

2012

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Recommended Citation

Khazanchi, Deepak and Zigurs, Ilze, "A Systematic Method for Discovering Effective Patterns of Virtual Project Management" (2012). *Information Systems and Quantitative Analysis Faculty Publications*. 16. <https://digitalcommons.unomaha.edu/isqafacpub/16>

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A Systematic Method for Discovering Effective Patterns of Virtual Project Management(*)

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(*) This paper is forthcoming in the journal *Essence* (2011).

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Abstract

The effective management of virtual projects within global organizations is an inherently collaborative activity as well as an increasingly critical issue. The concept of patterns provides a useful theoretical framework by which we can study the design of effective practices for the management of virtual projects. However, a number of significant gaps exist in our knowledge of this area and one of the most important is the need for a systematic method for discovering effective patterns. We propose such a systematic method and provide a detailed example of the use of our proposed pattern discovery method.

Keywords: project management, patterns, method, virtual projects

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Introduction

Projects are inherently collaborative activities and their management includes the design and execution of appropriate collaboration and communication processes. Virtual projects in particular are especially challenging from a collaboration perspective, since virtual environments can be supported by a wide variety of technologies that project team members and managers must incorporate into their work practices. Existing research and practice standards provide a variety of guidelines for project management practices (e.g., Gassmann and Von Zedtwitz, 2003; Project Management Institute, 2004), but these guidelines typically do not address the issues that are introduced in virtual projects due to the team's dependence on communicating and working in computer-mediated environments. The researchers propose a fresh approach that is not only based in theory but also has potential to be helpful in practice. Our approach is founded on the concept of patterns as a way of discovering effective processes in the complex environment of virtual projects. Patterns provide a unique way of thinking about and identifying practices that display some common property that feels instinctively right for this domain. Our approach not only addresses the existing gap in knowledge of virtual projects but also provides a needed theoretical perspective.

The theoretical frame of patterns has been shown to be a useful way to identify best practices for virtual projects (reference withheld for blind review). Patterns can be identified and stored in a library that can be used by organizations as a source of best practices and even a training vehicle for new employees (Austin and Westerman, 2000).

However, the ability to build a useful library or repository of patterns hinges on having an effective discovery process for those patterns. A systematic method for the discovery of patterns is fundamental to helping managers take advantage of the pattern approach. The researchers bring together concepts from the relevant literatures to propose a method to address these needs. The unique contribution of the paper is the development of a systematic method for the discovery of effective patterns of virtual project management, which will be henceforth referred to as the *pattern discovery method*. The paper also contributes by providing a detailed example of the application of the pattern discovery method to a data set of experiences from a field-based study of virtual projects.

The next section defines and discusses the paper's foundational concepts, namely, virtual projects, collaboration technology, patterns, and methods. Next, the authors present an argument for the development of the proposed pattern discovery method, followed by an elaborated example from field research-based empirical data. The authors conclude the paper with a discussion of implications for research and practice.

Foundational Concepts

Virtual projects and collaboration technology

A *virtual project* can be defined as an alliance of dispersed people who are working together to accomplish a specific task or opportunity under time and resource constraints (Palmer and Speier, 1997; Shenhar, 1998; Evaristo and Munkvold, 2002). The term "virtual" is used to mean the extent to which project members are dispersed on

one or more dimensions and rely on information and communication technologies for carrying out project goals. Dispersion includes but is not limited to geography, time, and organizational affiliation. Reliance on technologies is also recognized as a fundamental component of virtuality. This definition is consistent with recent reviews of virtual teams and the virtuality concept in general (Dubé and Paré, 2004; Pinsonneault and Caya, 2005; Powell et al., 2004).

Collaboration technology for virtual projects is defined as an integrated and flexible set of tools for structuring process, supporting task analysis and performance, and communicating among project members. This definition incorporates the typical aspects of team functioning that have been a consistent part of the literature of group support, namely, process structure, task support, and communication support (e.g., McGrath and Hollingshead, 1994; Nunamaker et al., 1991; Zigurs and Buckland, 1998). In describing technology this way, our goal has been to accommodate both its fixed and emergent characteristics.

Patterns

Effective practices within virtual projects entail decisions about how to best apply different technology capabilities for different contexts or task needs. The authors use the theoretical frame of patterns to bring these ideas together for identifying and using best practices. Patterns are an intuitive way to understand the complexity of the world around us. Alexander first developed the concept of patterns in architecture as a way to define repeatable solutions for achieving quality (Alexander, 1965; 1978; 1999). The pattern concept has subsequently been applied in many areas, including object-oriented design

(Gamma et al., 1994), groupware design (Luckosch and Schümmer, 2004), and the design of facilitation techniques in groups (Kolfshoten et al., 2004).

Alexander defines a *pattern* as a three-part rule that expresses a relationship among a specific context, a problem, and a solution. The problem is a set of forces that occurs repeatedly in that context. The solution is a certain “spatial configuration” that allows the forces to resolve themselves. The pattern itself describes how the solution can be used whenever the problem occurs in that particular context. A collection of patterns represents a pattern language, defined as a system of patterns that combines to produce a variety of important outcomes (Alexander, 1965; 1978; 1999).

In their previous research, the authors have found that patterns for virtual project management can be identified and effective patterns can be distinguished from ineffective ones (Khazanchi and Zigurs, 2005). Patterns for virtual project management include a description of processes, best practices, factors, tools and/or techniques that relate to such key project management issues as communication, coordination, and control. A specific pattern can be described in terms of: (1) the pattern’s *name*—a descriptive word or phrase that captures its essence; (2) the *context*—a description of the situation to which the pattern applies; (3) the *problem*—a question that captures the essence of the problem that the pattern addresses; (4) the *solution*—a prescription for dealing with the problem; and (5) an optional *discussion*—any additional information that might be useful in applying the pattern.

A pattern can be conceived as being defined at different levels of specificity, for instance, as focusing on different areas or themes of project management. Classic themes in project management include the issues of coordination, communication, and

control (Malone and Crowston, 1994; Kirsch, 1997; Project Management Institute, 2004). These three broad areas of project management are used in our research as themes around which to discover patterns. In addition, the term “discovery” is used in its broadest possible sense, that is, as including not just the initial identification of a potential pattern but also its naming, validation, and ultimate evolution.

Methods

The last foundational concept is that of the method itself. The concept of methods has a long history in the field of Information Systems and a variety of different types of methods for systems development exist, e.g., structured, object-oriented, socio-technical, soft systems, and agile (Iivari et al., 2000/2001). A method’s purpose is to provide a systematic and repeatable process. Specifically, a systems development method can be defined as a set of procedures, techniques, tools, and documentation aids for implementing an information system, including phases and deliverables for helping plan, manage, control, and evaluate projects, all of which is supported by an underlying philosophical view (Avison and Fitzgerald, 1995). These general components of system development methods form the foundation for the pattern discovery method. In particular, the underlying philosophy of the method is emphasized, which is rarely explicitly discussed in systems development methods but which has particular richness in the pattern discovery method.

Empirical Basis of the proposed Pattern Discovery Method

The proposed pattern discovery method elaborated in the next section is primarily founded on our own stream of research in this domain (Khazanchi and Zigurs, 2005 & 2006; Zigurs and Khazanchi, 2008a; Zigurs and Khazanchi, 2008b) and an analysis of

the prior literature on virtual project management. In this section, a brief summary of the key highlights of our research that is relevant for this paper is described. This context is particularly important since the evidence used to illustrate each phase of our propose pattern discovery method is from our previous research. In Khazanchi and Zigurs (2005), the authors conducted a literature review on best practices and theory in the management of virtual projects and virtual teams. This research utilized the theoretical frame of patterns to propose an integrative way of looking at recommendations for best practices. Further, a virtual project typology was proposed based on the traditional notions of complexity, scope and risk as they relate to virtual project management. This virtual project typology included three types of projects based on extreme and mixed values of each of these three dimensions – lean (low complexity, low risk and narrow scope; hybrid; and extreme (high complexity, high risk and wide scope).

The research primarily focuses on addressing the question “what patterns of communication, coordination, and control can be identified for the successful management of virtual projects.” The underlying hypothesis in this research was that patterns of virtual projects can be identified and that one can differentiate between effective and ineffective patterns. Thus, guided by the major concepts from the literature review and the overall theoretical frame of patterns, a series of electronic focus groups were conducted. Project team members from five global firms in a variety of industry sectors participated in the study. The individuals participating in this study were from various parts of the world and had substantive experience with virtual projects. The virtual focus groups were conducted using WebIQ™ (<http://www.webiq.net>), a Web-based meeting support tool that includes capabilities for building an agenda, conducting electronic brainstorming, and administering questionnaires. Each participant was given an individual login and password. After logging in, each participant filled out a

questionnaire that asked about a specific virtual project in which they had participated within the last year. Responses to brainstorming questions were instructed to be about that same project. Participants then had a 72-hour window in which to brainstorm their ideas about the following two questions:

1. What specific management and team member practices contributed to the effectiveness of your project?
2. What specific management and team member practices contributed to the ineffectiveness of your project?

All the comments collected during the virtual focus group were thoroughly examined and coded for each dimension of management practice of interest. These managerial dimensions in our study are communication, coordination, and control. A pattern is then articulated based on the set of comments that applied to each project type and managerial dimension. For us then a potential design pattern for virtual project management would include descriptions of processes, best practices, factors, tools and/or techniques that impinge upon coordination, communication, and control. Multiple patterns could be generated from one set of comments.

Given this empirical context, in the next section the pattern discovery method is detailed with specific empirical illustrations of each phase from our research.

Pattern Discovery Method

“Your brain has an in-built mechanism for finding patterns you've programmed because of where you've put your attention. Solutions, innovations, and success come not from greater intelligence or creativity but from what we notice because of where we point those attributes.” (Allen, 2003, p. 60)

Patterns reflect the essential meaning of actual experience that can be abstracted and applied in other contexts. Alexander suggests that if we can capture the *essential*

qualities of what we do well, then we can apply these qualities to do the same thing in other contexts and applications (Alexander, 1978). Alexander claims that these “good qualities” can only be captured by observation, by experience, by both positive and negative examples and, at times, by abstract argumentation (Alexander, 1978, pp. 255-259). In this way, we can “... discover some property which is common to all the ones which feel good, and missing from all the ones which don't feel good” (p. 255). Alexander’s argument justifies starting with features or characteristics of actual virtual projects, rather than starting with more general problem identification. Although problem identification is the typical first phase in most problem-solving approaches, including classic systems development methods, the “Alexander approach” provides a distinctly different point of view. In essence, we are arguing for a bottom-up approach rather than a typical top-down approach.

In the spirit of Alexander’s perspective, we recommend a five-phase approach to discovering, extracting, and writing patterns for effective virtual project management. Figure 1 shows the phases in our proposed method. Table I summarizes how each general component of a method is instantiated in our proposed pattern discovery method. The following sections elaborate each phase and provide detailed discussion and examples from the case study data of each of the phases in Figure 1 and the components in Table I.

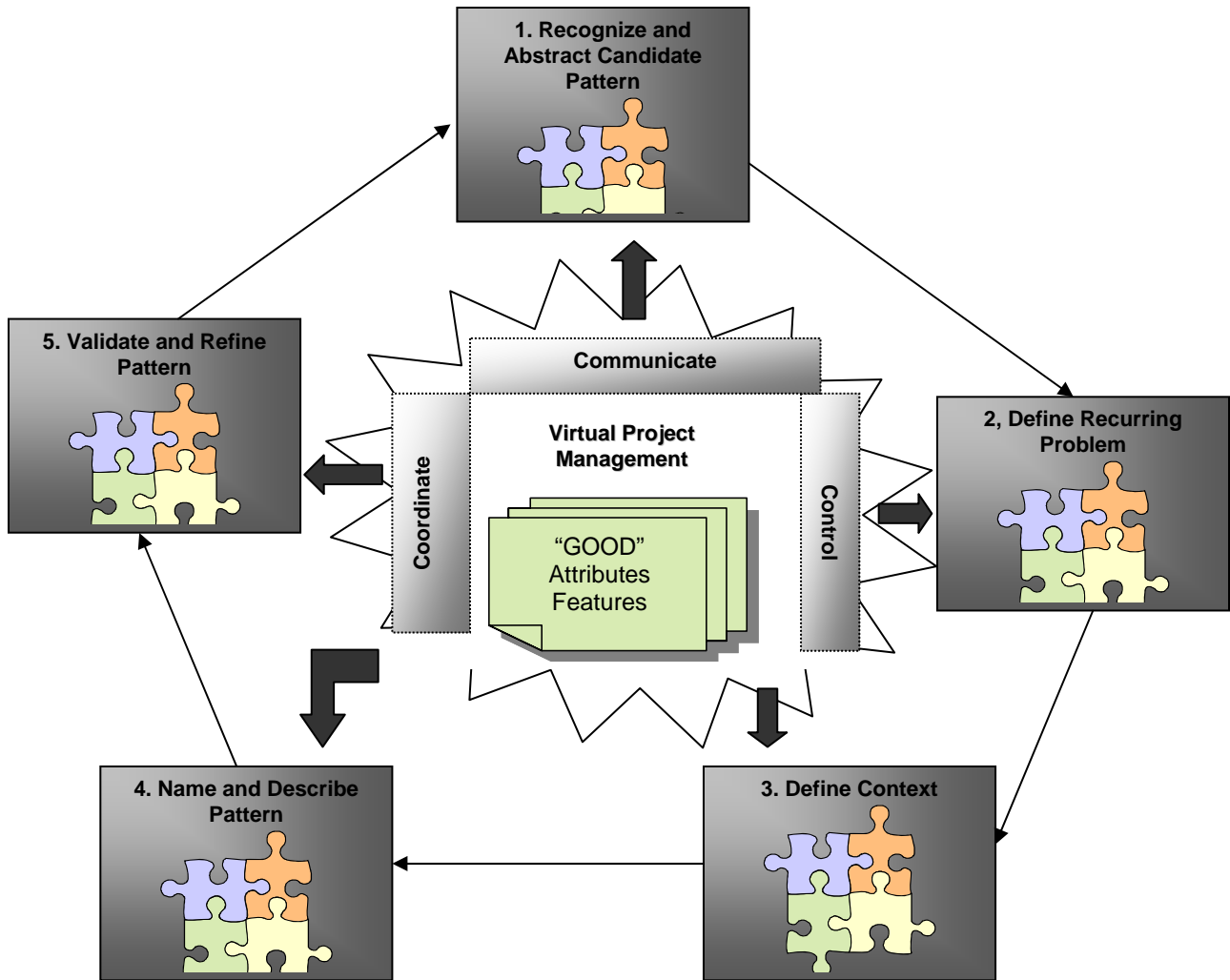


Figure 1: Pattern Discovery Method

**Table I
Components of Pattern Discovery Method**

Method Component	Pattern Discovery Method
Goal	To provide a systematic and effective process by which to recognize, document, and validate useful and adaptable patterns for management of virtual projects
Guiding Principles and Beliefs	Patterns capture the essential meaning of actual experience that can be abstracted and applied in other contexts. Patterns help to identify solutions for recurring problems of design. Patterns provide an intuitive way of understanding and dealing with complexity. Patterns exhibit some property which is common to all the ones which feel good, and missing from all the ones which don't feel good. Creativity and a free-form approach are fundamental. A master/apprentice model is the best approach for developing and using patterns.
Phases	1. Recognize and abstract candidate pattern 2. Define recurring problem 3. Define context 4. Name and describe pattern 5. Validate and refine pattern
Processes	Argumentation Brainstorming Induction Eureka Observation
Techniques	Focus group Interview Document evaluation Questionnaire Observation
Tools	Pattern repository Electronic brainstorming system Survey tools Collaboration technologies (e.g., IM, email, phone conferencing)

Phase 1: Recognize and abstract candidate patterns

The **first phase** for identifying a pattern is to **recognize and abstract a candidate pattern** via characteristics or features of virtual project management that impinge on the effective management of the project. The process of recognition and abstraction involves

understanding the quintessential meaning of the lessons learned from characteristics such as attributes, artifacts, experiences, and archetypes that result in effective virtual project management practices. Figure 2 shows the details of this process, which is both inductive (via abstraction from things we do well) and iterative (via an “instinct check” that confirms or redefines the abstraction).

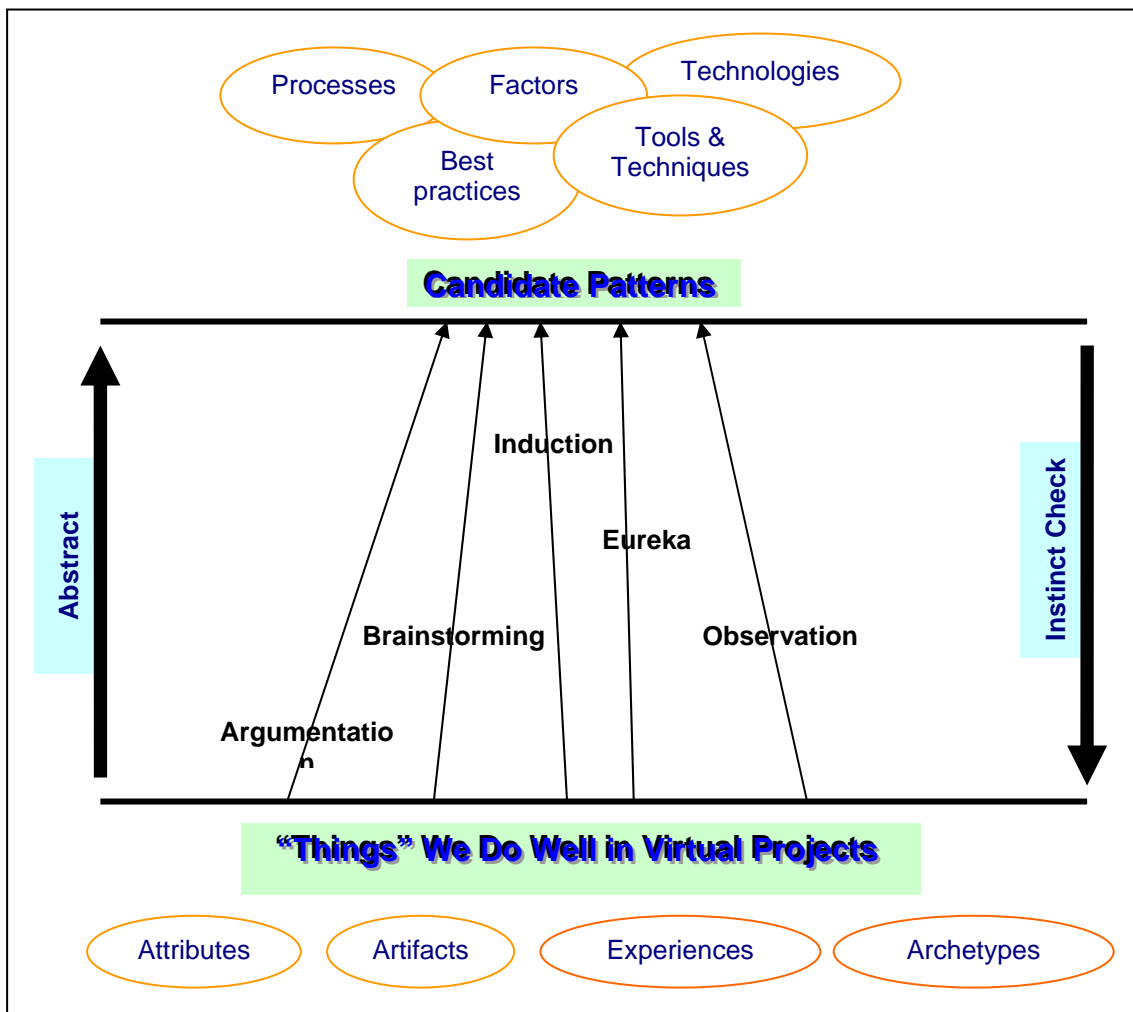


Figure 2: Phase 1 - Recognize and Abstract Candidate Pattern

Table 2 shows some examples of these features based on the field data from our previous research. The candidate pattern might consist of a process, a best practice, a set of factors, tools and/or techniques, technologies, or some combination of these elements. The discovery of candidate patterns within an organization may be the most difficult aspect of the method. The authors recommend the use of a systematic internal assessment of practices via a variety of techniques, including focus groups, interviews, evaluation of documents, and questionnaires. Brainstorming ideas from focus groups of experienced virtual team members is one technique that can be used to develop a set of candidate patterns for a virtual project. Brainstorming responses can be coded for themes, as illustrated in the detailed example that follows.

Table 2
Characteristics of Patterns in Virtual Project Management

	Definitions	Examples (Reference withheld for blind review)
Attributes	An inherent quality or characteristic of virtual projects and virtual project management.	<p>“Management commitment is key to sustaining the virtual team model.”</p> <p>“The first couple of months we evaluated if new team members can fit in culturally in the team.”</p>
Artifacts	An object or thing created by human agency such as reports, deliverables, tools, models (e.g., use cases), or processes (e.g., Rational Unified Process).	<p>“We have a home grown tool - knowledge portal which has features for collaboration, e-learning and knowledge management which was found really useful. It was a challenge to implement it but once the team started using it everyone saw the power and usefulness of the same.”</p> <p>“Well defined processes - We spent quite a bit of time to clearly lay down the processes and clarify to people who are responsible for what. These processes were then available at knowledge portal. The best thing was the team participated in creating them and ownership was higher.”</p> <p>“Use of diagrams and process flows to explain business processes to team members.”</p>
Experiences	The know-how or procedural knowledge relating to virtual projects and virtual project management.	<p>“Periodic teleconferences involving all team members to discuss progress, problems, ideas/suggestion, [and] feedback from recent work.”</p> <p>“Access to development/architects for advice/help in problem resolution.”</p> <p>“Sought consensus on meaning of requirements.”</p>
Archetypes	An ideal model or example of effective virtual project management practice.	“Weekly progress meetings (within our group level, not necessarily with our manager) helped us track progress, issues and get anything that had stalled/gotten dropped going again.”

In our empirical study previously referenced, candidate patterns were discovered through the use of an electronic brainstorming tool in an asynchronous format.

For example, consider the following comments (both positive and negative) from the brainstorming exercise and discussion activities related to virtual projects that were identified in the study as being of high complexity:

- “Frequent Interactions - We had multiple medium on which the team could communicate, voice, IM, mails, videocons, telecons and we encouraged them.”
- “The first couple of months we evaluated if new team members can fit in culturally in the team”
- Prompt reporting of problems to all. (“This news doesn't get better with age!”)
- “Management commitment to sustaining the virtual team model is key”
- “Created culture of willingness to share and to accept all information.”
- “Face to Face discussion on success of remote support. On Site support would have worked better due to having to leave voice mail, waiting for several hours for a response, coordinating availability, etc. “
- “A well defined set of goals and objectives were defined every year, these were owned by members across the virtual team”
- “Its important to associate faces to names and we encouraged travel across shores for knowledge sharing, work culture understanding etc as much as possible “
- “Sought consensus on meaning of requirements”
- “Yup. Face-to-face or conference call discussions are necessary to decide the words we'll use for consensus statements. The written word (whether sent via mail or email) is necessary for documenting the consensus.”
- “Utilized the phone for discussion and error diagnosis/resolution.”
- “Its important to associate faces to names and we encouraged travel across shores for knowledge sharing, work culture understanding etc as much as possible.”
- “Time Zone difference causes an issue when communication is not prompt.” Underestimating the effort and playing catch up all the time
- “Lack of information sharing”
- “Lack of understanding of common goals”
- “Misunderstanding of words and expressions”
- “Recurring meetings. So many. So long. So unfocused. Took time needed to do the work.”
- “Weekly status reports on progress.”
- “Time Zone difference causes an issue when communication is not prompt”
- “Conducted virtual team workshops from time to time to identify strengths and challenges for the virtual team”

From the above comments, we observed the emergence of certain features that could be abstracted from these comments that relate to effective communication in the management of virtual projects. For example, in particular, some of these ideas had to do with the critical importance of addressing communication challenges by establishing periodic conferencing using multiple channels of communication, including face-to-face meetings. Similarly, other ideas relate to managing virtuality-related challenges through collocation of teams. The **intuition check** to decide whether to include these as patterns is done, according to Alexander and others, by examining and visualizing this feature or aspect to see if it “just feels right instinctively.” These solutions can be abstracted initially in the candidate patterns shown in Figures 3 and 4.

Solution

Schedule periodic conferences using technologies that emphasize communication (e.g., telephone and telephone conferencing, e-mail, and video conferencing).

Solution

Schedule periodic face-to-face (FTF) conferences by flying some team members—possibly by rotation—to different locations. Though costly, even occasional participation in FTF meetings over the lifetime of a project is very effective. FTF meetings can engender increased trust and engagement among team members, and can also help clarify various facets of the project and resolve issues/conflicts.

Figure 3. Candidate Patterns Related to Communication

Solution

Overcome distance barriers due to time zone and geography by eliminating them during activities requiring intensive interaction and coordination, such as project initiation, by temporarily collocating team members. Require periodic site visits and travel by team members to different sites. Designate team member liaisons as focal points of coordination who spend some time in the home office location, to become acculturated and informed about technical issues; liaisons can then transfer knowledge to local sites for day-to-day coordination. Assign team members in one geographic region (e.g., North and South America) to tasks requiring telephone or video-based interactions because they share time zones and thus can more easily schedule conferences.

Figure 4. Candidate Pattern Related to Virtuality

Phase 2: Define recurring problem

The **second phase** in our method is to **define the problem** that this specific feature or set of features solves. In our example of highly complex projects, the problems being solved include how to effectively communicate and the inability to handle time zone and geographic differences while effectively engaging all team members in a virtual project. Using Alexander's notion of a problem, we can capture the essence of what each of these candidate patterns attempts to solve in that specific context. The authors find it convenient to capture the essence of the problem that each pattern addresses in the form of a simple question. Figures 5 and 6 expand the previous descriptions of the candidate patterns that were discovered from phase 1.

Problem

How do you ensure effective communication among virtual team members?

Solution

Schedule periodic conferences using technologies that emphasize communication (e.g., telephone and telephone conferencing, e-mail, and video conferencing).

Problem

How do you ensure effective communication and build trust among virtual team members?

Solution

Schedule periodic face-to-face (FTF) conferences by flying some team members—possibly by rotation—to different locations. Though costly, even occasional participation in FTF meetings over the lifetime of a project is very effective. FTF meetings can engender increased trust and engagement among team members, and can also help clarify various facets of the project and resolve issues/conflicts.

Figure 5. Adding a Problem Statement to Communication Patterns

Problem

How do you overcome time zone and geographic differences and effectively engage all team members?

Solution

Overcome distance barriers due to time zone and geography by eliminating them during activities requiring intensive interaction and coordination, such as project initiation, by temporarily collocating team members. Require periodic site visits and travel by team members to different sites. Designate team member liaisons as focal points of coordination who spend some time in the home office location, to become acculturated and informed about technical issues; liaisons can then transfer knowledge to local sites for day-to-day coordination. Assign team members in one geographic region (e.g., North and South America) to tasks requiring telephone or video-based interactions because they share time zones and thus can more easily schedule conferences.

Figure 6. Adding a Problem Statement to the Virtuality Pattern

Phase 3: Define context

The **third phase** is to **define the context** in which this feature is appropriate, i.e., a description of the situation to which the pattern frequently applies. In our examples, we look at the specific experiences of virtual team members to establish the context of the problem. Thus, we find that some of the virtual team members participating in these complex projects had difficulty with time zone and geographic differences at both the national and global levels. This problem is exacerbated during crunch time or crisis situations when communication is not prompt, delaying the problem resolution process. Furthermore, in our examples, there is a clear lack of effective communication, resulting in some mistrust, both in terms of face-to-face interaction and in terms of periodic conferences using various technologies. These contextual descriptions are included in each of the candidate patterns identified previously for our example projects (see Figures 7 and 8).

<p>Context Team members do not have a shared understanding of project issues and solutions.</p>
<p>Problem How do you ensure effective communication among team members?</p>
<p>Solution Schedule periodic conferences using technologies that emphasize communication, e.g., telephone and telephone conferencing, email, and video conferencing.</p>
<p>Context Team members neither agree nor have a shared understanding of project issues, solutions, work processes, and documentation requirements.</p>
<p>Problem How do you ensure effective communication and build trust among team members?</p>
<p>Solution Schedule periodic face-to-face (FTF) conferences by flying some team members, possibly by rotation, to different locations. Though costly, even occasional participation in FTF meetings over the lifetime of a project is very effective. FTF meetings can engender increased trust and engagement among team members and also help clarify various facets of the project and resolve issues/conflicts.</p>
<p align="center">Figure 7. Adding Context to Communication Patterns</p>

<p>Context The project team is having difficulty with time zone differences at both the national and global levels, especially during crisis situations when communication is not prompt and the problem resolution process is delayed.</p>
<p>Problem How do you overcome time zone and geographic differences and effectively engage <u>all</u> team members?</p>
<p>Solution Overcome distance barriers due to time zone and geography by eliminating them during activities requiring intensive interaction and coordination, such as project initiation, by temporarily collocating team members. Require periodic site visits and travel by team members to different sites. Designate team member liaisons as focal points of coordination. Have them spend some time in the home office location, to become acculturated and informed about technical issues. Liaisons can then transfer knowledge to local sites for day-to-day coordination. Assign team members in one geographic region (e.g., North and South America) to tasks requiring telephone or video-based interactions because they share time zones and thus can more easily schedule conferences.</p>

Figure 8. Adding Context to the Virtuality Pattern

Phase 4: Name and describe pattern

The **fourth phase** is to name and describe the pattern, so it can be explained to, and shared with, others. Alexander talks about names being labels for the patterns in the form of a descriptive word or phrase that captures its essence. In addition to the name, in this phase, one could include evidence and other discussion as applicable in the description of the pattern. Figures 9 and 10 show the patterns after the addition of descriptive labels and, in the case of the Virtuality pattern, additional discussion that further explains relevant details of the pattern.

Communication Check
Context Team members do not have a shared understanding of project issues and solutions.
Problem How do you ensure effective communication among team members?
Solution Schedule periodic conferences using technologies that emphasize communication, e.g., telephone and telephone conferencing, email, and video conferencing.

Face Time Check
Context Team members neither agree nor have a shared understanding of project issues, solutions, work processes, and documentation requirements.
Problem How do you ensure effective communication and build trust among team members?
Solution Schedule periodic face-to-face (FTF) conferences by flying some team members, possibly by rotation, to different locations. Though costly, even occasional participation in FTF meetings over the lifetime of a project is very effective. FTF meetings can engender increased trust and engagement among team members and also help clarify various facets of the project and resolve issues/conflicts.

Figure 9. Completed Patterns for Communication

Manage Virtuality	
Context	The project team is having difficulty with time zone differences at both the national and global levels, especially during crisis situations when communication is not prompt and the problem resolution process is delayed.
Problem	How do you overcome time zone and geographic differences and effectively engage <u>all</u> team members?
Solution	Overcome distance barriers due to time zone and geography by eliminating them during activities requiring intensive interaction and coordination, such as project initiation, by temporarily collocating team members. Require periodic site visits and travel by team members to different sites. Designate team member liaisons as focal points of coordination. Have them spend some time in the home office location, to become acculturated and informed about technical issues. Liaisons can then transfer knowledge to local sites for day-to-day coordination. Assign team members in one geographic region (e.g., North and South America) to tasks requiring telephone or video-based interactions because they share time zones and thus can more easily schedule conferences.
Discussion	Collocating team members for face-to-face interactions can also help them establish ground rules and common understanding that facilitate communication and coordination when team members return home. Collocation also allows team members to build a social network. It stimulates the development of team identity, cohesion, and commitment that can be potentially sustained once team members are again dispersed. Overcoming time zone differences is critical not just for global teams. Wherever there are multiple time zones, whether within the same country or different countries, virtuality must be explicitly managed.

Figure 10. Completed Pattern for Virtuality

Phase 5: Validate and refine pattern

The **fifth and final phase** of our method is to continue to **validate, refine, reevaluate, coalesce, abstract, and improve** identified patterns as further intellectual analysis is brought to bear. Clearly, *prima facie* validation for a given pattern, particularly in terms of its soundness, plausibility, veridicality, and pragmatism, is achieved by the very fact that it is derived from what we know has worked with regard to the dimensions of interest in virtual project management. However, it is very reasonable to accept that the further validation of patterns such as “Face Time Check,” “Communication Check,” and “Manage Virtuality” is an ongoing process. As a pattern is applied in new contexts, the

abstracted description of the pattern will either reinforce its veridicality or result in revisions. Furthermore, identified patterns will necessarily be neither exhaustive nor in their final form.

How does one apply the patterns discovered using the method described above? Consider for example a systems integration project in the banking sector that is being executed in three countries at the same time. Developers, systems integrators, and consultants may be working at multiple locations. This means that the project is highly complex, large in scope, very risky, and highly virtual. The project would need a variety of collaborative technologies for supporting tasks and communication. Having determined the nature of the project, the project manager could start by selecting relevant patterns from a library or repository of virtual project management patterns. The manager could then use those patterns to design and develop a set of project-specific instantiations that would take the form of specific artifacts or archetypes that embody the patterns. The example of the “Manage Virtuality” pattern that is provided in Figure 10 would certainly be relevant to such a project.

Implications and Conclusions

In this paper, we have identified a systematic method by which effective patterns of virtual project management can be discovered and written. However, in order for project managers to be able to extract these patterns and then communicate and continue to evolve them, the following conditions need to be in place:

- A common vocabulary and conceptual understanding of the guiding principles that govern the development of patterns.

- A simple, natural language interface that allows “master” and novice managers alike to contribute patterns without difficulty. Patterns should be easy to read and complete, since clarity comes not only from the language but also by focused abstraction of experiences. Clarity also makes patterns easier to share and communicate with others.
- A central repository of patterns to share knowledge and templates within the organization.
- A master/apprentice model very much like the editor and associate editor model in journals, where any virtual project team members can potentially identify and write a pattern but there is a validation process by a “master” manager who has more substantial experience in the field. People who have been successful at managing virtual projects have the expertise to mentor and teach novices in project management. According to Alexander, a person learns by helping someone who has mastery of the task.

The above items enumerate the bare minimum prerequisites that must be in place to accomplish the goal of developing a library of usable patterns. Ultimately, the practice of recognizing, writing and developing effective patterns for virtual project management is an organic activity that is driven by engaged employees and a culture that emphasizes such a free-form approach. The discovery of patterns is specific to the organization and its culture, but there is no reason to believe that the identified patterns could not be generalizable to other organizations. This assertion is in line with Alexander’s notion that “good (pattern) languages are in harmony with geography, climate, and culture.”

What this paper has demonstrated is an iterative set of phases to build, hopefully, veridical representations of what practices work in virtual project management in the

form of patterns abstracted from attributes, artifacts, experiences and/or archetypes of things we do well in virtual projects. Ultimately a collection of such patterns would allow an organization to build a pattern language of sorts. It is important to note that a pattern is not a prescription, although a pattern could be used to create a prescription in a specific context. The authors view what people typically call prescriptions as instantiations of relatively stable patterns in specific contexts. While prescriptions are typically carried out in a “cookbook” approach in a very specific situation, patterns are generic and more akin to the idea of universal laws. Furthermore, the research in this area comes from different reference disciplines and perspectives, and a unified view or theory of best practices does not yet exist. Being able to combine perspectives in a seamless way with skills and technology provides integrative blueprints for best practices in virtual projects. In that sense, best practices are just one element of what a design pattern for virtual project management can describe.

Furthermore, a given pattern will be related to other patterns and this “web of relationships” will need to be identified and documented as the patterns become solidified and stable. The greater this web of relationships with other patterns, the more likely a specific pattern has the potential to be effective in terms of its representation of the features or practices or experiences imputed within its description. These assertions are fruitful avenues for testing in future research.

The authors have argued that the pattern approach represents not only a fresh look at the concept of processes and practices in project management, but also that the idea of patterns is inherently appealing in a virtual context. Patterns provide the kind of flexibility that is essential to the complexity that defines a virtual project context, including the fundamental need to balance and integrate work practices and processes with

technology choices. Because of this there is great likelihood that the method described here for extracting and communicating effective patterns for virtual project management can be generalized to other domains. Earlier in this paper and in our prior research it has been argued that the concept of patterns is a useful way of making sense of complex behavior by looking for the regularities in such behavior. To quote Alexander (1965), “[W]hen we build something good, when we build a system that works well, we must ask what is it about this that makes it good? Why is it good? What are its essential qualities that will allow us to build something completely different but which is good in the same way.” Thus patterns are analogous to recurring themes, familiar processes, rules of thumb, or standard procedures. Patterns are a means of providing holistic, “abstractions of experiences” that are profound in some way and can be implemented to solve problems in a specific context. To some extent patterns are a means of communicating insights about a problem domain to others. Patterns do not have to be distinct from each other; in fact if they are linked in some way that allows us to develop a pattern language. To this extent, in this paper we have suggested an approach that can provide some initial structure to discover and develop a pattern language in any domain.

More traditional approaches, such as prescribing contingencies or different types of media and task fit, do not have the same iterative and adaptable characteristics that the patterns approach has. Again, this assertion is a fruitful avenue for testing in future research. Indeed, these interesting avenues for future investigation suggest rich potential of the pattern concept for contributing to better understanding of practices and processes for effective virtual project management.

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