Ambidexterity and Global IS Project Success: A Theoretical Model

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Abstract

Increasingly more IS projects are globally dispersed. As a result, the success of IS projects can be affected by various global boundaries such as geographical distance, time separation, organizational boundaries and cultural differences. At the same time, system requirements dynamism significantly undermines global IS project performance because it is difficult for global teams to effectively sense and respond to changing system requirements. Therefore, to deliver quality systems on time and within budget in today's dynamic, global environments, process, people, and technology employed by IS projects need to simultaneously exhibit ambidexterity—i.e., both rigor and agility. Drawing upon prior literature and interview data from field studies, this research develops a theoretical model that explains and predicts global IS project success based on ambidextrous project capabilities. Specifically, the model identifies IS project rigor and IS project agility as two key IS project capabilities that moderate the negative effects of global boundary complexity and system requirements dynamism on global IS project success.

1. Introduction

Two important factors that determine high performance in a task are the nature of the task context and the nature of the task itself [1]. This is also true for global information systems (IS) projects, which are highly complex, dynamic, and contextualized tasks. Task context has been considered to be a core concept in understanding IS development and implementation [2]. Given current globalization and outsourcing/offshoring trends, many IS project contexts can be characterized as very global [3]. IS projects increasingly require complex, globally-distributed collaboration arrangements as organizations seek to develop and implement effective systems for users and customers around the world at lower costs by leveraging globally-dispersed internal or external resources [4]. Global IS projects are divided by various global team boundaries such as geographical distance, time separation, organizational boundaries and cultural differences. These global boundaries often co-exist in a given IS project and the resulting complexity of collaborating across these multiple global boundaries becomes an important risk factor for project success.

With respect to the task itself, the best word to characterize IS project work is "dynamism." System requirements are dynamic and volatile because of the inherent uncertainties involved in understanding the functional scope of a system, which has been characterized as the "feature churn" problem [5]. Furthermore, requirements volatility and conflict are also the result of competitive environment changes such as market factors, technological advances, competitive products, regulatory constraints, standards committees, corporate politics, marketing plans, research results, and financial conditions [6]. Constant system requirements changes during IS project lifecycles are the norm, rather than the exception. Furthermore, the negative effect of system requirements dynamism on project performance is larger for globally-dispersed projects than for collocated projects because it is much more difficult for global teams to effectively sense and respond to changing requirements. Therefore, effective management of changes is critical for IS project success.

Organizational ambidexterity, an organization's capacity to simultaneously demonstrate alignment and adaptability, has been associated with higher levels of organizational performance [7]. Similarly, successful project managers employ ambidextrous coping strategies to mitigate the adverse effects of global boundary complexity and system requirements dynamism on global IS project success [8]. This prior research suggests that successful global software development and implementation requires ambidextrous project capabilities that are not only flexible/agile but at the same time rigorous/disciplined in order to cope with complex challenges of global projects. For example, once certain coping strategies are adopted, a team has to comply with these strategies in a disciplined and rigorous way. At the same time, a team has to exhibit flexibility to adapt quickly and revise strategies when needed [8]. We refer to this project capability to employ both rigor and agility when managing IS work as "IS project ambidexterity".

In this research we develop a theoretical model that explains and predicts global IS project success based on direct and moderating effects of factors including complexity of global boundaries, system requirements

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dynamism, IS project rigor, and IS project agility. We formulate six propositions to guide further research in this area, articulate measurement guidelines for the key theoretical constructs, and offer general discussion about the research implications of our "global IS project success" model, including additional important research questions in this area and future research directions. We base our theoretical foundation on both prior literature and interview data from two previous field studies which included a number of global IS projects from large organizations [9, 10]. The first study involved semi-structured interviews of 22 global IS project managers from seven different companies who were located in seven different countries. The second study was conducted in a large U.S. semiconductor company.

The theoretical development we present in this study contributes to the IS research literature in a number of ways. First, we conceptualize the notion of complexity of global boundaries and proposes this construct as an important determinant of global IS project success. We also introduce the concept of IS project ambidexterity – i.e., IS project rigor and IS project agility – as a moderator of the effects of complexity of global boundaries and system requirements dynamism on global IS project success. In addition, we develop propositions that address the following two main research questions:

- How do complexity of global boundaries and system requirements dynamism affect global IS project success? and
- How does project management ambidexterity – rigor and agility – mitigate these effects?

Finally, we provide measurement guidelines to direct future empirical research in this area.

2. Development of a Theoretical Model

Our theoretical model intends to explain and predict global IS project success. This model identifies two important contextual determinants of global IS project success: complexity of global team boundaries, which is viewed as the most salient contextual characteristic for global tasks; and system requirements dynamism, which is viewed as the most significant task characteristic for global IS projects. Contemporary collaboration arrangements in global IS projects are characterized by complex configurations involving multiple global boundaries, including time zones, geographic distance, organizational boundaries and cultural differences. While much has been written about the challenges of bridging these boundaries or discontinuities to get the job done [11-13], not much has been argued about the complexity of global configuration arrangements. We argue in this study that it is this complexity that presents substantial challenges to global IS projects, more than the boundaries themselves.

The model then identifies a key IS project capability called IS project ambidexterity consisting of IS project rigor and agility as two moderating factors that mitigate the adverse effects of the two determinants on the dependent variable, global IS project success. We argue in this study that the difficulty in communicating and coordinating global work coupled with the dynamic nature of system requirements make it necessary for global collaborators to employ rigorous and agile project practices. Consequently, we posit that ambidexterity characterized by rigor and agility in project practices mitigates the adverse effects of complexity of global boundaries and system requirements dynamism. The proposed theoretical model of global IS project success is shown in Figure 1. Although this model presents a parsimonious model of global IS project success by focusing on the factors of interest, other important antecedents or control variables need to be included for a full-blown research model. These antecedents/control variables include system development methodology, project size/duration, personnel capabilities, user involvement, top management support, etc.

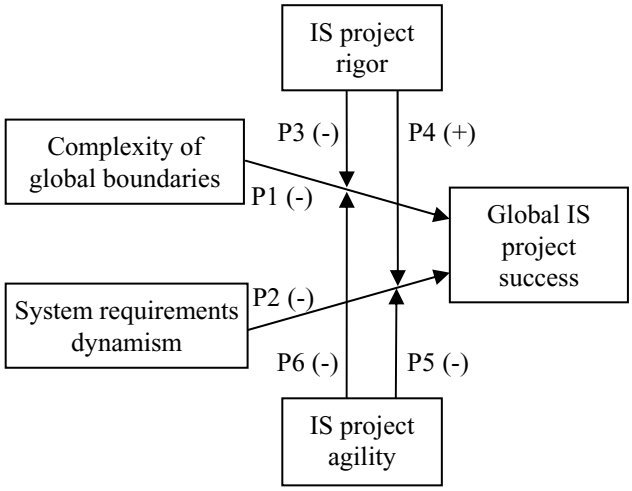

Figure 1: A model of global IS project success

2.1 Global IS project success

Prior literature suggests that IS project success consists of two different dimensions: process performance and product performance [14, 15]. Process performance refers to how well the IS project process has been undertaken. It is measured by on-time/on-budget completion of the project, user participation, team member satisfaction and morale, etc [15, 16]. Product performance refers to the performance of the system, including system quality, system functionality, system impact, and user satisfaction about the system. The DeLone and McLean IS Success Model [17] provides an

overall framework for measuring the dimensions of global IS success. Based on the outcomes measures that were most frequently cited by global IS project managers in a recent field study [9] our framework proposes the following measures of *global IS project success*: on-time completion, within-budget completion, project costs/effort, globally-dispersed resource utilization, and global coordination effectiveness for process performance; meeting system requirements and system quality for product performance.

2.2 Effect of complexity of global boundaries on global IS project success

Team members in globally distributed IS projects are generally separated by various global boundaries (e.g., time, distance, cultural, organizational, etc.). These boundaries create barriers that make it difficult for members to communicate and work together [12, 13, 18, 19]. While much attention has been paid to the effects of individual boundaries, we argue that it is the simultaneous presence of multiple boundaries that can make the global context of the task quite complex. How these various boundaries are distributed in a team can make a big difference. For example, one possible configuration is one in which a team spans a number of boundaries, but where team members separated by one boundary are also separated by most of the other boundaries. This is a typical configuration of the familiar outsourcing relationship between U.S. and Indian firms in which team members are in one of two locations and these locations are divided by organizational, distance, time zone, cultural and language boundaries.

While the literature suggests that such alignment of boundaries create deep "fault lines" that are very difficult to bridge [20], we have found evidence from field studies [21] that team members in dual locations can adjust and learn to operate in such configurations because the location, time, organizational, cultural and language differences, despite being substantial, are well known to all team members who then learn and adjust to these differences. In contrast, a team that operates in multiple (more than two) locations spanning multiple time zones, cultures, languages, and organizations experiences interactions that are more unpredictable. As one interviewee commented: "the factor of complexity increases tremendously when you not only have multiple companies and multiple internal divisions, but also they're spread across multiple regions, across multiple time zones, and also if they have cultural or language differences." When different team members are divided by different boundaries, the global boundary context of the team becomes more complex making it difficult for the whole team to find a rhythm and interaction style. We refer to this diversity of global boundary configurations in the team as the "complexity of global boundaries." We posit that complexity of global boundaries will negatively impact global IS project success.

While the complexity of global boundaries may sound like an intuitive concept, it is not easy to define the construct. A related concept found in recent research is "virtualness." Griffith et al. [22] suggests three dimensions that determine virtualness: (1) physical distance among team members; (2) level of technology support; and (3) percentage of time apart in the task. Kirkman and Mathieu [23] took this concept a step further and proposed "synchronicity" as one of their three fundamental dimensions of "virtuality", which more appropriately distinguishes between "real-time" and "lagged-time" interaction. Lu et al. [24] introduced the concept of "workplace mobility" to the mix to capture the extent to which team members work at various sites, telecommute and use mobile devices.

While these conceptualizations of virtualness are a step in the right direction, they don't completely capture the complexity of a global context, partly because they don't account for the number of geographic sites, time zones, cultures, languages and organizations represented in a team. More importantly, these concepts don't capture how these boundaries are distributed across the team, which affects how difficult it is to interact with team members. For example, as the number of sites represented in a project increases, it makes team interaction more difficult, but more so when the team operates in multiple time zones because this creates more complex workflow coordination challenges [10]. Thus we propose that the *global boundary complexity* can be characterized by: (1) the number of distance, time zone, culture, language, and organizational boundaries in a team; and (2) the dispersion of team membership across these boundaries—i.e., more widespread distribution of membership across boundaries increases coordination complexity.

One IS project manager in our field study mentioned that project managers tended to underestimate costs for global IS projects, failing to take complex global boundaries into account when preparing project budget plans. "I would think that it would be foolish to not take whatever mathematical calculation you have (for a domestic project) and start off with 1.5 times that budget and plan amount." Another project manager said that it took more time to finish his global project than planned due to communication difficulties: "it takes a lot longer time to figure out certain things that would probably get resolved by a 5 minute phone call … they dwell on the issue or problem for probably a week or two weeks." Taken all together, we propose:

Proposition 1. The complexity of global boundaries negatively affects global IS project success.

Measuring the complexity of global boundaries is not easy because the presence of various global team boundaries is often confounded (e.g., the number of development team locations is often highly correlated with the number of time zones). Therefore, we suggest measuring global boundary complexity using a multidimensional construct that includes the number of boundaries present in the team (e.g., number of sites, time zones, cultures, etc.), the dispersion of these boundaries (e.g., variance in distance, time separation, etc.), and the distribution of team membership across boundaries (i.e., whether members are widely scattered or concentrated within boundaries). Such a multidimensional approach will help to identify underlying dimensions that constitute the complexity of global boundaries.

2.3 Effect of system requirements dynamism on global IS project success

System requirements change continuously as it takes time for project teams to discover user needs. In addition, rapidly changing business and technology environments make system requirements volatile and dynamic throughout project lifecycles. Even if project teams freeze system requirements at one point in time during project execution, critical changes in business priorities and business processes are likely to result in system requirements changes that are too important to ignore.

One global IS project manager confirmed the impact of requirements dynamism: "I feel there is one factor that has impacted this project – mainly, the number of requirement changes that have happened in this project is huge. We have had about 35 changes to requirements, until as late as system testing." The impact of requirements dynamism on project success is magnified for global projects because it's difficult to coordinate a globally dispersed team to effectively manage changing requirements. This challenge associated with coordinating a response and the uncertainties inherent in global projects are our rationale for proposing dynamism as an important determinant of global IS project success.

In this research, *system requirements dynamism* is defined as rate of change in requirements for the system. System requirements dynamism has its theoretical underpinning from the notion of environmental dynamism in the organization theory literature. Environmental dynamism in general refers to rate of change in the external environment of the focal organization [25], which causes uncertainty [26], ambiguity [27], and variability [28]. Similar to environmental dynamism, system requirements dynamism causes uncertainty, ambiguity, and variability in an IS project and requires the project team to go after a moving target.

To respond to changes in system requirements, the IS project team is likely to require additional time, cost, effort and resources. Furthermore, the project team may not be equipped with adequate skills, knowledge, and experience to effectively respond to system requirements changes, particularly unpredictable ones. As a result, the system delivered by the project is likely to have defects and quality problems. Therefore, system requirements dynamism may exacerbate the historically low rate of IS project success. IS project managers have consistently identified system requirements change as one of the most critical risks in their software development and implementation effort [29].

Our field interview results confirmed the negative effects of system requirements changes on IS project performance. One project manager said, "If something changes, she would ask: OK, you just threw all this stuff at me … what do you want me to work on first because I can't do it all by the time you need it … what's your priority?" Another project manager stressed that system requirements changes caused tension between the client organization and the outsourcing vendor as it had a profound impact on project outcome. "Every time we ask for new deliverables or changes, we're always getting a lot of pushback from (the vendor) that they cannot meet our delivery dates." Given the literature support and empirical evidence, we propose:

Proposition 2. System requirements dynamism negatively affects global IS project success

To measure system requirements dynamism, we first need to identify most important types of system requirements. Prior literature has identified various classifications of system requirements such as technical vs. non-technical requirements, functional vs. non-functional requirements [30, 31]. Important system requirements include system scope, business processes, input data, output data, data structure/model, user interface, system response time, system throughput, security, reliability, and backup/recovery [32]. Different types of IS projects are likely to have different weights on these requirements. Once important types of system requirements are identified, dynamism can be measured by assessing rate of change in each type of system requirement.

2.4 Moderating effect of IS project rigor

The alignment dimension of organizational ambidexterity is defined as the "coherence among all the patterns of activities in the business unit" [7]. A similar concept has been identified in the software development context as "process consistency" defined as the consistent adoption of project management practices identified in Software Engineering Institute's Capability Maturity Model (CMM) [33]. Additionally, in previous field studies involving global IS projects, rigor was present in a variety of project practices including: more detailed system requirements documentation, a single formal project delivery process, common technological environments and stronger project controls [8]. Therefore, for the purpose of our ambidexterity research framework, we define *IS project rigor* as the strict adherence to detailed, IS project process and structure across all project sites.

Global boundaries increase project coordination complexity and the risks of errors, delays and higher costs in global IS projects. However, rigorous adherence to project processes and structure can reduce these risks by eliminating process variability and minimizing need for coordination. Therefore, rigor mitigates the negative impact of the complexity of global boundaries on global IS project success. One global project manager summarized the importance of rigor in global IS projects as it relates to project success, "I don't want to make it too simplistic but, good communication, strong project management and common processes are the keys that make projects successful from my standpoint."

Support for these key project success factors was provided by comments from other project managers. For example, the importance of a structured communication schedule was highlighted in one project: "once we had that [the communication plan] determined, the project has been outstanding since then." Rigorous project tracking with frequent progress reviews was also important to success in global IS projects, as another interviewee commented: "the (project) dashboard is visible to people at my level as well as my boss, that's senior-management level, to quickly review, either once a week or once in two weeks, how the project is progressing against dashboard criteria that we want to review." Another project manager stressed the role of common processes that overcame geographic boundaries: "we have common processes for development of systems; so common processes are very, very key when you have dispersed locations. Everybody does the same thing the same way."

Effective global collaborators put more effort and rigor into formal documents and processes, as illustrated by these comments made by two participants: "when you work a distance from a client and with a geographically dispersed team, you have to have clearly written requirements" and "the fact that the programmer is not seated next to you makes you have to write specifications in much more detail." The key role of common, standardized hardware, software and tools were highlighted in two interviews: "I think one of the key things we have done is we have internally developed project management automation tools that we use globally from wherever we are;" and "we have an extranet with our offshore partner and they use the same hardware and software that we use."

In summary, strict adherence to common project goals and processes across global development sites mitigates the negative effects of the complexity of global boundaries and thereby enhances global IS project success. Therefore, we propose:

Proposition 3. IS project rigor moderates the negative effect of the complexity of global boundaries on global IS project success such that it mitigates this negative effect.

Although project managers have touted rigor as a strategy for reducing the risk associated with global boundaries, strict adherence to process structure is likely to inhibit a project's ability to adjust to changes in system requirements. Rigorous project processes often require detailed documentation and sophisticated project control, resulting in heavy, rigid processes. Heavy, rigid processes are not effective for coping with dynamic business environments. In fact, to be able to quickly respond to changing system requirements, agile software development methods such as Scrum and Extreme Programming tend to keep processes light and lean, requiring minimal documentation and formal project control [34].

Furthermore, since rigor emphasizes conformance to agreed-upon processes and arrangements, it creates organizational inertia. Rigor often makes it difficult for the project team to depart from established routines and norms. As a result, adaptation of project processes, staff, technology, and resources to meet changing system requirements and business needs can be slow and inefficient when project rigor is high. Taken together, we propose the following moderating effect of IS project rigor on the relationships between system requirements dynamism and IS project success:

Proposition 4. IS project rigor moderates the negative effect of system requirements dynamism on global IS project success such that it exacerbates this negative effect.

Adherence to project management practices ("rigor") is a key component of the Capability Maturity Model (CMM) for software development and implementation. Many of the rigorous process activities

and practices adopted by global IS project teams in the field studies [8] are consistent with CMM software development and implementation practices. Based on CMM and field research we propose that the consistent application of the following key project management practices comprises IS project rigor and should form the basis of measuring the construct:

- A standard software development process is adopted and used consistently by all project sites.
- Project activities are planned and documented.
- Team members sign off on their responsibilities.
- Team members approve system requirement documents and project goals.
- Project performance is tracked against planned targets and corrective actions are taken.
- Project team engages in formal communication.
- A common technological environment exists across project sites
- Training for developing the skills/knowledge needed to perform in software development is provided.
- Software development tasks are well defined and precisely allocated.

2.5 Moderating effect of IS project agility

Recently, agile software development methodologies have been proposed and developed to increase IS project's ability to determine initial system requirements and accommodate system requirements changes during project execution [34]. The rapid adoption of agile software methods by organizations speaks to the importance of agility in contemporary software development and implementation. Although agility is an emerging concept in the software development literature, it has been studied in various bodies of literature, including organization theory, strategic management, operations management, and project management for many years. Agility has been defined in many different ways as the concept is inherently complex, confusing, and multi-dimensional [35-37]. In this research we define *IS project agility* as the IS project's capability to anticipate, sense, and respond to system requirements changes with speed and efficiency. IS project agility enables project teams not only to reactively respond to given changes but also to proactively anticipate and prepare for future changes.

Agility is closely related to the notion of organizational dynamic capability. Dynamic capabilities refer to the organization's abilities to integrate, build, and reconfigure internal and external resources, competences and capabilities to address rapidly changing environments [38]. Recently, IS researchers have drawn on the dynamic capability perspective to study the notion of IS agility [35]. We view IS project agility as a dynamic capability that reconfigures IS project resources, processes, and skills efficiently and effectively so that new, emerging, changing system requirements can be easily incorporated into the system under development or implementation.

Changes in system requirements may cause significant time/cost overruns and if the team's response is not timely it may result in obsolete and/or irrelevant systems by the time the project is completed. Rigidity of IS project processes, people, and resources would exacerbate the negative effect of system requirement dynamism on IS project success. In contrast, agility is expected to mitigate this negative effect of system requirement dynamism on IS project success. When processes, people, and resources are agile, time/cost overruns and quality problems due to changing system requirements can be reduced. Agile teams can quickly reconfigure existing processes/resources to accommodate changes. Agility makes system adaptation to changed business requirements smooth with reduced friction.

Prior empirical research suggests a possible interaction between organizational agility and environmental dynamism for organizational performance. For example, Eisenhardt [39] and Judge and Miller [40] found that, in highly dynamic environments such as high-tech industries, speed in decision-making process was critical for organizational performance by making fast-changing competitive environment less threatening. Classical contingency theory asserts that different environmental conditions require different organizational characteristics [41]. The effectiveness of the organization is contingent upon the amount of congruence or goodness of fit between environmental conditions and organizational characteristics [42]. In particular, uncertain, dynamic environments require organic, flexible organizational structures [43]. Sambamurthy and Kirsch [2] argue that environmental context is a core concept in understanding IS development. One IS project manager we interviewed stressed that the project team's ability to sense any possible changes or issues was critical for project success because it allowed them to effectively manage project-related changes: "It [our communication channel] was always open for any issue. This was a must and not an option. The real communication between the programmers there and the users here was something that had to be constantly going on [in order to succeed in the project]." Considering theoretical reasoning and empirical support, we propose:

Proposition 5. IS project agility moderates the negative effect of system requirements dynamism on global IS project success such that it mitigates this negative effect.

The complexity of global boundaries makes project coordination difficult and uncertain [9]. Project coordination across multiple complex boundaries requires sophisticated communication and task programming. Furthermore, the dynamics of project coordination is very unpredictable due to interdependencies among sites. Therefore, when complex global boundaries exist, it becomes difficult to predict the effectiveness of a planned coordination process at the project inception phase. As a result, project process, staff, technology, and resources need to be constantly adjusted and adapted as the project unfolds, in order to best meet complex, dynamic coordination challenges. The more complex global boundaries are, the stronger the need for agile adaptation of project coordination. Therefore, we posit that IS project agility mitigates the negative effect of complexity of global boundaries on IS project success by enabling adaptation and evolution of IS project process over time.

Prior field studies suggest that global IS projects are often failing at some point in time even if they ended up succeeding [9]. One of the important reasons why some of these projects were found to be failing at mid-point was that the respective project teams did not initially understand what it took to succeed in globally-dispersed projects. Due to multiple, complex, global boundaries, their initial project processes based on simpler previous projects did not work out. However, these project teams managed to bounce back from interim failure by adapting their project processes, people, technology, and resources to complex environmental requirements. Without such adaptations, the projects would have been unsuccessful. For example, one project manager explained a key turning point in a global project: "Deadlines were set but scope was not defined and continued to change so strong governance was implemented to help manage scope and user expectations." Taken all together, we propose:

Proposition 6. IS project agility moderates the effect of the complexity of global boundaries on global IS project success such that it mitigates this negative effect.

IS project agility can be measured by assessing how quickly and efficiently an IS project team is able to anticipate, sense, and respond to various changes in system requirements so that the team adapts to changed business environments and requirements. While IS project agility can be viewed as a multidimensional construct including various dimensions such as range, extent, and cost of adaptation, time and cost appear to be the most important dimension that defines the construct [43-46]. The shorter time and lower cost the project team require to handle a given system requirement change, the more agile the project team is.

3. Research Implications

Our proposed theoretical model of global IS project success recognizes global boundary complexity and system requirements dynamism as two most significant challenges inherent in global IS projects. Informed by prior relevant literature and based on findings from previous field studies our model proposes ambidextrous project capabilities, namely rigor and agility, as important moderators.

The model provides the theoretical foundation for empirical research to test the direct effects of the complexity of global boundaries and system requirements dynamism as well as the moderating effects of IS project rigor and agility on the relationships between the two determinants and IS project success. Next steps in this line of research will include a survey study across numerous IS projects with varying levels of global boundary complexity and system requirements dynamism as well as a longitudinal study of one or more global IS projects.

In addition to the propositions developed in this paper, we propose to study an important related research question: What is the nature of the relationship between rigor and agility? As empirical data and prior literature suggest, we need to consider the following three views. First, rigor and agility may be negatively associated. Global IS project teams increase rigor by refining and optimizing system development and implementation processes, establishing norms and standard procedures for communication and coordination, and investing in specialized personnel, technologies, or facilities. However, these practices tend to reduce agility and make it difficult to respond to changing system requirements and business needs at a future time [47]. Rigor requires commitments from the project team to adhere to agreed-upon methodologies and processes which in turn are likely to increase bureaucracy that impedes agility.

Alternatively, rigor and agility could be positively related. Rigor may enhance agility by providing structures and platforms for making future changes go smoothly in an orderly manner. Systematic, streamlined project processes can facilitate orderly changes, preventing chaotic transitions. In particular, when projects are highly complex, making changes to existing work processes and/or systems under development in response to system requirements changes can go easily out of control. Having some degree of rigor helps coordinate geographically-dispersed project team members to cope with dynamic environments. Prior literature in strategic management also suggests that

strategies for agility and flexibility require some degree of commitment and rigor [48]. Our field studies have shown that agility-enhancing options can be embedded in process and technology structure in rigorously planned and executed global IS projects.

Finally, rigor and agility might be independent and orthogonal. Some prior literature has shown no statistical relationships among agility, quality, and efficiency [49]. With the extant knowledge based on prior literature, we cannot conclude which of the three views about the relationship between rigor and agility is the correct one. It is also possible that different conditions might dictate different interplay between rigor and agility. Future research needs to address this research question by examining the task contexts and characteristics under which rigor and agility are negatively/positively associated or independent.

Another important related research question that is worthy of study involves the antecedents to ambidexterity. Once organizations understand how ambidexterity affects global IS project success, they need to know what factors affect rigor and/or agility. Prior literature and our empirical study suggest several promising factors that would affect IS project rigor and agility. Factors like team autonomy, team diversity, modular software architecture, and agile software methods appear to positively affect IS project agility while negatively affecting IS project rigor [50]. For example, team autonomy, which is defined as decentralization of decision-making power to the project team that will actually implement the project, is expected to strengthen agility because the project team members are more sensitive and responsive to changes in environments than upper management would be. Furthermore, high levels of autonomy tend to generate higher variance, which, in turn, can increase adaptability to environmental changes [51]. IT workforce with greater autonomy has been found to be a key element for increasing systems adaptability [52]. Agile software development methods tend to value people over processes/tools, working software over comprehensive documentation, and responding to change over following a plan. In agile software development methodologies tacit knowledge is considered more important than explicit knowledge and informal communication is more useful than formal communication [34]. As a result, agile methods are likely to increase IS project agility but decrease rigor.

On the other hand, the adoption and implementation of CMM and project management routines would increase IS project rigor while decreasing agility. While some CMM requirements include project capabilities for continuous optimization and adaptation, CMM mostly emphasizes rigor over agility. Therefore, higher CMM levels are likely to result in higher rigor and lower agility. Established project management routines enhance consistency of project processes, thus increasing project rigor. However, these routines create organizational inertia and prevent project teams from adapting to changing external environments and requirements.

Most factors discussed above tend to improve one aspect of IS project ambidexterity at the cost of the other aspect of it. Consequently, an important research question is how an organization can improve both IS project rigor and agility simultaneously without compromising any of the two aspects of ambidexterity. Prior literature has proposed two promising approaches to achieving ambidexterity: the structural approach and the contextual approach [53, 54]. The structural approach achieves ambidexterity by separating teams or units so that some teams/units focus on rigor/alignment and other teams/units focus on adaptation/change. With this approach, ambidexterity is enhanced through division of labor and specialization. In contrast, the contextual approach achieves ambidexterity by establishing processes that empower individual employees to make judgments about the allocation of time between rigor-focused and agility-focused activities. Therefore, with this approach, ambidexterity is enhanced by time allocation of individual employees. In addition, our observation from field research suggests that prior experience with global IS projects is an important enabler in achieving both rigor and agility. Awareness of needs for both rigor and agility in global IS projects increased the likelihood of the experienced project team to develop IS project ambidexterity, compared to less experienced teams. Future research needs to address these research questions to inform researchers and practitioners of effective approaches and strategies for building ambidextrous, global IS project teams.

4. Conclusions

In conclusion, while IS managers who lead globally-distributed IS projects need to be forewarned that global boundaries and system requirements dynamism increase project risks, the application of project management strategies that enhance both agility and rigor in complex global projects can help global teams meet their goals and succeed. Understanding how to achieve ambidexterity in global IS projects is an imperative for global managers and developers.

This research contributes to the IS research literature by introducing important theoretical constructs such as complexity of global boundaries and IS project ambidexterity; developing a theoretical framework for future empirical research that will reveal the interplay among global boundary complexity, system requirements dynamism, IS project rigor, IS project agility, and global

IS project success; and providing guidelines for operationalization of the theoretical constructs.

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