D ue to its communication and collaboration-intensive nature, as well as inherent interaction with most other development processes, the practice of requirements engineering is becoming a key challenge in global software engineering (GSE). In distributed projects, cross-functional stakeholder groups must specify and manage requirements across cultural, time-zone, and organizational boundaries. This creates a unique set of problems, not only when an organization opens new development subsidiaries across the world but also when software development is a multiorganizational business affair.

However, how is RE different in GSE, and are these problems new? Clients and software developers have come traditionally from different organizations; developing software for global markets isn’t a new adventure, and marketing departments rather than end users have typically been the major source of requirements. So what’s new this time around?

Perhaps it’s the new practices in which software is being developed in the software industry’s global landscape. It’s about the soft side of this practice: its people. The stakeholders who initiate such endeavors must withstand emerging challenges brought about by today’s pervasive way of doing business—in distributed settings.

Reports on GSE practice increasingly indicate that stakeholders’ different (emergent) needs, owing to the characteristics of client-vendor relationships nowadays, create these new challenges.1–3 Thus, we need innovative processes and technologies to manage stakeholders’ expectations and interaction in global projects. This article reports on the state of the practice, drawn from industrial empirical studies, of stakeholders’ interaction in global RE. The article revisits stakeholders’ needs in global RE, discusses the challenges they face in distributed interaction, and offers practical advice to alleviate these challenges, as distilled from empirical studies of GSE practice.

**RE stakeholders in GSE**

Because of the diversity in stakeholders’ professional backgrounds and interests (see the guest editors’ introduction), a critical need exists for stakeholders to achieve a shared understanding of requirements.
of the client's needs as well as the technological possibilities to address them. Effective client-developer relationships enabled by continued collaboration traditionally support the development of this shared understanding throughout the project life cycle. However, the GSE landscape, enabled by growing business opportunities and advanced communication technologies, has created significant challenges in this collaboration. Global RE stakeholders operate in geographical distribution, which hinders their colocated interaction. The factors that are driving GSE (proximity to clients, outsourcing to cost-effective-development countries, and round-the-clock development) have also contributed to a stakeholder landscape that has much more intricate characteristics and interaction needs.

New business models (see the “Global Software Engineering Business Models” sidebar) drive client organizations to outsource development to external and geographically remote vendors (as in offshore outsourcing); they drive software development organizations to open or acquire new software centers close to a client's remote location (as in offshore insourcing). The result is a remarkable diversification of and an increase in the number of geographically distributed stakeholder groups (see figure 1). These new models introduce additional stakeholder groups such as field personnel and analyst teams close to the client sites (interfacing with the client's IT department and business community during requirements gathering and prioritization). They also allow for any of a software development organization's teams (marketing, project, and product management) to collaborate from distributed locations, resulting in requirements change management and coordination activities to be performed in global settings. This further translates to a greater separation between

Figure 1. Global RE’s main stakeholder categories. Each stakeholder group might collaborate from multiple distributed sites (only two shown here). Dashed lines represent indirect lines of communication. Software development organizations can route their clients’ communications through field personnel and marketing teams and the client’s IT department. (See elsewhere for examples of stakeholder collaboration in offshore outsourcing projects and offshore insourcing.)
those knowledgeable of the client’s application domain and users’ needs (such as the client’s IT department and business community and the software development organization’s field personnel and marketing department) and

- the project execution team (such as the development organization’s project and product management teams).

It also means a much longer and more complicated set of communication channels for requirements knowledge to travel between these stakeholder groups.

Thus, we’re witnessing a set of redefined stakeholder interaction needs in the more complex RE stakeholder GSE scene—achieving shared understanding through a collaboration that requires

- even more interactive ways for communication and coordination throughout the entire project and
- fast relationship building and knowledge management in a climate of diminished trust and fast employee turnover in organizations.

Ironically, however, collaboration among more stakeholder groups suffers from problems generated by differences in culture, language, and processes (see “The GSE Landscape: Different Cultures and Processes” sidebar for an outline of GSE’s RE problems) along each of these communication channels. This creates particular RE challenges in knowledge management, alignment of RE processes, and requirements change management.

Challenges in stakeholders’ global RE interaction

Three types of processes can help stakeholders achieve shared understanding in RE:

- knowledge-acquisition and knowledge-sharing processes that enable the exploration of stakeholders’ needs, the application domain, and possible technical solutions;
- iterative processes that allow the reshaping of this understanding throughout the entire project; and
- effective communication and coordination processes that support the first two types of processes listed.

However, GSE challenges affect stakeholders’ interactions during these processes in the following ways.

Knowledge acquisition and sharing

Interaction between the designers and business analysts on one hand and the stakeholders who know the system requirements (for example, the business community, including system end users and managers) on the other suffers from common GSE knowledge management problems.7

First, the designers have less opportunity to seek out relevant knowledge because of the multiple layers of stakeholders. As figure 1 shows,

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**Figure A. Simplified matrix of global software development business models. (adapted from M. Robinson and R. Kalakota)***

**References**

fail to share information about the client organization’s priorities, standards, and policies. Similarly, system developers can fail to reveal accurate information about development estimates and priorities. Cultural factors such as differing attitudes toward hierarchy and communication styles (for example, not being able to openly communicate project priorities or progress) often result in remote stakeholders’ misinterpretation of actions, leading to damaged trust relationships. Loss of trust among stakeholders and the inability to effectively share knowledge also result from the fast-paced churn of stakeholders in these newly created interorganizational relationships. This further manifests in the inability to agree on a common RE methodology that fosters effective sharing of critical information during requirements management.

### Aligning RE processes and tools

The process differences inherent in interorganizational partnerships lead to difficulties in aligning RE processes and supporting tools, preventing knowledge management and change management practices from being effectively implemented across sites. Regardless of whether the software provider group is internal or external from the client organization, remote stakeholders often have different processes for requirements analysis, documentation, and change management because of their differing levels of RE process maturity at different sites.

The increased distance between those originating requirements changes and those with decision-making and execution power (project and product management teams in offshore development organizations) leads to increased overhead in defining more rigorous change management processes. It also leads to ineffective propagation of change information and increased development rework.

### Effective communication and coordination

Finally, the factor that contributes to and is influenced by the two challenges already listed is communication and coordination in global software teams.

Lack of informal communication in global teams negatively impacts relationship building, which is important in requirements negotiations. This relationship building is also important in providing stakeholders with the context needed for disambiguating the meaning of par-

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They must sometimes communicate with end users through the client’s IT department or the colocated field support personnel. Also, the project team members have a much higher chance of introducing misinterpretations of stakeholder needs at each communication level (owing to cultural factors such as language or communication styles). Secondary, knowledge sharing and integration across sites and functional groups can become problematic. Business users and managers can

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### References


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**The GSE Landscape: Different Cultures and Processes**

Whether organizations are taking part in offshore outsourcing or in-sourcing projects, GSE is characterized by work across different cultures and processes.

Two dimensions of stakeholders’ cultural backgrounds impact global software development, and RE practices in particular: ethnic (or national) culture and organizational culture. The aspects of ethnic culture that are relevant to understanding RE processes include language, attitude toward hierarchy, and communication style. For example, language nuances such as the use of homonyms (“overlooking the development of a requirement” means overseeing the requirement’s implementation for some but disregarding the requirement for others) might occur even in two English-speaking stakeholder groups. Attitude toward hierarchy (the “power distance” that relates to perceived relationships between superiors and subordinates) influences how willing some stakeholders are to openly decline new functionality requests, impacting activities of release planning and forecasting as well as suppliers’ ability to keep to schedule (because too much has been committed to). Furthermore, different communication styles characteristic of what Geert Hofstede called high-versus low-context cultures might lead stakeholders to tolerate ambiguity in requirements without recognizing the need to collectively aim for shared understanding of requirements or requirements processes.

Moreover, the organizational culture, or location-specific culture in the different functional groups involved in RE, often has a stronger impact than ethnic culture. Stakeholders in remote organizations often follow different methodologies for eliciting and managing requirements, and they lack authoritative leadership in RE processes.

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**References**

ticular requests, especially when political or personal agendas motivate those requests. Despite the emergence of low-cost synchronous Internet communication technologies, distributed stakeholders continue to rely on “formal” channels (that is, scheduled meetings) or asynchronous channels (that is, email or documentation) for requirements-related communication, given the often large time differences between sites or lack of well-established relationships that allow for impromptu conversations. This leads to requirements issues identified at one site to go unrecognized and unresolved for a long time, causing delays in development and damaged stakeholder relationships.

Furthermore, inadequate channeling of requirements change information across sites leads to difficulties in coordination. Dynamic and distributed cross-functional teams working on the same or related requirements often lack proper mechanisms for awareness of expertise at remote sites (given the inadequate knowledge-sharing practices) or of stakeholders being affected by or affecting a change in requirements.

While one can argue that these challenges are present in any interorganizational relationship (insourcing or outsourcing) or even between two colocated (but possibly multicultural) groups in a single organization, stakeholders’ geographical distribution in offshore relationships (as in offshore insourcing and outsourcing) exacerbates them significantly. Distance increases the cultural, ethnic, or work-related differences; it is a major contributor to the characteristics of the GSE landscape as described in the sidebar “The GSE Landscape: Different Cultures and Processes.”

Strategies to alleviate these challenges

Despite these challenges, practitioner reports of successful GSE practices give some hope to managing stakeholders’ distributed interaction. Those practices relevant to stakeholders’ RE interaction relate to supporting interorganizational structures and supporting communication structures. They enable interactive ways of communication and coordination during the project life cycle, for the purpose of successful relationship building and expectation management. Furthermore, the “Collaborative Tools” sidebar outlines some resources that GSE projects have found useful.

Collaborative Tools for Interacting with Distributed Stakeholders

The following research tools have been found useful in empirical studies in industry or academic settings. The two commercial RE tools have been useful in supporting distributed team interaction.

Research tools

**Egret:** Eclipse-based global requirements tool for distributed requirements management. Egret aims to support change management, knowledge management, awareness, and informal collaboration in teams that subscribe to the communication about a particular requirement. A preliminary evaluation of Egret with distributed IBM stakeholder teams found encouraging support for collaboration during distributed RE.

**IBIS:** Internet-based inspection system. The IBIS inspection process supports the asynchronous communication of remote stakeholder teams in the inspection of requirements specifications. Its use in academic settings indicates that it supports the development of shared understanding between remote clients and developers and more effective synchronous distributed requirements negotiations.

**Björn Regnell** and his colleagues’ method for visualizing agreement in distributed prioritization of market requirements allows stakeholders from distributed market segments to actively participate in an iterative requirements prioritization process. Its use in a case study found support for the stakeholders’ decision-making process.

**DCPT:** Distributed collaboration and prioritization tool. DCPT supports the distributed and collaborative prioritization of requirements using the WinWin requirements and negotiation system and has been used successfully in large stakeholder teams.

Commercial RE tools


**Telelogic Doors:** [www.telelogic.com/corp/products/doors/doors](http://www.telelogic.com/corp/products/doors/doors)

References


Supporting interorganizational structures

First, define a clear organization structure with communicating responsibilities for the distributed project. Creating roles with clear responsibilities, assigning the roles to the distributed stakeholders, and indicating which
Contacting the appropriate roles in the remote stakeholder group is as important as defining these roles.

roles must communicate with each other between the different stakeholder groups helps the stakeholder know whom to contact and thus facilitates requirements knowledge-sharing practices. Cross-functional teams associated with developing a particular requirement represent social networks whose members benefit from clear identification of roles and responsibilities in the RE process.

Second, establish peer-to-peer links at all management, project, and team levels across distributed sites. For effective requirements acquisition and validation, contacting the appropriate roles in the remote stakeholder group is as important as defining these roles. Not only do client-developer relationships benefit from direct links between roles at the same organizational level in requirements elicitation and validation activities, but the process of managing requirements changes and subsequent coordination are better supported in remote developer-developer relationships.

Third, partially synchronize interorganizational processes and perform frequent iterations and deliveries. Achieving shared understanding requires frequent requirements validation, and if aligning overall RE processes across multiple stakeholder sites is difficult, defining and frequently communicating about common “work products” has several benefits. To avoid inconsistency in notations and terminology in the RE artifacts developed at different sites, stakeholder groups can define, at the beginning of the project, a requirements specification vocabulary as well as templates for common work products such as requirements descriptions, associated test scenarios, and functional designs. Frequent validation of these artifacts gives the teams visibility into the progress of stakeholders’ work at remote sites and consequently aids expectation management.

Finally, establish cultural liaisons. To bridge the cultural gap across sites and organizations, you should define the role of a cultural liaison (often played by a project member from one culture, an analyst, a project manager, or an architect sitting with colleagues at the remote site). These liaisons are important in relationship building as well as in requirements elicitation and validation when dealing with tacit knowledge about working practice and cultural characteristics at particular sites.

Supporting communication practices

A second set of strategies to handle global challenges is to maintain open communication lines between these well-defined stakeholder roles. At the beginning of and throughout the project, meetings involving representatives from all stakeholder groups are important to agree on project targets, common work products, and their mapping to requirements and a risk-management plan. Small distributed teams have found weekly meetings supported by video- or teleconferencing successful for requirements gathering, validation, and management activities.

Global software development is no longer a phenomenon, but rather a practice resulting from conscious business decisions. Practitioners and researchers together must recognize the ongoing challenges that global stakeholders and global software teams face in their RE interaction. Beyond the suggestions noted here, I encourage more practitioner reports with concrete recommendations for successful RE stakeholder interaction.

References


15. R.D. Battin et al., “Leveraging Resources in Global


13. M. Paasivaara and C. Lassenius, “Collaboration Prac-


11. D. Smite, “Requirements Management in Distributed

12. J. Chisan and D. Damian, “Towards a Model of Aware-

Alleviating Distance in Global Software Development,”

17. R. Heeks et al., “Synching or Sinking: Global Software

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