



Global Software Engineering

An Industry Perspective

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SOFTWARE, LIKE ALL industry products, is the result of complex multinational supply chains with many partners from concept to development to production and maintenance. Global software engineering (GSE), IT outsourcing, and business process outsourcing during the past decade have showed growth rates of 10 to 20 percent per year.¹⁻³

This instalment of Practitioner's Digest summarizes experiences and guidance from industry to facilitate knowledge and technology transfer for GSE. It's based on industry feedback from the annual IEEE International Conference on Global Software Engineering, which had its 10th edition in 2015 (for more on ICGSE, see the sidebar).

Global Software Engineering's Drawbacks

The ICGSE 2015 industry keynote mentioned that only 30 percent of all embedded software is developed in a global or distributed context, whereas the vast majority is collocated.¹ Nevertheless, global development and sourcing is growing, and the number of quality deficiencies and callbacks across industries is increasing in parallel with this growth. So, successfully managing global software projects has rapidly become a key need across industries. However, most such projects don't deliver according to expectations.^{2,3}

Working in a global context obviously has advantages but also drawbacks. Cost reduction is still the major trigger for globalization, although its relevance has been decreasing over the past years. Insufficient competences, hidden costs, and many additional overheads severely reduce this potential. The ICGSE 2015 industry panel pointed out that 20 to 25 percent of all outsourcing relationships fail within two years, and 50 percent fail within five years.^{2,3}

Global development projects often fail when tasks are broken down too much, such as asking a remote engineer to do verification of software developed concurrently at another site.² In such cases, distance effects and lack of direct communication slow down development rather than help it. The single biggest source of difficulties in outsourcing or offshoring is bad communication across sites, which hinders both coordination and management. The learning curve for transferring a software package to a new team takes 12 months.¹⁻³ The effectiveness of software design and coding grows in a learning curve, with 50 percent effectiveness after one to three months and 80 percent after three to five months. This obviously depends on process maturity and technology complexity.

To overcome these difficulties, several solutions have been proposed and



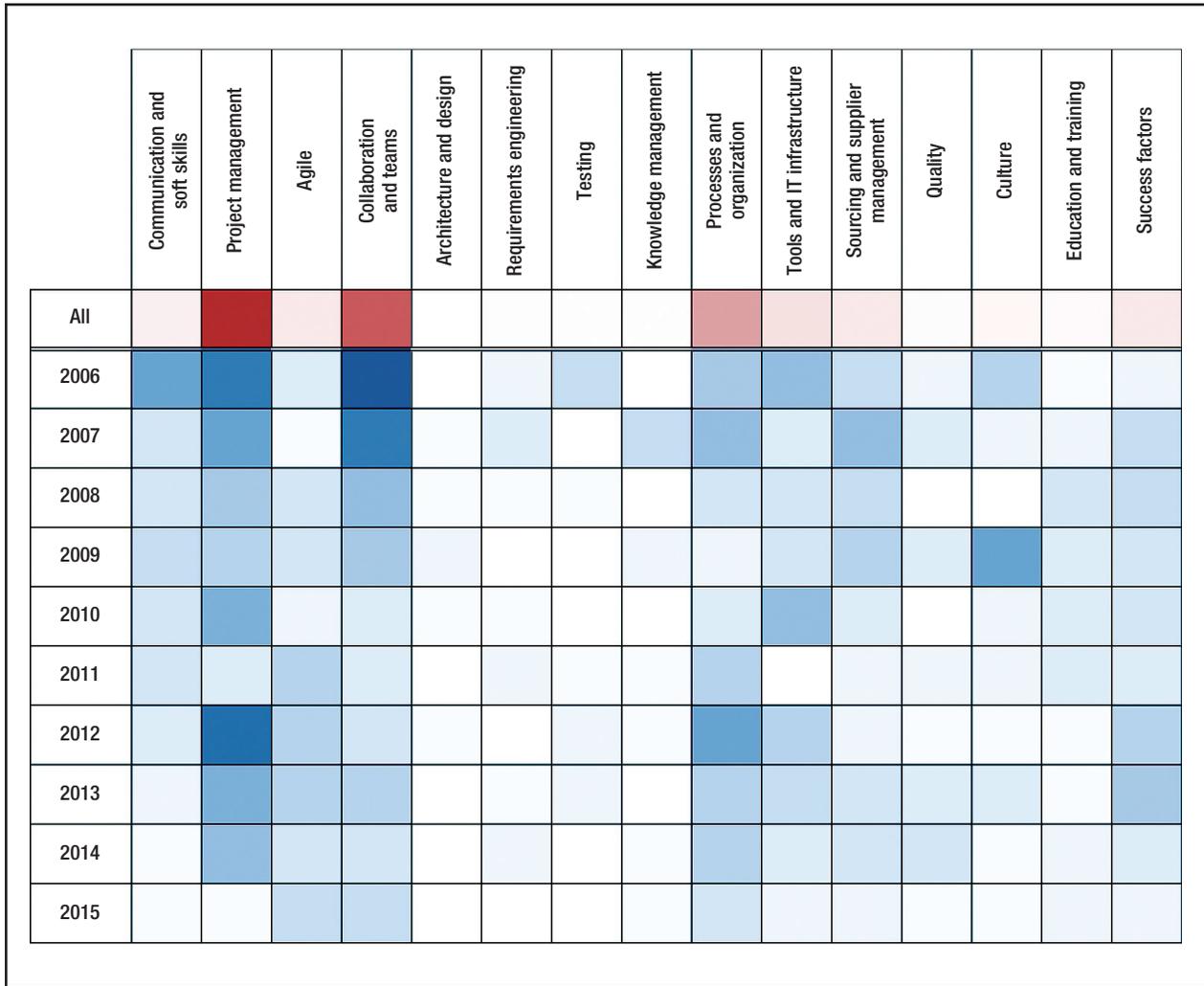


FIGURE 1. Papers at the IEEE International Conference on Global Software Engineering, classified by year and topic. Darker colors indicate more papers published about that topic.

published at ICGSE. For example, in 2007 Siemens proposed TAPER (Trust, Assess, Prove, Enhance, and Reengineer), a framework for establishing offshore development centers that's based on good practices.⁴ The company applied the framework's five phases successfully with significant results, such as a very high customer satisfaction rating, a low peak attrition rate, and satisfied professionals working with successful global projects.

ICGSE and Industry

Using cluster analysis, we classified the papers from the past 10 instalments of ICGSE. We identified several meaningful groups, which we also correlated with experiences from the ICGSE program committee chairs. Figure 1 shows the resulting classification.

Overall, the topics with the most papers were project management, collaboration and teams, and processes and organization. The analysis of

each year also shows interesting patterns. For example, in 2009, the topic with the most papers was culture.

While "normal" software engineering challenges have been discussed for years, ICGSE has added distribution as an extra dimension, thus calling for investigating problems and their solutions in a global context. For example, agile practices, considered the most promising ways to improve software development speed and qual-

ity, have received increased attention over the years (see Figure 1). This is closely related to questions of collaboration and team organization because agile principles, such as onsite customers, direct communication, or shared code ownership, must be adapted to GSE.

For instance, Nils Moe and his colleagues proposed ways for team leaders to coach global agile virtual teams.⁵ In their study, because the team members had overlapping hours, the team could base coordination on mutual adjustments and frequent feedback. Social software and face-to-face meetings were important. Consequently, team members became highly motivated and self-managing.

Maria Paasivaara and her colleagues studied the interplay between agile and GSE for industry projects. One of their recent studies, published at ICGSE 2014, proposed practices to allow rapid releases in large-scale agile projects.⁶ One practice involved having an experimental mind-set toward the change, taking a trial-and-error approach. At ICGSE 2013, Paasivaara and her colleagues proposed an approach to integrated agile and lean practices for GSE projects at Ericsson.⁷ This approach included early involvement of global sites, broad involvement at all organizational levels, a competence exchange program, constant communication and cross-site visits, and joint infrastructure.

In addition, several ICGSE papers investigated options for enacting agile approaches in GSE, quite often supported by tools, such as instant messaging, various collaboration tools, or collaborative testing and debugging. However, a decreasing number of papers discussed tools and IT infrastructure.



ICGSE

The annual IEEE International Conference on Global Software Engineering (ICGSE) brings together worldwide industry and research leaders in distributed software development. ICGSE 2015 had participants from over 20 countries, with one-third of the papers from industry. ICGSE 2016 will take place in Irvine, California from 2 to 5 August. Join the conference and learn how to succeed with distributed software projects. More information is at www.icgse.org.

Meeting the Challenges

GSE isn't easy, as Christof Ebert's ICGSE 2015 keynote talk explained.¹ Distance multiplies risks in an already high-risk business. Costs increase 20 to 40 percent at the beginning of the learning curve for one to two years. More than 20 percent of sourcing contracts are cancelled in the first year, and more than 50 percent don't deliver according to the objectives or strategy and are cancelled downstream. Over 80 percent of companies aren't satisfied with their global software activities. Unexpected loss of intellectual property rights and technology know-how increases, and proficiency levels decrease owing to inexperienced new hires.

The ICGSE papers have shown that, for the reasons we just mentioned, GSE significantly affects industry. Many of the papers have been grounded in academic–industry cooperation in which concepts and new approaches, methods, and tools were disseminated and evaluated in practice, to deal with these challenges.

With this in mind, we believe that global engineering will evolve toward a standard engineering management method that R&D managers must master. Processes and prod-

uct components will increasingly be managed in a global context. Suppliers from many countries will evolve to ease start-up and operations of GSE projects even for small and mid-sized enterprises in the high-cost countries. Brokers will emerge that help find partners in different parts of the world and manage offshoring overheads.

Customers are no longer in a position to judge that a piece of software from one site is better or worse than the same software produced somewhere else. What counts are things that impact the business and performance, such as resource availability, productivity, innovativeness, product quality, cost, flexibility, and skills. 🌐

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