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# A Research Framework for Investigating the Successful Configuration of Globally Distributed Agile Teams

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**Abstract**

*To combat the traditional challenges associated with software development, parallel interest is growing in agile methods and global software development through the use of virtual teams as potential solutions. Although in the past agile methods were not considered applicable to global projects, some current research suggests that this is no longer the case. Drawing upon extant literature, the purpose of this paper is to derive a research framework for investigating the dimensions which may lead to the successful configuration of globally distributed agile teams.*

*Keywords: globally distributed agile teams, agile software development, global software development, virtual teams, team configuration*

# Introduction

Currently, parallel interest is growing in the use of agile methods on one hand and global software development via virtual teams on the other as potential ways to alleviate the reoccurring problems associated with software development projects. Recently, there has been growing interest in combining the two in an effort to take advantage of the strengths of each. However, a potential conflict exists between the two approaches. A fundamental principle underlying agile methods emphasizes the need for colocated teams to participate in daily, face-to-face interaction (Fowler and Highsmith 2001). Global software development via virtual teams, however, relies to varying degrees on technology-mediated communications (Gibson and Cohen 2003). This raises the question of whether or not it is possible to successfully implement agile methods in globally distributed environments. There is a stream of research which suggests that it is (e.g., Kircher, Prashant, Corsaro, and Levine 2001; Schummer and Schummer 2001; Xiaohu, Bin, Zhijun, and Maddineni 2004). One issue that has not received specific attention, however, is the actual configuration of agile teams in globally distributed environments. Team configuration in these global settings is a complex phenomenon due to the many challenges which are not encountered within colocated teams (Herbsleb and Moitra 2001). Building upon the extant literature, the purpose of this paper is to propose a research framework for investigating three dimensions necessary for successfully configuring globally distributed agile teams.

# Literature Review

## *Agile Software Development Methods*

Highsmith and Cockburn (2001) contend that agile methods "view change from a perspective that mirror today's turbulent business and technology environment" (p. 120). The basic tenets of agile methods are outlined in a statement entitled the "Manifesto for Agile Software Development" and are guided by a set of twelve principles (Fowler and Highsmith 2001). Agile methods, however, do not explain simply one way of development, but rather a group of methods built on the idea of flexibility and adaptability (Abrahamson, Warsta, Sippon, and Ronkainen 2003). Examples of current agile methods include Extreme Programming (XP), Adaptive Software Development, Feature-Driven Development, and Scrum. Although numerous methods exist, two concepts lie at the heart of each of these methods: working code and effective people. Only through creativity, team work, customer participation, and continuous feedback can effective projects be completed on time and within budget (Highsmith and Cockburn 2001). Empirical studies have indicated that agile methods can help to improve the software development process (Abrahamson 2003; Abrahamson and Koskel 2004).

## *Global Software Development and Virtual Teams*

According to Damian and Moitra (2006), global software development is "becoming the norm in the software industry" (p. 17). Carmel (1999) defined global software development as teams working together to accomplish project goals from different geographic locations. The driving factors contributing to the this movement include: a large, talented global resource pool, proximity to the market, quick formation of virtual teams, "round the clock" development, cost advantages, and the need for flexibility (Carmel and Agarwal 2001; Damian and Moitra 2006). The result is that, "software development is increasingly a multisite, multicultural, globally distributed undertaking" (Herbsleb and Moitra 2001, p. 17). With this movement by many organizations, the pairing of virtual teams and globally distributed projects is becoming more common (Barkhi, Amiri, and James 2006**;** Crampton and Webber 2005; Sarker and Sahay 2004). In today's turbulent business environment, virtual teams enable greater organizational flexibility and the ability to respond quickly to change.

## *Agile Methods and Globally Distributed Environments*

Currently, there is limited research exploring the use of agile methods in globally distributed environments. However, there appears to be a growing interest in the issue of whether or not distributed software development can be agile (Agerfalk and Fitzgerald 2006; Ramesh, Cao, Mohan, and Xu 2006). This issue revolves around the significant difference in key tenets of agile and distributed development approaches. Agile methods tend to follow more informal processes, while distributed development relies heavily on formal mechanisms (Ramesh et al. 2006). Further contributing to this view is that proponents of agile methods insist that agile practices must be used in their entirety in order to be effective (Fitzgerald, Hartnett, and Conboy 2006). Consequently, up to this point, the prevailing viewpoint has been that agile methods cannot be applied in global software development (Holmstrom, Fitzgerald, Agerfalk, and Conchuir 2006). However, some research suggests that agile methods can be successfully implemented within global settings by tailoring individual practices (e.g., Kircher et al. 2001; Lee, Delone, and Espinosa, 2006; Schummer and Schummer 2001; Xiaohu et al. 2004).

# Research Framework

## *Configurational Theory*

There is a wide ranging base of literature utilizing configurational Theory (Miles and Snow 1978; Mintzberg, 1979, 1983). Configurations are basically patterns or characteristics that describe an entity. Meyer, Tsui, and Hinings (1993) defined a configuration to "denote any multidimensional constellation of conceptually distinct characteristics that commonly occur together" (p. 1175). Myer et al. suggested that work group design represents a possible group level configurational approach (Hackman and Oldham 1980; Hackman and Walton 1986). The latest iteration of the model indicates that team effectiveness is based on the following enabling conditions: real team, compelling direction, enabling structure, supportive organizational context, and available expert coaching (Hackman 2002). Drawing from this model and existing literature on team virtualness concepts and the software agility literature, we propose three key dimensions for addressing the question of how agile teams can be successfully configured in globally distributed environments. The dimensions of the research framework include: team structure, agility, and virtualness (see Figure 1).

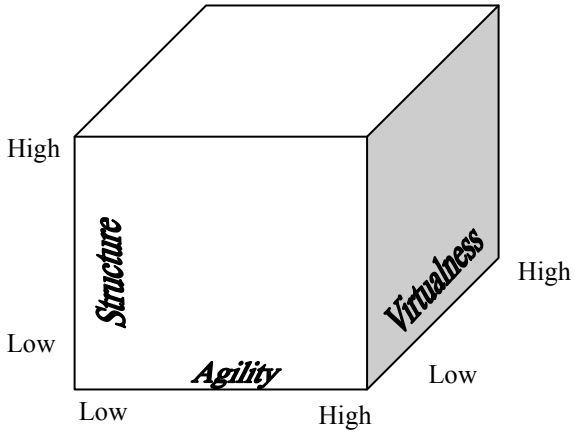


**Figure 1. Globally Distributed Agile Team Configuration Research Framework**

## *Team Structure*

For the purpose of this paper which explicitly deals with team configuration, the components of enabling structure were adopted to form the first dimension (y-axis) of the research framework. As stated by Hackman (2002), "it is a fantasy – a tempting and pervasive one, but a fantasy nonetheless – that it is possible to have great teams without the bother of creating enabling team structures" (p. 13). In regard to virtual teams in particular, Powell et al. (2004) commented that many times it appears as if virtual team design is only an afterthought based upon an examination of the structural characteristics of virtual teams which have been studied up to date. Although this model addresses teams in general, Hackman (2002) suggested that "the structural conditions that foster effectiveness of face-to-face teams are just as critical for virtual teams – but with one caveat: *It is much harder to create those conditions in virtual teams*" (p. 131). In sum, Powell et al. (2004) stated, "we believe that investigation of team structure in the virtual environment holds significant promise for research and practice because it represents perhaps the most controllable and influential aspect of virtual team design" (p. 16). Hackman identified task design, core norms of conduct and team composition as key structural elements to team success. Task design addresses the issues of meaning, autonomy, and feedback. Core norms call for the establishment of appropriate behaviors expected of members. Team composition provides guidance for the elements of size, mix, knowledge and task-related skills, and interpersonal skills. Based upon these three elements, teams can be considered unstructured (low on the structure continuum) or highly structured.

## *Team Agility*

The second dimension (x-axis) is team agility which may be defined as how closely the team aligns with the general values and principles of agile methods as well as with practices of a specific method. These values, principles, and practices are drawn from the Agile Manifesto as well as from specific agile methods and help to distinguish agile teams from more traditional plan-driven teams. For instance, the Agile Manifesto ascribes the following values to agile teams: individuals and

interactions, working software, customer collaboration, and responding to change. Plan-driven teams, on the other hand, emphasize processes and tools, comprehensive documentation, contract negotiation, and following a plan (Fowler and Highsmith 2001). Extreme Programming (XP) involves twelve specific practices that comprise this particular agile methodology. Proponents of agile methods have consistently argued that in order for agile methods to be successful and bring the best benefits, they must be implemented as a whole (Beck 2000). However, some research suggests that agile methods can be tailored and that specific values and practices can be chosen and used with benefit (e.g., Kircher et al. 2001; Schummer and Schummer 2001; Xiaohu et al. 2004; Fitzgerald et al. 2006).

### *Team Virtualness*

The third dimension (z-axis) of the research framework is premised on the concepts of team virtualness (Bell and Kozlowski 2002). The basic argument is that virtual teams can be placed on a continuum where one extreme represents the "ideal" type, whereas the opposite extreme characterizes a type that more closely resembles a traditional team. This typology serves to characterize teams as more or less virtual based on the combination of the characteristics which includes temporal distribution, boundary spanning, lifecycle, and member roles. Temporal distribution denotes that a virtual team is distributed across time. The team members may be colocated in time, separated by only a few hours, or separated by many hours. Additionally, members may also be temporally synchronized, e.g., they are located in different time zones, but are all still working off of the same time reference. Boundary spanning refers to the fact that virtual teams not only cross the boundaries of space and time, but also functional, organizational, and cultural boundaries as well. Due to their ad hoc, flexible nature, virtual teams can be formed quickly, but may only be in existence for a short period of time depending upon the project to which they are assigned, thus exhibiting a distinct lifecycle when compared to traditional team. Finally, virtual teams provide for the selection of members from a substantial pool of workers with a diverse set of skills who ideally participate in multiple roles within multiple teams. Based on these characteristics, the basic premise is that "virtual teams need to adopt different characteristics to successfully operate within the constraints that are imposed by the complexity of their collective task" (Bell and Kozlowski 2002, p. 16).

## Configuration of Globally Distributed Agile Teams

Globally distributed agile team configuration represents a complex phenomenon. The following section explains how these dimensions of team structure, agility, and virtualness can be applied to agile teams within globally distributed environments.

### *Configuring the structure of the team (task design, core norms, and team composition)*

The proposed research framework suggests that the measure of team structure, "low" or "high", can be investigated by examining the three characteristics of task design, core norms, and team composition. According to Powell et al. (2004), significant attention has been paid to the design of virtual team interaction, but much less attention has been given to the design of the work unit itself. In order for work to be meaningful, members need to feel a sense that they are working on something greater than themselves and that it has importance to the organization as a whole (Hackman, 2002). One of the strategic challenges of global software development and the use of virtual teams is the division of work across geographically distributed sites. In distributed work it is important to avoid dividing the work up to the point that the members do not perceive that they are working together on a larger project. To foster a sense of autonomy in global software development, ideally the teams at each site would to a large degree work independently while continuing to communicate with other sites to keep the entire project in focus (Herbsleb and Moitra 2001). Suchan and Hayzak (2001) emphasized that those individuals chosen for the team must be both independent and self-directing, but at the same time be able to work interdependently with other team members. Regular feedback is also crucial as it is the element that allows the team to learn and to improve. Many times, however, globally distributed teams are formed for short projects and are disbanded before the feedback loop can be completed. It should be the goal of the project leader to attempt to provide as much feedback as possible to the team before it is dissolved.

The establishment of a shared set of norms which direct the individual and corporate behavior of virtual teams has also been cited as an import element of virtual team design (Suchan and Hayzak 2001). In regard to norms, it is important that each team member positively internalizes this set of rules and in essence "buys-in" to their use (Sarker, Lau, and Sahay 2001). Due to the cultural diversity, language barriers, and communication and coordination challenges involved in globally distributed teams, these norms may help alleviate conflicts within the team (Damian and Zowghi 2003). Norms should also as establish common goals and strategies (Kayworth and Leidner 2001-2002; Suchan and Hayzak 2001).

Hackman (2002) advocated having as few team members as possible to accomplish the task, in fact, "a team may function better when it has slightly fewer members than the task actually requires" (p. 118). Determining size is largely dependent on the complexity of the task. Powell et al. (2004) stated that to their knowledge no specific study to date has been conducted that explicitly examined virtual team size as a variable during the team design phase. The mix of the team members is also important. Hackman (2002) suggested that "a well-composed team strikes a balance between having members who are too similar to one another on the one hand and too different on the other" (p. 122). Powell et al. (2004) pointed out that there is a need for research which examines the characteristics of successful virtual teams and what managers should be looking for when choosing virtual team members. They also pointed out that little research exists which examines the personality types that are more conducive to working in virtual teams. Balijepally, Mahapatra, and Nerur (2006), however, have examined the personality characteristics of agile software development teams which may provide insight when designing globally distributed agile teams. Finally, an argument has been made that virtual team members must possess excellent interpersonal and conflict management skills (Suchan and Hayzak 2001). Based on the work group design research and the global software development and virtual teams literature, the assumption would be that the successfully configuration of globally distributed agile teams would be largely dependent upon the prescribed suggestions in regard to task design, core norms, and team composition. However, because globally distributed agile teams represent a complex phenomenon, research on these specific types of teams may suggest possible alternatives.

### *Configuring the agility of the team (general values and specific practices)*

According to the proposed research framework, teams with "high" agility are adhering to a greater degree on the general values of agile methods and a greater number of specific practices of their chosen agile methodology. Conversely, teams with "low" agility adhere to a much lesser degree on the general values and specific practices. The assumption would be that teams with a "high" level of agility would inversely possess a "low" level of virtualness, i.e, as team agility increases team virtualness will decrease. However, as the research suggests, the tailoring of agile practices within globally distributed environments may have an impact on this relationship.

### *Configuring the virtualness of the team (temporal distribution, boundary spanning, lifecycle, member roles)*

With the move toward global software development, the formation of agile development teams within a globally distributed environment calls for an alternative and more agile configuration. According to the proposed research framework, the measure of team virtualness, "low" or "high", can be investigated by examining the four characteristics of temporal distribution, boundary spanning, lifecycle, and member roles. The "ideal" type can be defined as follows: "it is distributed across time, spans numerous functional, organizational, and cultural boundaries; it is short lived; and is composed of members who each possess multiple roles in different virtual teams" as opposed to the more "traditional" type which is "temporally entrained, has less permeable boundaries, has a continuous lifecycle, and is composed of members who have singular roles" (Bell and Kozlowski 2002, p. 28-29). The assumption would be that teams with a "high" level of virtualness would inversely possess a "low" level of agility. However, with the constant improvement of information and communication technologies and the telecommunication infrastructure which support them, this inverse relationship may be positively impacted.

## Research Application

Using the research framework in Figure 1 and the assumptions above, we suggest that globally distributed agile teams vary in their possible configurations and that some configurations are more successful than others. Because of the dynamic nature of organizations in the global arena and the reoccurring challenges involved in software development projects, one goal of a successful globally distributed agile team configuration is to be as adaptable and flexible as possible utilizing the strengths of agile methods and global virtual teams. As mentioned above, with tailoring approaches and advances in technology-mediated communications perhaps this may not be as improbable as some suggest. A scenario in which this research framework could be used would be to examine existing globally distributed agile teams in practice. Because this area is emergent, the initial research method would be exploratory, and follow a case study approach in order to collect and analyze qualitative data (Benbasat, Goldstein, and Mead, 1987; Bonoma, 1985; Yin, 2003). This data would be collected via semi-structured interviews, documentation analysis, and review of archival records such as organizational charts, project charts and specifications, and email and chat logs. The purpose would be to generate a theory that explores the successful configuration of globally distributed agile teams that is grounded in the data and integrated with prior research

(Eisenhardt 1989). The result would be the development of a set of best practices which organizations could follow when configuring this type of team that would be informed by both the data and the existing literature.

## Limitations

The research framework proposed in Figure 1 is presented with the understanding that it goes beyond the data we have at this point. The authors understand that as multiple iterations of analysis occur between the framework and the field data, the framework is likely to sustain potentially significant modifications to better reflect that data. The goal of this paper, therefore, is to generate a starting point for investigating the successful configuration of globally distributed agile teams based on the existing literature and then to gather data from existing globally distributed agile teams in order to better represent the role that each dimension plays.

Because the study of agile methods in globally distributed settings, especially the configuration of these types of teams, is emerging the authors realize the model proposed is not perfect. The team structure dimension (y-axis), in particular, may be problematic in that it may not represent a true continuum as do the other dimensions. It is rather reflecting the *sub-dimensions* of structure, rather than the differing *levels* of structure. This may in fact lead to confusion about how to detail out all of the possible team configurations. As it stands now, the framework is proposed as an initial step for examining this phenomenon by looking at how existing globally distributed teams are configured around the three dimensions in a more exploratory, descriptive sense to see what has contributed to success and then offer suggestions for generalizing these observations of the configuration of other agile teams in global settings.

In future research, it is well possible that the authors will attempt to examine not simply how existing teams are configured, but more specifically how the level of agility and virtualness impact the team structure itself. This would seek to examine four types of team structure: (1) low agility, low virtualness; (2) high agility, low virtualness; 3) low agility, high virtualness; and (4) high agility, high virtualness. It would be very interesting to see how these different team structures vary from one another based upon the levels of agility and virtualness and how they might impact the use of agile methods in globally distributed environments. The explanation of the configuration of a high agility, high virtualness team would be of interest both in research and practice.

## Conclusion

In conclusion, this paper contributes to the Information Systems field by providing a research framework based on extant literature for investigating the dimensions which may lead to the successful configuration of globally distributed agile teams. As of this time no known research framework exists which incorporates the dimensions of team structure, agility, and virtualness. The utilization of globally distributed agile teams has the potential to significantly impact the field of software development. As such, our hope is that this framework will serve as a building block for further research in this important area.

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