggests that location could have an effect on success (and its correlates). To examine these further, we must test the

hypotheses.

Analysis of Hypotheses

For null hypotheses, $H_0^i: P(x > y) = P(x < y)$, where $i \in \{1, \dots, N\}$ in the list of hypotheses and $(x, y) \in \{ (Agile, Structured), (Nearshore, Farshore), ((Nearshore, Farshore) | Agile) \}$, we provide the mean, variance, T-Test, χ^2 Test, and histogram. We also show which of them can be rejected because $p < 0.05$. For any rejected hypotheses, we accept their alternatives, $H_0^i: P(x > y) \neq P(x < y)$.

Table 2³ summarizes the Location = (Nearshore, Farshore) results.

<i>i</i>	Null Hypothesis	Location	Count	μ	Histogram	T-Test	<i>p</i>	Reject		
1	Meeting frequency (5+, 3, 2 1, <1 times a week)	Nearshore	40				3.4286	0.18009	No	
		Farshore	40							
2	Communication problems (1:Never - 5:Most Times)	Nearshore	39	2.154		0.97645	0.00047	25.4993	2.90E-06	Yes
		Farshore	40	2.975		1.07387				
3	Business day overlap (Sufficient, Adequate, NA)	Nearshore	40				0.5862	0.74594	No	
		Farshore	40							
4	Asynchronous communication (Sufficient, Complementary, Not)	Nearshore	40				2.0591	0.35717	No	
		Farshore	40							
5	Collaboration types: Async, Sync, Both	Nearshore	40				5.9935	0.04995	Yes	
		Farshore	40							
6	Agile or Structured	Nearshore	40				0.2133	0.64417	No	
		Farshore	40							
7	Ways to define products: Docs, Meetings, Other	Nearshore	37				1.2859	0.52573	No	
		Farshore	39							
8	Project management effort (1:Less - 5:More)	Nearshore	38	3.368		0.59401	0.02540	6.2911	0.04304	Yes
		Farshore	40	3.750		1.00639				
9	Success (1:Never - 5:Most Times)	Nearshore	39	3.769		0.81983	0.00117	11.9226	0.00258	Yes
		Farshore	40	3.125		0.96576				
10	Higher Cost (1:Never - 5:Most Times)	Nearshore	37	2.595		0.96937	0.02409	10.1113	0.00637	Yes
		Farshore	40	3.100		1.12774				
11	Schedule (1:Never - 5:Most Times)	Nearshore	39	2.487		0.97916	0.00546	0.0072	0.01358	Yes
		Farshore	39	3.128		1.12810				
12	Quality (1:Low - 5:High)	Nearshore	38	3.526		0.90045	0.00378	0.0183	0.02399	Yes
		Farshore	40	2.900		1.05733				

Table 2: Location Hypotheses Summary

The null hypotheses we reject are $H_0^i: i \in \{2,5,8,9,10,11,12\}$; or, communication problems, collaboration types, project management effort, success, cost, schedule, and quality. The Shapiro-Wilk Test shows that the response frequency counts are normally distributed for the success and quality hypotheses; hypotheses 2, 5, 8, 10,11 have a large enough sample size to assume normality. The single tail, heteroscedastic T-Test for each of these rejected hypotheses shows that the differences between $\mu_{Nearshore}$ and $\mu_{Farshore}$ are statistically significant (Hays & Winkler, 1970).

Table 3 shows the Methodology = (Agile, Structured) results.

³ Some cells in this and other tables are empty because the calculations make no sense—such as the mean of a categorical variable.

<i>i</i>	Hypothesis	Methodology	Count	μ	Histogram	σ	T-Test	<i>p</i>	Reject	
1	Nearshore or Farshore	Agile	50					0.5020	0.64417	No
		Structured	30							
2	Meeting frequency (5+, 3, 2 1, <1 times a week)	Agile	50					2.2857	0.31891	No
		Structured	30							
3	Communication problems (1:Never - 5:Most Times)	Agile	50	2.680		0.93547	0.14316	1.7035	0.19184	No
		Structured	29	2.379		1.32055				
4	Business day overlap (Sufficient, Adequate, NA)	Agile	50					0.9041	0.63632	No
		Structured	23							
5	Asynchronous communication (Sufficient, Complementary, Not)	Agile	50					1.5288	0.46561	No
		Structured	30							
6	Collaboration types: Async, Sync, Both	Agile	50					2.0473	0.35927	No
		Structured	30							
7	Ways to define products: Docs, Meetings, Other	Agile	48					1.7648	0.41379	No
		Structured	11							
8	Project management effort (1:Less - 5:More)	Agile	50	3.640		0.77618	0.16182	1.6990	0.37776	No
		Structured	28	3.429		0.95950				
9	Success (1:Never - 5:Most Times)	Agile	50	3.460		0.90824	0.16182	0.0542	0.81729	No
		Structured	29	3.414		1.01831				
10	Higher Cost (1:Never - 5:Most Times)	Agile	49	3.122		0.94940	0.00349	32.7158	7.87E-08	Yes
		Structured	28	2.393		1.16553				
11	Schedule (1:Never - 5:Most Times)	Agile	49	2.857		0.88976	0.32276	1.3853	0.34055	No
		Structured	29	2.724		1.38607				
12	Quality (1:Low - 5:High)	Agile	50	3.200		0.96890	0.47772	0.6637	0.58145	No
		Structured	28	3.214		1.13389				

Table 3: Methodology Hypotheses Summary

The only null hypothesis that can be safely rejected is cost. The single tail, heteroscedastic T-Test for the rejected hypothesis shows that the difference between μ_{Agile} and $\mu_{Structured}$ is statistically significant, indicating Agile costs are higher. For this hypothesis only, the distribution of the response frequency counts is also normally distributed.

Table 4 summarizes results where the Location = (Nearshore, Farshore), given Agile is the assumed methodology.

<i>i</i>	Null Hypothesis	Location	Count	μ	Histogram	T-Test	<i>p</i>	Reject		
1	Meeting frequency (5+, 3, 2 1, <1 times a week)	Nearshore	23				0.6734	0.41187	No	
		Farshore	25							
2	Communication problems (1:Never - 5:Most Times)	Nearshore	23	2.435		0.94514	0.02232	18.4484	0.00010	Yes
		Farshore	26	2.962		0.82369				
3	Business day overlap (Sufficient, Adequate, NA)	Nearshore	23					1.0703	0.58557	No
		Farshore	26							
4	Asynchronous communication (Sufficient, Complementary, Not)	Nearshore	23					0.4102	0.81457	No
		Farshore	26							
5	Collaboration types: Async, Sync, Both	Nearshore	23					3.9079	0.14171	No
		Farshore	26							
6	Ways to define products: Docs, Meetings, Other	Nearshore	22					2.9193	0.23231	No
		Farshore	25							
7	Project management effort (1:Less - 5:More)	Nearshore	23	3.348		0.57277	0.00362	4.7405	0.02946	Yes
		Farshore	26	3.923		0.84489				
8	Success (1:Never - 5:Most Times)	Nearshore	23	3.870		0.75705	0.00076	8.7797	0.01240	Yes
		Farshore	26	3.077		0.89098				
9	Higher Cost (1:Never - 5:Most Times)	Nearshore	22	2.773		0.92231	0.00545	7.8857	0.01939	Yes
		Farshore	26	3.462		0.85934				
10	Schedule (1:Never - 5:Most Times)	Nearshore	23	2.435		0.78775	0.00028	10.3104	0.00577	Yes
		Farshore	25	3.280		0.79162				
11	Quality (1:Low - 5:High)	Nearshore	23	3.652		0.71406	2.76923	11.1634	0.00377	Yes
		Farshore	26	2.769		0.99228				

Table 4: Agile and Location Hypotheses Summary

As in the earlier set of null hypotheses involving location, when we assume Agile methodology, the same

hypotheses are rejected—there is no difference in: success, cost, project management effort, schedule, quality, and communication problems. In addition, success, cost, schedule, and quality are normally distributed and a single tail, heteroscedastic T-Test shows that their means have a statistically significant difference in all cases except quality.

Table 5 compares the means of the total dataset and Agile-only, for normally distributed variables. The purpose of the comparison is to get a directional indication if an Agile strategy can affect outcomes—it is not to compute quantitative differences in methodologies.

<i>i</i>	Null Hypothesis	Location	μ (All)	μ (Agile)	μ (All) - μ (Agile)	Agile Higher
1	Success (1:Never - 5:Most Times)	Nearshore	3.769	3.870	-0.1003	Yes
		Farshore	3.125	3.077	0.0481	No
2	Higher Cost (1:Never - 5:Most Times)	Nearshore	2.595	2.773	-0.1781	Yes
		Farshore	3.100	3.462	-0.3615	Yes
3	Project management effort (1:Less - 5:More)	Nearshore	3.368	3.348	0.0206	No
		Farshore	3.750	3.923	-0.1731	Yes
4	Schedule (1:Never - 5:Most Times)	Nearshore	2.487	2.435	0.0524	No
		Farshore	3.128	3.280	-0.1518	Yes
5	Quality (1:Low - 5:High)	Nearshore	3.526	3.652	-0.1259	Yes
		Farshore	2.900	2.769	0.1308	No
6	Communication problems (1:Never - 5:Most Times)	Nearshore	2.154	2.435	-0.2809	Yes
		Farshore	2.975	2.962	0.0135	No

Table 5: Comparison of Means

The comparisons show that for nearshore development, when compared to the population as a whole, Agile methodology has better success, lower PM effort, and higher quality; it also had higher costs and communication problems (see final column, “Agile Higher”). Agile farshore development had lower success, greater PM effort, more schedule problems, and lower quality, when compared to the combined population of Agile and Structured development. Likelihood of cost increases was higher in both near and far, but Agile farshore software development showed the largest increase. In summary, when isolating Agile-only software development, the same characteristics are evident as in the overall dataset, just more pronounced.

In conclusion, the analysis shows that:

- A nearshore location for outsourcing of software development results in statistically significant desirable differences in overall success, lower cost, lower Project Management effort, maintaining schedule, higher quality, and fewer communication problems.
- Agile software development results in statistically significant increased cost. It has no statistically significant effect on any other variable we measured.
- Holding Agile methodology constant does not alter nearshore location effects, but it was associated with more negative outcomes already found in farshore software development while emphasizing the positive ones. As expected, Agile was correlated with greater cost risk generally but had a stronger effect on farshore.

Interviews

To seek underlying motivations and insights about our quantitative findings, we interviewed six survey respondents. As noted in Data Collection, their roles and locations were diverse. Responses were inductively coded and summarized in Table 6, with a count of the codes mentioned by the interviewees during the one-on-one interview.

Question	Responses [count of mentions]
Outsourcing nearshore motivations	Cost [4]. Cultural affinity [2]. Talent [4]. Flexibility & Availability [2]. Communication [1]. Complex systems better done nearshore [1]. Local market knowledge [2].
Outsourcing farshore motivations	Flexibility & Availability [1]. Cost [2]. Talent [3]. Resources [1] Schedule [1]. Round-the-clock work [1]. Local market knowledge [1].
Reasons for using location	Nearshore: Support [2]. Cost [1]. Talent [1]. Farshore: Software development [1]. Talent [2].
Accommodations for outsourcing	Farshore: limited synchronous communication [1]. Project leader nearshore to assist farshore team [1]. Business day time-shifting [3]. Invest in cultural alignment, often neglected with vendors [1]. Collaboration tools [5]. SLAs [1].
Observed nearshore success	Yes [5].
Reasons for nearshore success	Cost [1]. Efficiency [3]. Quality [1]. Responsiveness [1]. Better adherence to schedule [1]. Cultural affinity [1]. Better communication [4]. Farshore more transactional [1]; more difficult [1].
Reasons for firm's methodology	Agile: Flexibility [4]. Responsiveness [5]. Vendor accountability [1]. Transparency [1]. Honest conversations, team cohesion/dynamics [2]. Better quality [1]. Fits startup paradigm [1]. Develop internal capabilities [1]. Structured: good for outsourcing [1]
Reasons for higher Agile costs	Requirements changes [3]. Work aborted [2]. Cost of quality underestimated at outset [1]. Communications intensive [3]. Product-market fit [2]. Error-prone process [2]. Side-tracked by short-term issues [1]. Less advance planning and estimation [2]. Inexperience [2].
Constraints of Agile	Need good project management [1]. Team size should be smaller [1]. Complex [1]. Alignment with methodology [3]. May not be suited for entirely new product [1]. Requires constant communication [1]. Collaboration tools a must [1]. Agile expensive when project requires high-communication-mode (in definition or endgame) [1]. Partner readiness [1].
Benefits of Agile	Managing complexity [2] and uncertainty [3]. Flexibility and responsiveness [4]. Quality [3]. Product-market fit [2]. Transparency [1]. Team participation [1].
Projects/firms suited for Agile	Requirements ambiguity [3]. Complex applications [1]. Customer-facing products [2].
Projects or firms best suited for Structured	Well-defined features [1] and timelines [1]. New products [1]. Traditional industries and public sector [1]. Need to interface with non-Agile teams [1]. Language or communication barriers [1]. Backend projects [2].

Table 6: Interview Answers Summary

All interviewees cited some form of arbitrage as a reason for outsourcing. Cost arbitrage was mentioned by all as a motivation in many questions; talent and the ability for vendors to flexibility scale up (and down) resources were other oft-cited arbitrage strategies. A few mentioned access to local knowledge for outsourcing nearshore and farshore but some others were unaware of this motivation.

We asked interviewees if they had seen positive outcomes from nearshoring and if they could explain such outcomes. All of them had observed positive results from nearshoring, in either some or all of the measures we tracked. One manager even had a direct comparable: when he began his development work in Paris, France, he had an outsourced nearshore team based in Eastern Europe. Subsequently, he moved his operations to Seattle, USA, thereby transforming the same development team to an farshore one. He observed decreased efficiency, increased Project Management effort, and more communication problems, despite the fact that he had worked with this same team for over a year and had established a strong rapport with them. Thus, it seems the added stress and overhead of temporal distance are impediments to success. This sentiment was affirmed by other interviewees.

We asked interviewees if they had noticed increased costs arising from Agile development. Some had not and postulated that perhaps the question was improperly understood by the respondents. A plurality of

interviewees, however, felt that increased costs (compared to budget) arising from Agile methodologies were plausible because Agile product specification tended to be less precise than Structured; as the Agile development unfolded, new features or other requirements would emerge, often as unbudgeted work. Worse, some work could be discarded. Many noted the increased cost of communication, often involving the entire team for meetings. Lack of experience with Agile was cited as another culprit.

Overall, though changing requirements was considered a positive characteristic because it resulted in a final product that would meet end-user expectations.

Agile was lauded for its flexibility, transparency, product-market fit, suitability for complex projects, and team engagement; but it requires intensive communication and project management. The importance of training and investing in team alignment around methodologies and processes to mitigate ill effects was noted. Structured methods had their place for well-defined projects.

Discussion

Our research questions were:

RQ1: In the outsourced IT Software Engineering industry, what is the effect of outsourced development team location (nearshore vs. farshore) on: 1) Meeting frequency; 2) Communication problems⁴; 3) Business day overlap; 4) Asynchronous communication; 5) Collaboration types; 6) Methodology; 7) Ways to define products; 8) Project management effort; 9) Success; 10) Cost; 11) Schedule; 12) Quality.

RQ2: In the outsourced IT Software Engineering industry, what is the effect of software development methodology on: 1) Location (nearshore vs. farshore); 2) Meeting frequency; 3) Communication problems; 4) Business day overlap; 5) Asynchronous communication; 6) Collaboration types; 7) Ways to define products; 8) Project management effort; 9) Success; 10) Cost; 11) Schedule; 12) Quality.

RQ3: In the outsourced IT Software Engineering industry where the development methodology is Agile, what is the effect of outsourced development team location (nearshore vs. farshore) on: 1) Meeting frequency; 2) Communication problems; 3) Business day overlap; 4) Asynchronous communication; 5) Collaboration types; 6) Ways to define products; 7) Project management effort; 8) Success; 9) Cost; 10) Schedule; 11) Quality.

Our quantitative results indicate that outsourcing temporal distance is a greater determinant of outcomes than development methodology. Since success is correlated with other outcomes, temporal distance affects other outcome-related variables such as cost, lower PM effort, maintaining schedule, higher quality, and fewer communication problems. These findings are consistent with motivations for nearshore GSD, as noted in the literature and cited in section, *Outsourced Nearshore Software Development*. Development methodology, however, appears to influence higher costs. We thus confirm the relative insignificance of methodology on outsourced GSD.

In prior research of GSD, there has been a focus on outsourcing as a means for managers to arbitrage costs (both labor and infrastructure), obtain access to talent, and lower the risk of hiring expensive employees in advanced economies.

To the extent that these advantages can be obtained either nearshore or farshore, outcomes can be meaningfully improved by preferring temporally-near locations—i.e., within five hours of the primary development center. Thus, lower costs, higher quality, and timely schedules can be better attained with nearshore outsourcing compared to farshore. This conclusion reflects similar findings by other researchers as described in the literature review.

Development methodology has a statistically significant effect on expected costs, in that budgets are more likely to be exceeded with an Agile methodology. As some interviewees pointed out, this might not be an adverse outcome, if the resulting project better meets the needs of the business. That said, some organizations may have strict controls on costs, in which case an Agile approach that could result in higher costs may be unattractive. To the extent that software development projects are well-suited to Structured methods—for instance, if requirements are static or are generally well-known—then an Agile approach could be declined with no loss because our findings indicate that methodology does not seem to affect outcomes.

While development methodology may not be a strong determinant of outcomes (some researchers found it was not an independent variable (Estler, et al., 2014)), a few highly desired attributes of Agile development, such as intensive communication and project management effort, may be undermined by choice of outsourced location. That is, farshore outsourcing seems to be associated with communication problems and less frequent

⁴ The boxed outcomes indicate statistically significant effects.

meetings, both of which are quintessentially Agile. So, given management strategies such as farshore/nearshore or infrequent meetings/asynchronous communication, the development methodology may be determined.

Software development, as an intellectual activity with objective inputs and outputs, seems well-suited for outsourcing—yet temporal distances can affect outcomes. The implication of these findings is that nearshoring can increase the prospect of attaining positive outcomes; and, conversely, farshoring can decrease the likelihood.

In any case, arbitrage strategies must be implemented with accommodations for those combinations of choices that are likely to cause problems. Particular care should be paid to alleviating likely problems in communication.

Further Research

In software development, it has long been posited that methodology is a determinant of success (Boehm, 1981); in particular, Agile methods for insourced, onsite development have been associated with successful outcomes (VersionOne, 2017). However, methodology does not appear to be a strong determinant of outcomes in the outsourced software development industry when the location is either farshore or nearshore. In studying determinants of outcomes, researchers should be aware that location can supersede the impact of methodology. This observation opens up a broader question: could location be a significant impact on insourced development, too? If not, to what extent does a firm's internal culture mitigate these potential impacts?

Distributed software development has been found to increase the cost of communication and risk of problems (Espinosa & Carmel, 2004). According to the Allen Curve, even small distances can impede the flow of communication in research and development (Allen, 1984). So, with distributed teams, does the deterioration in communication (and successful outcomes) increase monotonically from proximity to nearshore and thence to farshore as predicted by the Allen Curve, or does it perhaps fall off more precipitously with temporal distance? Allen has stated to the effect that quality of relationships determines the quantity of communication, rather than available technology (Allen & Henn, 2006). Is this true in software development, even with all the new social media-based tools available, such as Slack, JIRA, and others? And even though we have focused on temporal proximity, could geographic proximity further impact outcomes?

If methodology is not an independent variable or at least not a strong determinant of outcomes, it's possible that other variables—for example, type of communication—are. Other factors such as project size, project complexity, team experience could also be determinants. Research to determine independent variables that might affect methodologies and outcomes could be fruitful. Our research provides a starting point in identifying frequency of meeting, communication type, or ways to define products, as potential independent variables. Characterizing such impacts on methodology could help managers adapt methodologies to operational conditions.

Customer Implications

In outsourced software development, temporal distances matter. Our research indicates that nearshore is an adaptation to these distances that alleviates some deleterious effects.

By the same token, it suggests that for farshore development, teams should not try to duplicate the communication practices that are successful when team members are nearby (e.g., onsite development).

For customers of outsourced offshore software development, the research indicates that they should select their outsourcing location carefully, favoring temporally nearer locations over farther ones, since time difference is a stronger determinant of success (and its related outcomes) than methodology. Furthermore, development methodology is not a highly significant determinant of success in outsourced software development—a project can be just as successful with traditional, structured management techniques. In fact, structured development seems to be more effective at keeping costs aligned to budgets. What this means in practice is that managers should have reasonable expectations about the broad applicability of Agile methods to outsourced farshore projects, since Agile requires intense synchronous communication. For nearshore development, we confirmed that Agile methodology has better success, lower PM effort, and higher quality at the cost of higher costs and communication problems. In Agile, the likelihood of cost increases was higher for near and far, but Agile farshore software development showed the largest increase.

Agile farshore development had lower success, greater PM effort, more schedule problems, and lower quality. On the other hand, farshore development may be successful given the proper accommodations, such as greater use of asynchronous communication and more formal definition of product requirements. In fact, one experienced manager claimed that some projects, perhaps those of a routine nature or with limited end-user

engagement, may be best managed using Structured methodologies and outsourced farshore to optimize costs. Finally, managers may wish to adapt their development methodology to accommodate management choices such as meeting frequency or intensive use of asynchronous communications. In other words, a strict application of Agile may not always be appropriate. Table 7 summarizes the main findings for methodology and location of interest to customers of outsourced offshore software development.

Software Development Methodology	
Agile Higher costs (vs. budget)	Structured More predictable costs (vs. budget)
Outsourcing Location	
Nearshore Higher success Higher quality Lower schedule risk Less PM effort Fewer communication problems	Farshore More PM effort Schedule risk Quality risk More communication problems

Table 7: Methodology and Location Findings

Threats to Validity

Internal threats to validity include sampling methods, selection biases and survey construction. We discuss these in turn.

Sampling methods for finding respondents and interviewees may jeopardize validity. For example, among other sources, we used the connections on LinkedIn of the principal investigator, which could result in an unrepresentative sample. However, we partially addressed this by public postings on social media with relevant hashtags to reach different audiences.

Selection biases of respondents could also affect validity in that it's possible those with strongly held opinions would be more likely to respond to the survey or interview. Similarly, interviews may have been conducted with individuals not representative of customers. These threats are common to studies that employ the survey-and-interview methodology and often cannot be easily mitigated. However, our practice of asking qualifying questions to eliminate unqualified respondents is a step in that direction as was the heuristic of selecting interviewees from diverse backgrounds.

Survey granularity and respondent interpretation of both survey and interview questions are a hazard to validity. For example, we required respondents to select either Nearshore or Farshore as the outsourcing location, deliberately avoiding a hybrid in which an outsource team could be in more than one location.

There was no option for finer gradations of Nearshore, such as a team located in the same time zone, but physically separated. Further, how respondents subjectively interpreted the survey's Likert items could affect validity: what is "low" to one person may well be "medium" to another. To reduce differences of interpretation, we provided examples or definitions of the Likert values. And, by forcing respondents to choose between Nearshore or Farshore, we intended that they would strive for internal consistency in answering subsequent questions. Our correlation tests suggest that ambiguity was minimal and interviewee answers consistency attained.

Among external threats to validity are survey coverage and responsiveness—that is, does the survey data permit generalization and did the non-respondents possess characteristics that were not present to the same degree in the respondents? We attempted to both survey and interview a diverse group of experts as described in Selection of Participants, so we believe risks to validity from coverage are minimized. We received 80 qualified responses from a broad range of roles and companies, which should mitigate the threat of poor responsiveness. Still, we cannot eradicate these risks.

Interviewer effects are a well-known threat to validity (Lavrakas, 2008). We attempted to minimize these by adhering to the interview question script. Since the interviews were conducted under a variety of conditions, such as in-person or via telephone, we were exacting about signaling when the formal interview began and ended, so that other discussion topics would not be commingled.

We also declined to express opinions or provide leading commentary. However, for clarity's sake, we did

periodically verbally summarize the interviewees' statements. Nevertheless, we cannot guarantee that interviewer effects were completely suppressed.

Conclusion

We studied the effects of temporal distance and methodology on outsourced GSD using a survey of 80 respondents, interviewed 6 of them, and analyzed the correlations between location or methodology and success, cost, Project Management effort, schedule, quality, communication problems, team meeting, business day overlap, asynchronous communication, collaboration type, and ways to define products. We found that Nearshore has a positive effect on cost, lower Project Management effort, maintaining schedule, higher quality, and fewer communication problems. These findings are consistent with the literature on outsourcing nearshore (Oshri, et al., 2009). Šmite stated that "nearshoring is an alternative solution that may enable more successful collaboration, although it may not result in the cost-savings intended" (Šmite, et al., 2010). Our research, however, confirms the finding of improved communications in nearshore outsourced GSD and that there are still cost savings over far offshore outsourced GSD. In-depth interviews confirmed that customers experienced superior outcomes such as higher quality, greater flexibility, and efficiency with nearshore development.

We found that Agile development methodology influences higher cost. But we confirmed the outcomes in outsourced nearshore GSD that users of Agile have long assumed: greater success and quality compared to farshore. Moreover, we determined that development methodology is not a highly significant determinant of success in outsourced software development. Projects using traditional, structured management techniques can be quite successful and seem to be more effective at keeping costs aligned to budgets. Thus, broad application of Agile methods to outsourced farshore projects may not be warranted because of the need for intense synchronous communication. Since our study is limited to the outsourced GSD, its conclusions may not apply to insourced or onshore. Our methodology may have limitations such as interviewer bias, surveyee selection bias, survey granularity and others.

For customers of outsourced GSD, one useful insight is that if they are constrained to use an Agile methodology in outsourced software development, nearshoring is a better choice than farshoring.

In conclusion, we found advantages to nearshore development, especially in combination with Agile methods, but that costs could increase with the employment of Agile development methodologies.

Appendix A: Survey Questions

Aside from a consent agreement, qualifying questions and contact questions, the survey consisted of the following (* indicates mandatory):

1. The number of employees in my company is:
 - 1 - 99
 - 100 - 999
 - 1000 - 9999
 - 10,000 or more
2. Which of the following best describes your IT job role?
 - Software Developer
 - Technical Lead or Architect
 - Manager or Project Manager
 - Product Owner
 - CIO or similar executive level
 - Other (please specify)
3. Our outsourced development team is primarily:
 - Nearshore (i.e., 5 hours' time difference or less)
 - Farshore (i.e., more than 5 hours' time difference)
4. We have development team meetings with outsourced team members:
 - Daily or more frequently
 - Three times per week
 - Twice a week
 - Once a week
 - Less than once a week
5. Communication was a problem...

- 1 – Almost never 2 – Never to half 3 – About half the time 4 – Half to Most 5 – Most of the time
6. We see better results working with outsourced team members when:
- There is sufficient overlap in the business day to allow all team members to meet at least once
 - There is enough overlap in the day to allow some team members to meet
 - Team members don't need to meet daily, so overlaps aren't important.
7. Asynchronous communication (i.e., participants not always active at same time) using messaging or email with the outsourced team is:
- Sufficient for most of our development work (more than 80% of communication is done with these tools)
 - Complementary for development work (40% - 80% of communication)
 - Inadequate for most development (less than 40%)
8. Collaboration among insourced and outsourced team members is mostly:
- Asynchronous (i.e., participants not simultaneously active), using email or messaging
 - Synchronous, using tools such as video conferencing
 - More or less equally synchronous and asynchronous
9. Our software development methodology is:
- Mostly Agile (i.e., iterative, where requirements & solutions evolve via collaboration between self-organizing cross-functional teams).
 - Mostly Structured software development (i.e., requirements and designs are defined in advance with formal interfaces and specifications).
 - Equally Agile and Structured
10. The most important ways we define product details and work to be done are (please rank):
- Shared documents (e.g., Word files or Wikis)
 - Meetings (in person or virtual)
 - Other (e.g., asynchronous)
11. The effort to manage outsourced projects is usually...
- | | | | | |
|------------------------|---------------------------------|--------------------|---------------------------------|------------------------|
| 1 – Less than expected | 2 – Somewhat less than expected | 3 – About expected | 4 – Somewhat more than expected | 5 – More than expected |
|------------------------|---------------------------------|--------------------|---------------------------------|------------------------|
12. Our outsourced projects are usually successful (i.e., meet time, cost, feature objectives) ...
- | | | | | |
|------------------|-------------------|-------------------------|------------------|----------------------|
| 1 – Almost never | 2 – Never to half | 3 – About half the time | 4 – Half to Most | 5 – Most of the time |
|------------------|-------------------|-------------------------|------------------|----------------------|
13. The costs of our outsourced projects are higher than expected...
- | | | | | |
|------------------|-------------------|-------------------------|------------------|----------------------|
| 1 – Almost never | 2 – Never to half | 3 – About half the time | 4 – Half to Most | 5 – Most of the time |
|------------------|-------------------|-------------------------|------------------|----------------------|
14. Our outsourced projects have schedule problems...
- | | | | | |
|------------------|-------------------|-------------------------|------------------|----------------------|
| 1 – Almost never | 2 – Never to half | 3 – About half the time | 4 – Half to Most | 5 – Most of the time |
|------------------|-------------------|-------------------------|------------------|----------------------|
15. The quality of our outsourced projects is:
- | | | | | |
|---------|--------------------|-------------|---------------------|----------|
| 1 – Low | 2 – Low to Average | 3 – Average | 4 – Average to High | 5 – High |
|---------|--------------------|-------------|---------------------|----------|

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