Globalizing Software Development

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In an attempt to provide insight into managing successful international technology collaboration, this article presents a framework to guide managers in dividing and integrating labor and assessing methodological and organizational weaknesses. The analysis draws on technology and management literatures and specifically addresses outsourcing systems development work to emerging economies. Recommendations are provided not only on how to organize international work at present, but also on the characteristics of projects and tasks that are good candidates for international outsourcing, and what capabilities must change in order to move to an international project management methodology involving lower project risk and lower coordination costs.

Like many other industries, software has entered an era of globalization (Kim, et al., 1989; Schware, 1989) due to different factor costs among nations, technological advances (such as improved telecommunications, greater standardization and modularization of software, etc.), and the presence of multinational competitors that are on the leading edge of global work integration. In addition, outsourcing is on the rise (Khosrowpour, 1995; Apte, 1990), and information technology (IT) work is being outsourced internationally in a manner that less resembles international trade and more resembles integrated, international production.

With these changes, IT managers are having to “internationalize” their management practices in order to coordinate and control their international operations. Unfortunately, they face a dual problem of transitioning towards transnational IT management (a) from their own locally-oriented IT management heritage (Cash, et al., 1992), as well as (b) from the heritage of international business, which has traditionally been conducted more as trade than as integrated, international production (Bartlett and Ghoshal, 1992). Tight coordination and control across national borders was not even attempted until fairly recently because of the lack of communications infrastructure (Ohmae, 1989: 139), and new management techniques for dealing with integrated transnational operations are still being developed.

In the face of these changes, managers need guidance in managing their international efforts and deciding which activities should be outsourced across national borders. To this end, the current article presents a framework for thinking about transnational IT management. The article first outlines some trends that are enabling the changes and which are changing the way IT projects are managed. Then the framework is presented, issues of task partitioning and integration are outlined, and recommendations are provided both for current capabilities and infrastructure and for the future.

Although the framework could apply to IT management in general, the article focuses on the specific situation of outsourcing software development to emerging economies. Before delving into the framework, two terms should first be defined: outsourcing and emerging economies. Outsourcing, as it is used in this article, refers to sourcing tasks outside of a work group. For example, if an IT department finds it no longer has the resources or expertise to handle all the demands
for new computer applications, it might contract with a local third party to provide those services (outsourcing). If, however, the department is under cost pressures or needs expertise it cannot find locally, it might contract with a third party half-way around the world in an emerging economy (international outsourcing) such as India or the Philippines (see Meadows, 1995, for data on their software industries).

The term “emerging economy” is used here, instead of “less developed country” (LDC). Although “less-developed country” is a popular term, it de-emphasizes the substantial civilized history of the nations referred to and the economic development already achieved. Further, the terms do not focus on the critical issue at hand, i.e. the emergence of these nations as global economic powers. Likewise, “industrialized nation” will be used instead of “more developed country” (MDC) in order to focus on industrialization as an economic phenomenon, and in order to use a comparable term.

New Developments Enabling Change

New systems development methods and tools are enabling the outsourcing and IT globalization trends mentioned above. In the field of software development, near-term trends (Marciniak, 1994) point toward enhanced methods for design, more standardized procedures, better ways of evaluating designs, and rising levels of design quality and overall system quality. Defining requirements will continue to be problematic. In the long-term, the discipline should mature along the same lines as the engineering profession, making systems development more a science than an art. In the meantime, however, it is an art and will continue to be for the foreseeable future.

Trends that appear favorable for outsourcing to emerging economies include greater modularity (such that pieces of systems can be developed off-site more easily), standardization of programming languages and environments (reducing the learning curve and hardware and software investments), open systems (allowing for multiple development environments to be used), rise of client-server and other non-mainframe environments (reducing capital investment requirements in capital-poor nations), rise of more reliable means of defining user requirements (favorable to emerging economy software developers if they can gain access to them and use them effectively), easier transportability of software over international telecommunications facilities (which are improving at a rapid pace), rise of Integrated Project Support Environment (IPSE) systems (which provide a coordinated set of software engineering and management tools), and the rise in outsourcing in general.

Tools/techniques such as prototyping and Rapid Application Development (RAD) that improve user-developer interaction may prove invaluable to overseas outsourcers for improving their interaction with users and producing designs that are more reliable. However, system requirements will probably remain generally unstable, and overseas outsourcers will have to contend with problems of cross-cultural communica-

tion, knowledge of local business practices, and the need for rich media (e.g. face-to-face) during relationship-building and unstructured problem-solving tasks.

Not so favorable for systems development outsourcing are trends which increase the productivity of industrialized-nation systems developers and focus systems development activities on the user-developer interface (the weak link in overseas outsourcing, as discussed below), including code generation and reuse, use of higher-level languages (e.g. 4GLs+, OOPS, etc.), enterprise modeling, end-user computing, and increased use of packages (although they frequently must be tailored).

Will new methods and tools make the need for outsourcing to emerging economies obsolete (such that all the research being done in this area, including this article, is needless)? The answer is “No.” First, new methods — even if they do reduce overall labor demand by making systems professionals more productive — take on average 18 years to roll out into the industry (Gibbs, 1994). In the meantime, there is a worldwide shortage of 1 million systems-builders, and by the year 2,000, it is estimated that Japan alone may need about one million more software engineers and programmers (Mijares, 1992).

Second, in the face of a growing software labor shortage, most companies have continuing backlogs of new applications and maintenance, and there will always be a need for at least some technical work which can be readily outsourced overseas. Software professionals are increasingly forced to maintain software rather than develop it (60 - 80% of software budgets and 50% or more of corporate I/S staff are allocated to software maintenance) (Kim, et al., 1989; Keen, 1991), furthering the maintenance backlogs and the shortage of labor for systems development. Emerging economies can do a large part of the maintenance and at least some of the development work.

Third, a floating global resource of knowledge workers from both industrialized nations and emerging economies is arising, with the expertise necessary to serve clients in a variety of locations worldwide (Aharoni, 1993). MNCs increasingly need “local” expertise in multiple sites (including emerging economies), and international business holds great potential for at least some degree of homogenization (see, for example, Porter, 1986, and Bartlett, Doz, & Hedlund, 1990). Indeed, globally used information systems may need to be globally developed (on globally used information systems, see, for example, Deans & Kane, 1992, and Roche, 1992).

Framework

Dividing tasks among the groups that participate in an international systems development project is, at its most basic level, a problem of division of labor. Understanding how to organize international outsourcing projects requires addressing three questions:

1. Division of Labor Theory: Without regard to capabilities, how should the work be organized?
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