OFFSHORING OF SOFTWARE DEVELOPMENT: PATTERNS AND RECESSION EFFECTS

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I. INTRODUCTION

There has been rapid growth in offshoring of software development since the later 1990s. It has been driven mainly by cost and access to skilled labor, and secondarily by market opportunities.

In the past, offshoring has occurred mostly in times of high growth and a tight labor market in the U.S. software industry. Beginning in 2007, however, the U.S experienced a severe economic recession which had the potential to change these traditional relationships (PricewaterhouseCoopers, 2008). Consequently, this research asked the question: "What are the current patterns of offshore software development and what are the impacts of the economic downturn on offshore development?"

We had conducted an earlier survey of offshoring by U.S.-based software companies in 2008 (Dedrick, et al., 2009). The topic was offshore software development, including drivers and obstacles, location, performance, and management practices. We repeated the survey in 2010 to determine changes in these features and particularly, the impact of the 2008 recession on offshoring of software development. This report summarizes the main findings from the 2010 survey.

Survey respondents

A telephone survey was conducted by Abt SRBI (New York) from January 28 to April 12, 2010. The respondents were selected from firms with SIC codes corresponding to computer programming services (7371) and prepackaged software (7372). Respondents were generally executives involved in software development.

The survey resulted in 254 completed cases with a response rate of 19.9%. Of the firms surveyed, 104 had no offshore development and were asked a short set of questions to compare them with the 150 firms who did have offshore development. Firms that conduct any offshore development completed the full survey. The full telephone survey took about 20 minutes to complete.

II. OFFSHORE VERSUS NON-OFFSHORE COMPANIES

Using the full sample of firms, we can compare companies that have some offshore development with those that have none. Doing so, we find the following differences. Firms that have offshore development have a much larger average share of revenues outside the U.S. (27% versus 10%), suggesting that offshore development is linked to firms' involvement in foreign markets.

Table 1. Comparison of firms with and without offshore development

	Some offshore development activities	No offshore development activities
Number of firms	150	104
Mean percent revenue from sales outside the U.S.	27%	10%
Mean number of software developers	162	82

Firms that employ offshore development are significantly larger in terms of average number of developers (162 versus 82). Likewise, looking at firm size in terms of total employment, we find that larger firms are more likely to have offshore development than smaller ones (Figure 1).

These findings suggest that offshoring is easier to implement for larger companies with more resources, or that there is a greater potential payoff for larger companies who can gain economies of scale in offshore operations or better tap into international markets.

**Figure 1. Offshore development by size of company**
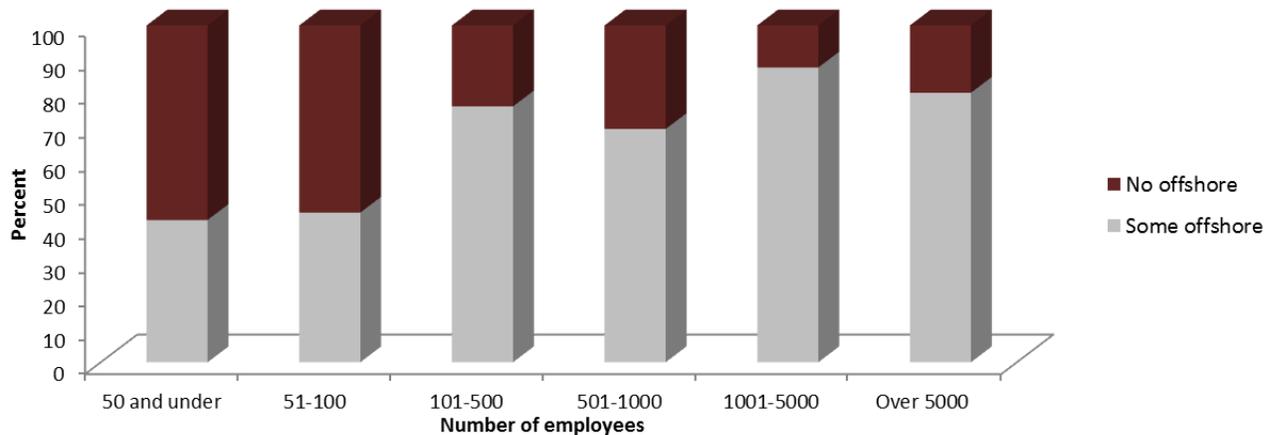
There also are differences between firms that have offshore development and those that do not in terms of the type of software that they develop. Firms that have offshore development have a significantly higher concentration of revenues in on-demand (SaaS) software, and a lower concentration in custom software development (Figure 2). There is no significant difference for on-premise (enterprise) or packaged software development.

Figure 2. Percent revenue by software category
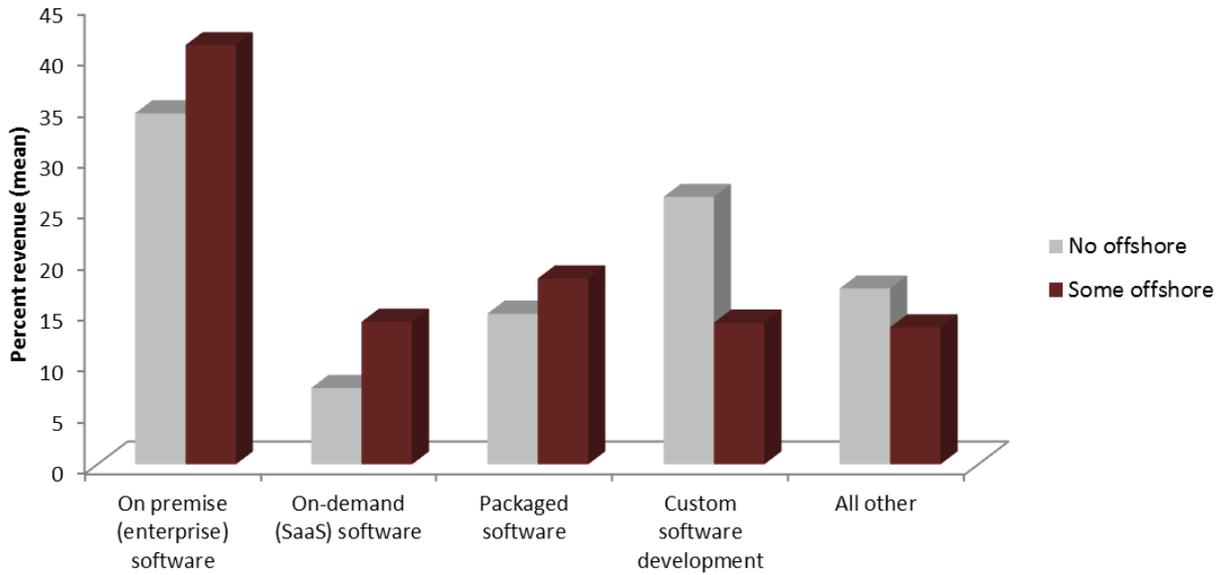
We can further break down firms by their mode of development. These include those that have no offshore development, those who develop offshore using in-house (captive) developers only, those that go offshore via outsourcing only, and those that have both in-house and outsourced offshore development (Figure 3).
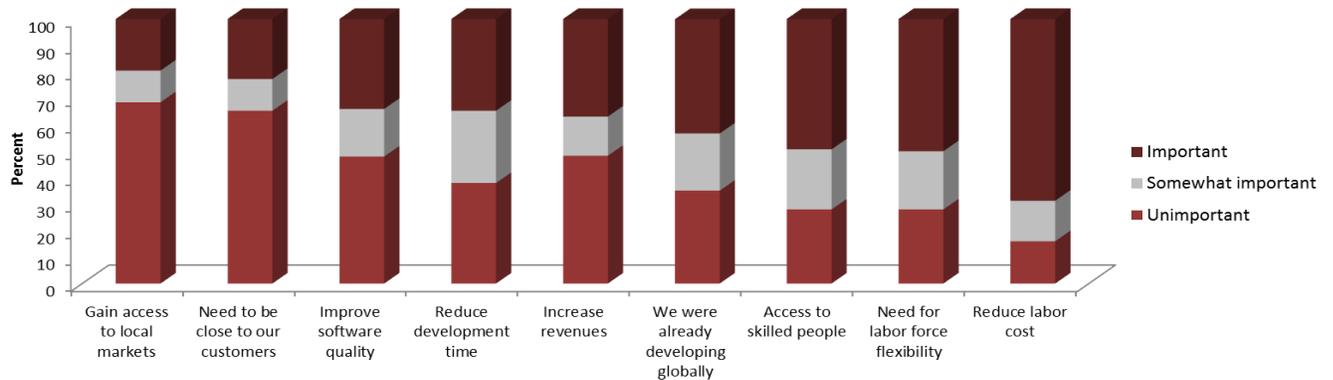
Figure 3. Mode of software development
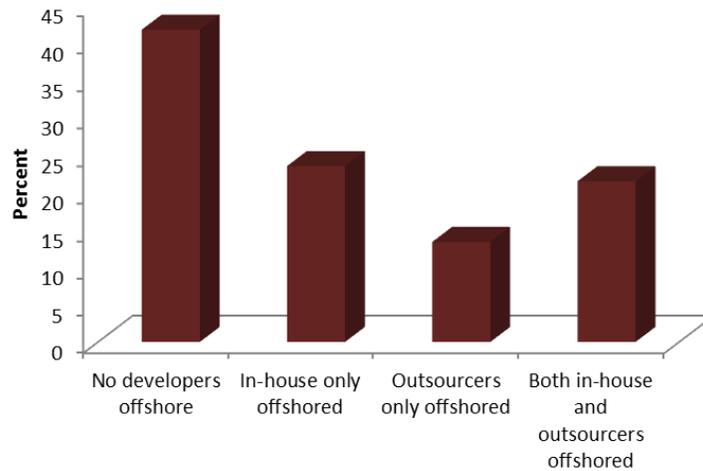
III. COMPANIES OFFSHORING SOFTWARE DEVELOPMENT

We next focus on the 150 companies that have some offshore software development activities. We examine the drivers and obstacles to offshoring, the offshore locations, the activities that firms conduct offshore, their offshore performance and their management practices.

Drivers of offshore development

The most important factor driving firms to go offshore is to reduce labor cost, followed by need for labor flexibility and access to skilled labor (Figure 4). Least important are the desire to gain access to local markets outside the U.S. and the need to be close to customers. It is true, as noted above, that firms with offshore development have a much larger share of their revenues outside the U.S., but it appears that the main driver of offshoring is still the desire to find low-cost labor.

Figure 4. Offshore drivers

There are significant differences in drivers by type of firm, however. Figure 5 shows that among those who have offshore development, firms with outsourced only software development, or both in-house and outsourced development are significantly more likely to mention need for labor force flexibility as a reason for going offshore compared to those who go offshore solely in-house. These in-house (captive) only software development companies are more likely to report "we were already developing globally" as a driver significantly more often than those companies offshoring through outsourcers only.

Figure 5. Offshore drivers for in-house and outsourced development
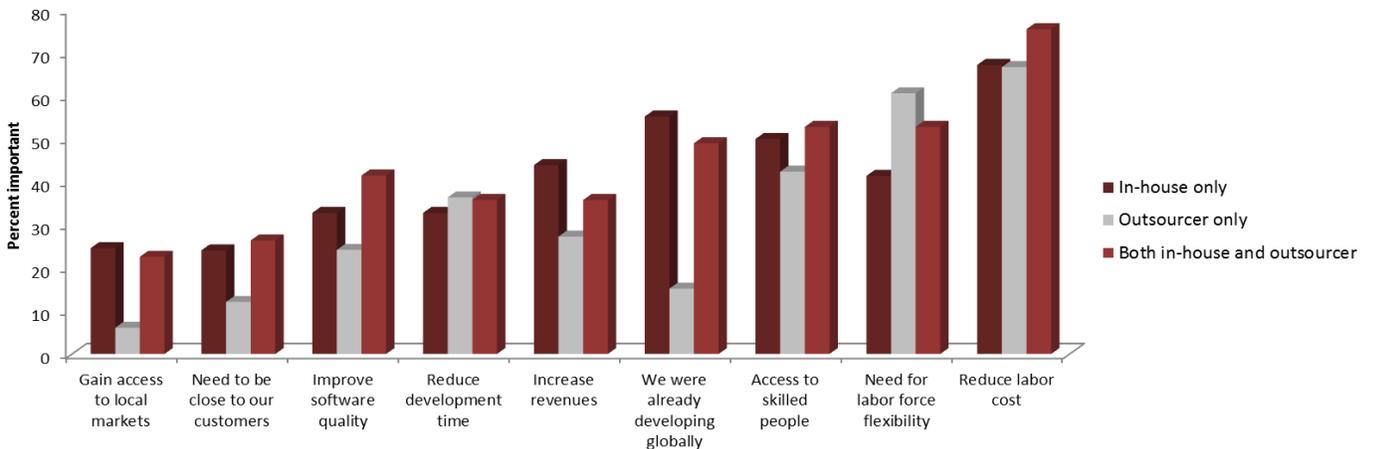
Obstacles to offshoring

The biggest obstacles reported with offshoring involved difficulties with knowledge transfer, and cultural and communication problems (Figure 6). The skill and experience levels of offshore workers was reported as less important, as was concern about data security. There was greater concern with the strategic importance of the activity and with breaking up work across teams. Overall, however, the biggest challenges involve the process of collaborating and sharing knowledge among teams in different locations, compounded by cultural and perhaps language differences.

Figure 6. Obstacles to offshore development
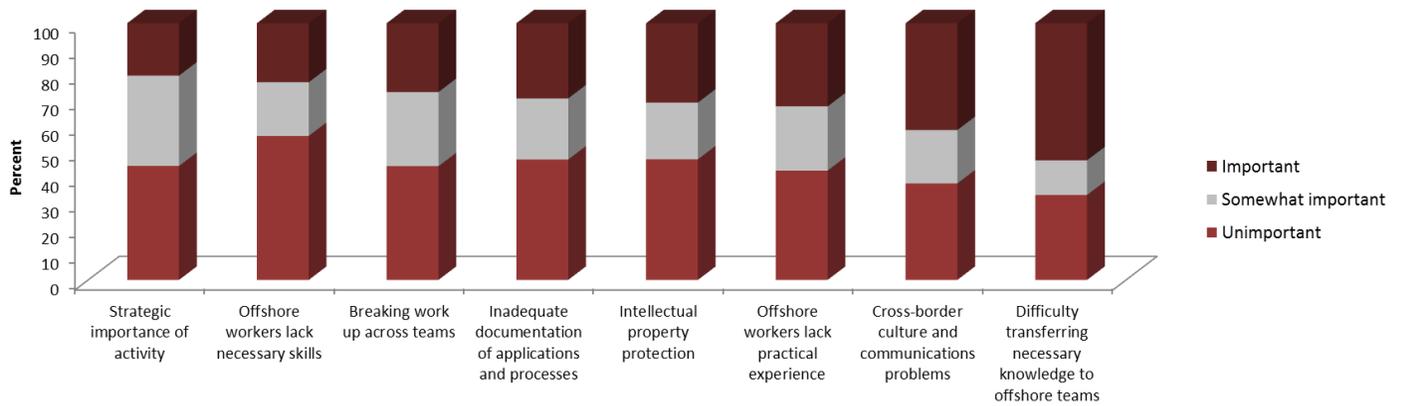
Comparing firms by mode of offshoring (in-house, outsourced, both), we find that firms that use only in-house development report fewer problems in general (Figure 7). However, the differences among firms by mode of offshoring are not statistically significant.

**Figure 7. Obstacles by mode of offshoring**
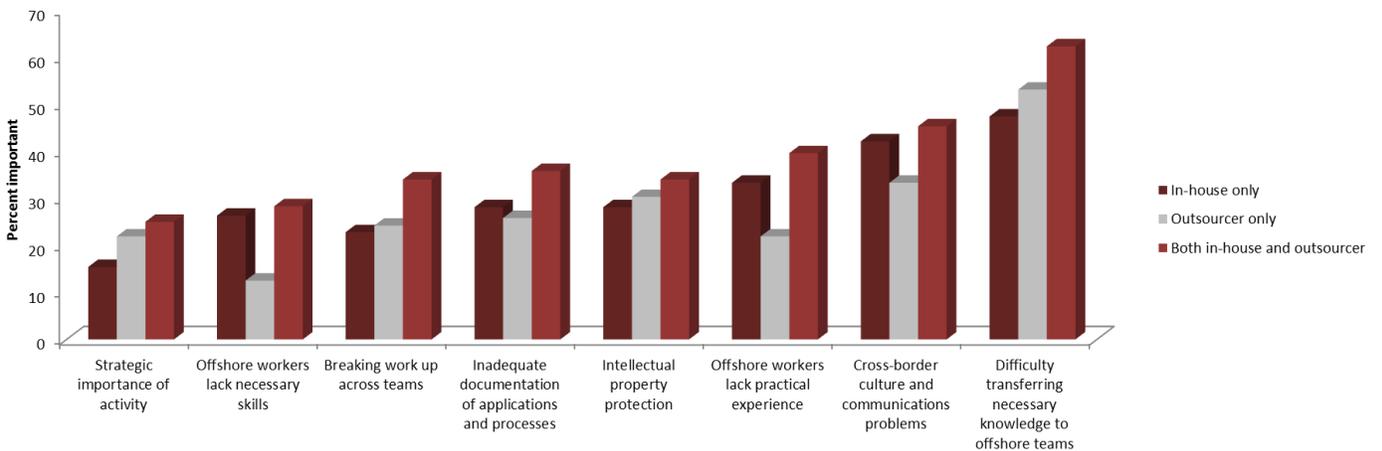
Location of offshore development

The most common location for in-house offshore development is India, identified by 46% of those firms who have any offshore development. Next is Western Europe, at a close 44%, followed by other Asia/Pacific (outside China) and Canada at 22%, China at 20%, Eastern Europe at 19% and Latin America at 3% (Figure 8).[1]

The picture is different for outsourced development. Here, India is more predominant, mentioned by 65%, with Eastern Europe at 24%, China at 17%, and Western Europe at 12%.

These differences are consistent with the idea that in-house development is aimed more at serving affluent markets such as Western Europe, while outsourced development is mostly about access to low cost talent and is focused more in India. Also, many of the major outsourcing service providers are based in India and have most of their development there, so respondents might be outsourcing work to those firms.

Figure 8. Countries or regions where in-house developers are located
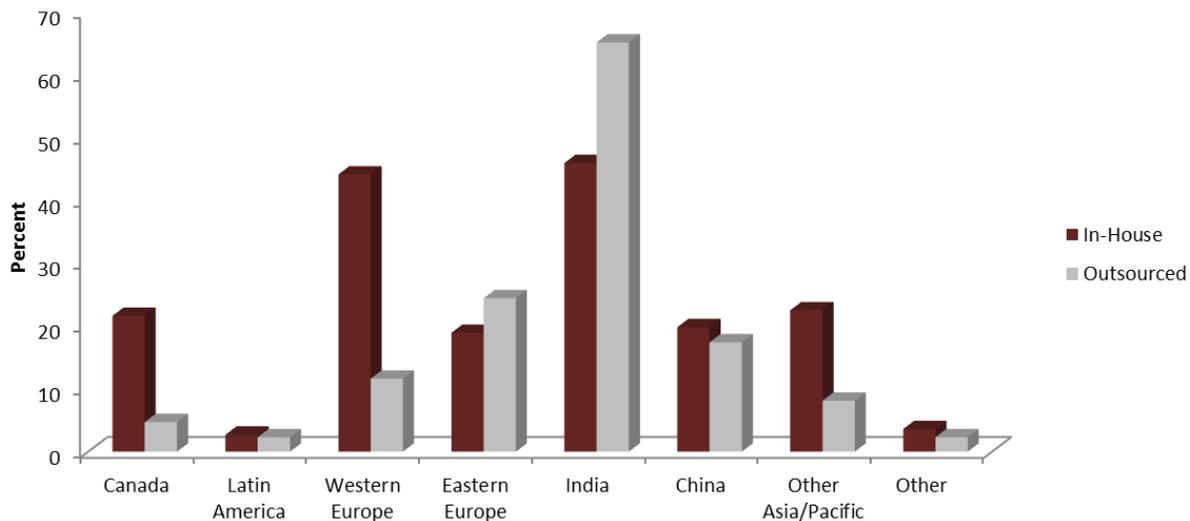

The activities firms conduct offshore

Software development can be divided into several different tasks or activities, including analysis, design, coding, testing, implementation, maintenance, project management, localization and R&D. Firms may keep some activities onshore while moving others offshore, or they may move the entire process offshore for a particular project or product. It is often argued that more routine tasks can be more easily relocated, while more specialized tasks need to remain at home to utilize workers with specific skills and experience or to be close to customers.

[1] Note that firms can have more than one offshore location.

In the case of in-house development (Figure 9), our results are consistent with these expectations. The activities that are most often carried out offshore are the more routine tasks of testing and coding. Higher level activities such as analysis, design and R&D are less likely to be done offshore. Also less likely to be offshore is project management, which requires customer relationship management skill and experience; and implementation, which generally must be done at the customer's site.

Figure 9. Proportion of in-house development activities done onshore or offshore
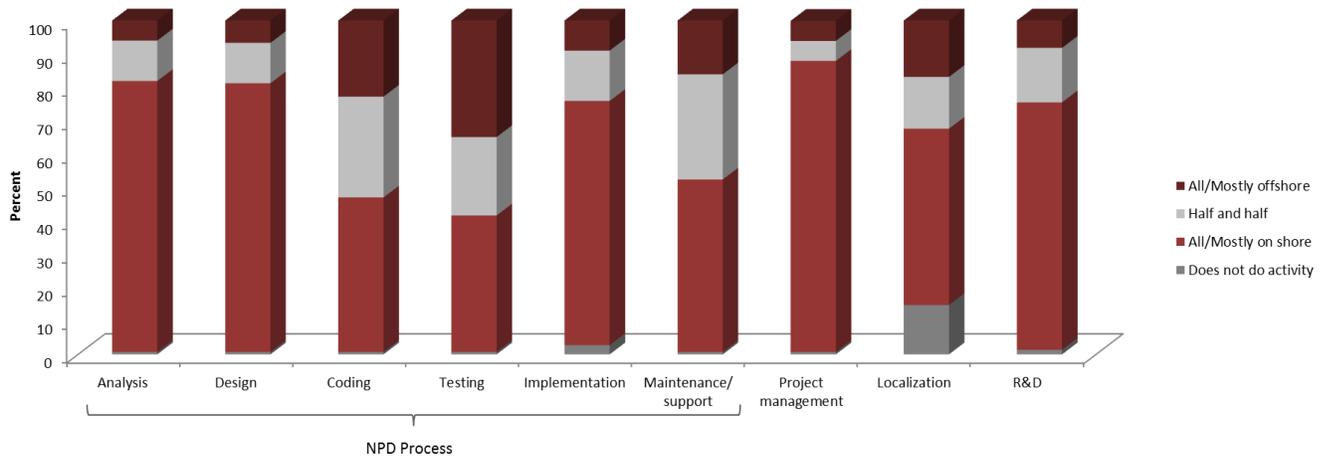
The pattern of activities done offshore is the same for outsourced development as for in-house. In this case, however, a much higher share of all of the development activities are done offshore (Figure 10). Indeed, the proportion of outsourced activities done offshore is 2-3 times greater than that for in-house development. Again, this is probably at least in part due to end user firms outsourcing to foreign (especially Indian) firms who carry out the full range of development activities in their own home locations.

Figure 10. Proportion of outsourced development activities done onshore or offshore
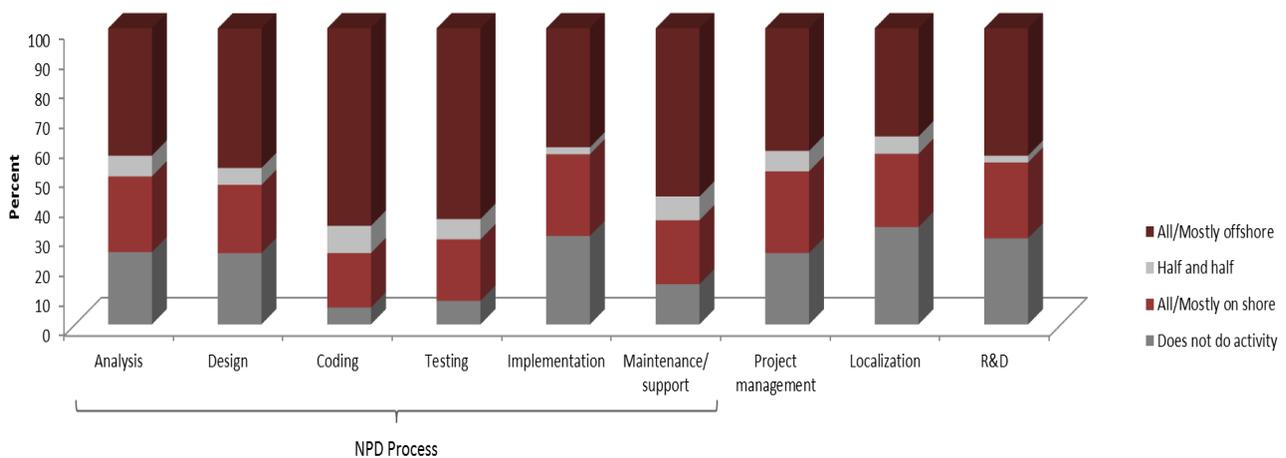
Offshore Performance

Respondents were asked how offshoring affected their firms' performance on several measures. First we looked at quantitative estimates of cost savings. The average (mean) cost saving reported was 25%, with a median of 20%. There was a wide variance in savings. Fully 19% of firms reported no cost savings at all, while 22% reported savings of greater than 40% (Figure 11).

Figure 11. Cost savings from offshore development
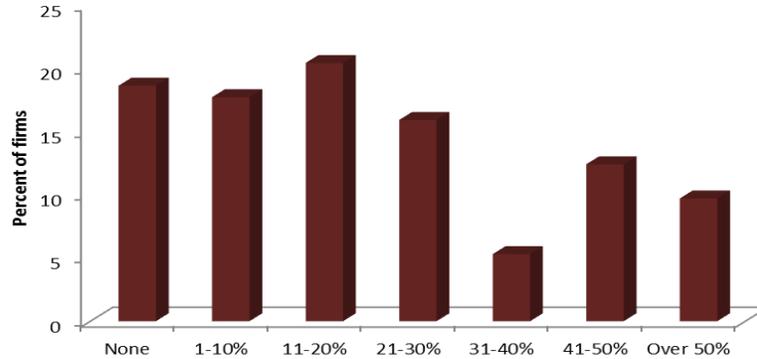
Respondents also reported impacts of offshoring on a number of qualitative measures (Figure 12). The greatest positive impacts were seen in labor force flexibility, with 61% reporting improvement. Labor flexibility refers to the ability to increase or decrease the number/skill-type of software developers employed at any one time in response to changing need. It is more about response to demand than cost savings although it has inherent savings implications. These include savings from being able to scale up or down rapidly and change skill-types or levels vs. hiring permanent workers with fringe benefit and retirement obligations.

About half of all firms reported improvements in competitive position, speed of product development, and access to needed skills. About a quarter reported improvements in customer service levels and revenue from non-U.S. markets. Some firms reported worse performance as a result of offshoring, most commonly in software quality, speed of product development, and customer service.

**Figure 12. Impacts of offshoring on performance**
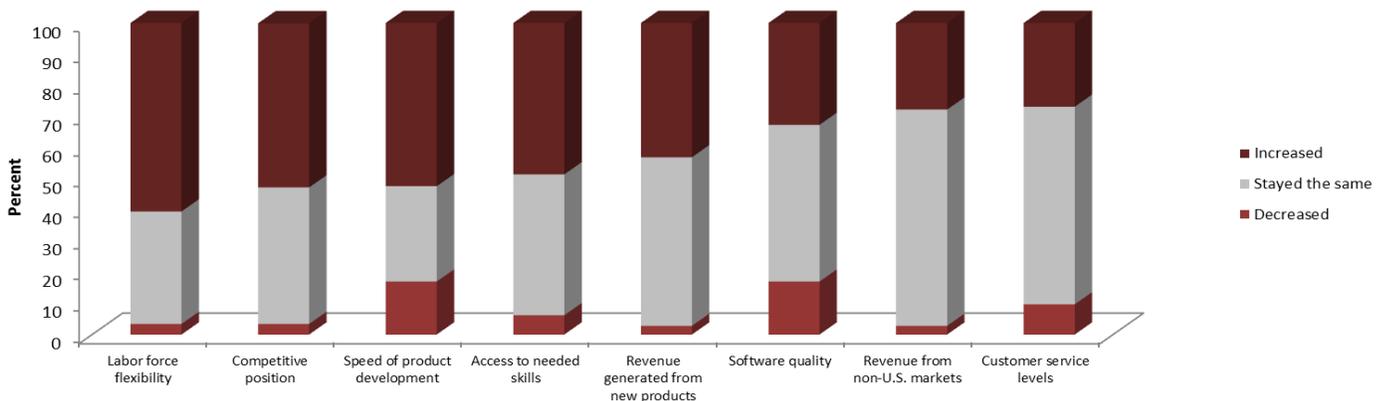
Management of offshore development

Firms use a number of tools to manage their offshore development processes (Figure 13). Almost half of those interviewed said they made extensive use of maintaining career paths in the U.S. to retain staff, an important issue when work is being moved offshore. Only 29% focus on developing career paths outside the U.S. to attract and retain offshore staff. About 37% evaluate new projects for suitability of offshoring a lot, a process likely to lead to greater use of offshoring.

In order to facilitate collaboration and knowledge sharing, 42% frequently have U.S. and offshore team members meet face-to-face, 32% use formal training programs, while only 10% rotate offshore managers to the U.S. and 14% have U.S. managers locate to offshore sites as ex-pats. While U.S. managers may be responsible for the performance of offshore teams, only 21% of firms frequently link U.S. managers' compensation to the performance of those operations.

Figure 13. Offshore management practices
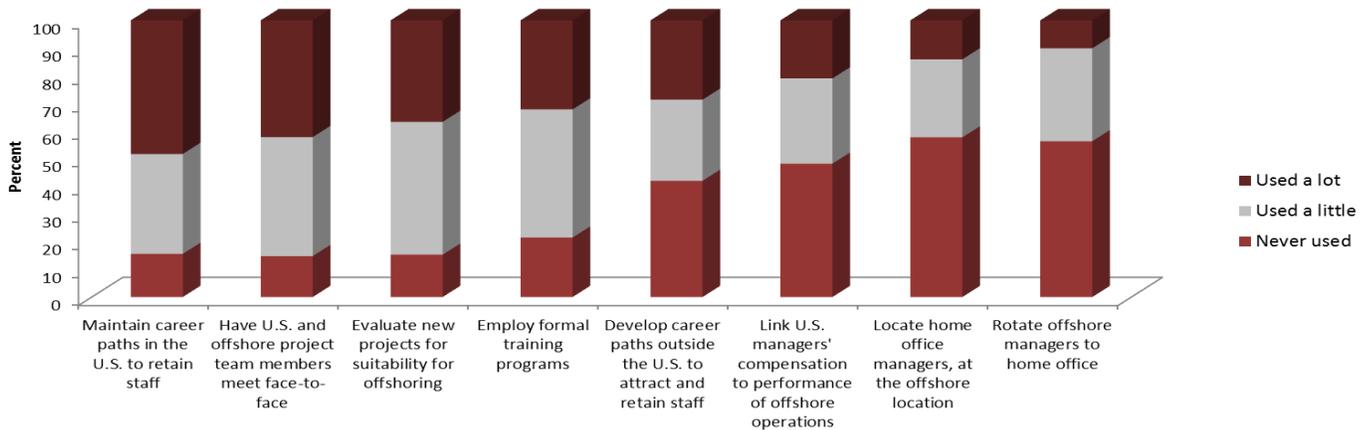
Among the firms in the entire sample, there was widespread use of a set of software development and project management practices (Figure 14). Interestingly, there was no significant difference between those that offshore development and those that do not, even though practices such as standardization and formalized processes are often seen as prerequisites for effective offshoring.

Figure 14. System development and project management practices
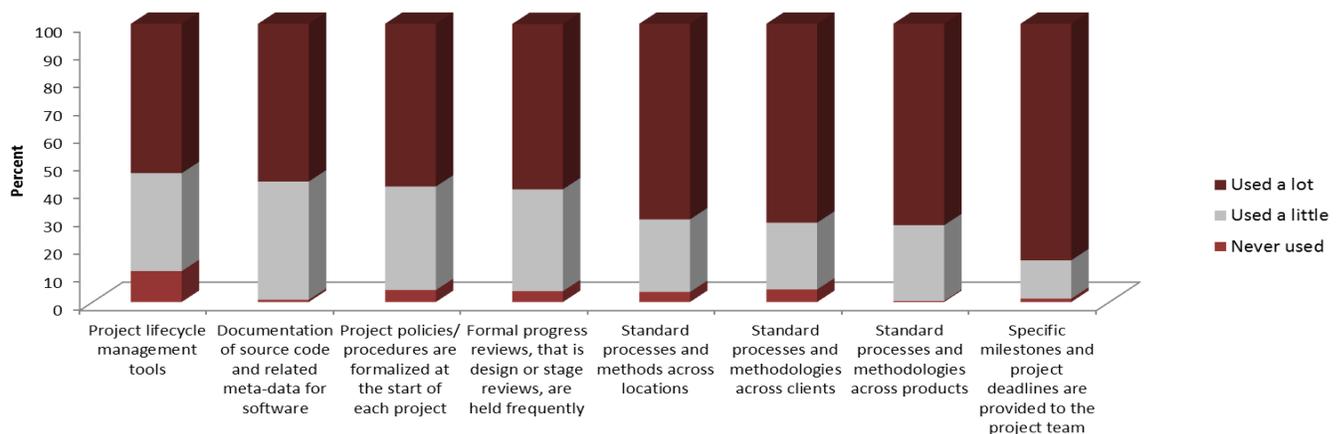
IV. EFFECTS OF THE RECESSION ON U.S. SOFTWARE FIRMS

Historically, the impact of recession is increased pressure on firms to reduce costs. This pressure might come from changes in costs or changes in market opportunities. Changes in cost might be due to exchange rate fluctuations, alleviation of talent shortages in the U.S., or declining wage differentials between the U.S. and developing countries (Bergin, et al., 2008). Changes in market opportunities might be due to the collapse of demand in U.S. and other developed markets or due to sustained growth in some international markets.

The reactions of firms to severe recession could range from consolidation of software development activities in fewer locations (either onshore or offshore), postponing or canceling projects, laying off workers (either onshore and/or offshore) and increasing or decreasing their efforts in international markets. The overall impacts of these reactions could be a reduction in the firm's total work force and/or a possible shift in the percentage of workers onshore versus offshore, and/or a change in the mix of in-house versus outsourced workers.

We first look at change in international sales over the past two years, then re-examine the drivers of offshoring and then look at reported changes in offshoring due to the recession.

International sales

As suggested above, firms might have gone offshore in the past two years in search of international sales in response to the recession at home. Indeed, this might be the case for some firms, as international sales have increased for nearly three-fifths of the firms, while international sales have stayed the same for 36% and actually decreased for about 5%. This suggests that firms might also have increased offshoring of software development in response to growth of international markets (Figure 15).

During the past two years, the U.S. economy has faced several economic difficulties which has resulted in a recession. During this time period, we asked software companies what, if any, impacts the recession is having on offshoring, as well as its effect on international sales and number of offshore developers. We find that most firms not offshoring reported no change in international sales. For those offshore, 32% reported that their international sales increased a lot, while 31% reported sales increasing a little or no change.

Figure 15. Effects of recession on international sales
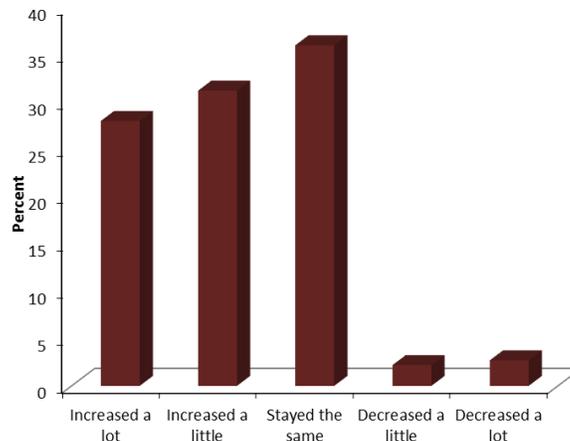
Offshoring drivers during the recession

Consistent with the prospect that some firms went offshore to increase sales, two important drivers of offshoring were to "increase revenues" and "gain access to local markets," reported by 37% and 20% of the firms, respectively (Figure 4, earlier).

However, reducing labor cost was a far more important driver for the software firms (69%). Next was gaining labor force flexibility (50%) and gaining access to skilled labor (49%). Labor force flexibility refers to being able to expand and contract the labor force in response to demand, and not being tied long term to employees; consequently, it also has implications for reduced labor cost. Taken together, these findings indicate that cost factors are the most important drivers of software offshoring.

Change in in-house vs. outsourced software developers located offshore

Overall, 42% of the firms reported no change in the percentage of software developers located offshore in the past two years. Among those who report the percent of developers increased, the proportion of firms reporting that in-house developers have increased is greater than those reporting outsourced developers have increased (Figure 16).

Among those who report that the percent of developers have decreased (11%), the proportion of firms reporting that outsourced developers have increased is greater than those reporting in-house developers have increased (Figure 16). Thus, for those firms that have increased the percent of developers offshore, the trend is clearly in favor of in-house vs. outsourced developers.

Consistent with their expressed need for labor flexibility (Figure 4, earlier), more firms have reduced the proportion of outsourced developers than have reduced the proportion of in-house developers. These firms have simply used the flexibility provided by outsourcing to reduce costs while hanging on to their own offshore developers.

**Figure 16. Effects of recession on software developers**
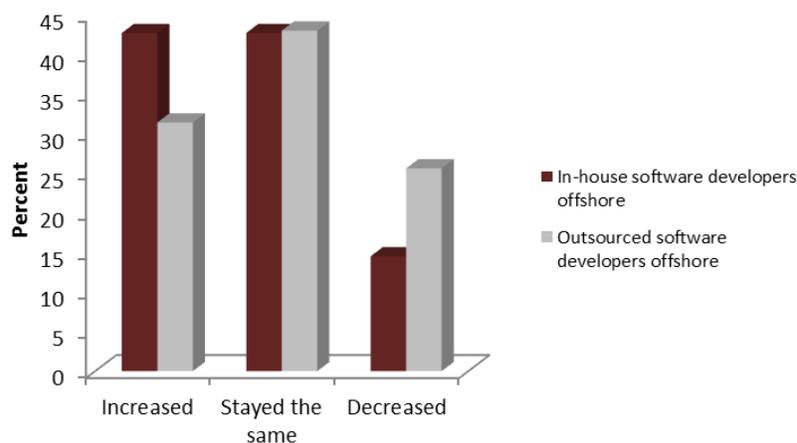
Recession effect on offshoring

Overall, the recession seems to have had a modest effect on offshoring in the software industry as 47% reported that the amount of offshoring stayed the same, while only 23% reported an increase and 30% reported a decrease (Figure 17).

Of those who said that the recession had led to an increase in offshoring, 61% cited greater cost pressure, 4% said there are better growth opportunities abroad, and 35% cited other reasons. Of those who said the recession had led to a decrease in offshoring, consolidation of development staffs was cited as the principal reason (52%), followed by decreased market opportunities abroad (29%). The idea that "U.S. labor is now more cost competitive" was cited by 10% of the firms. Thus, contrary to predictions by some economists, there is little evidence of a decline in wage differentials as a result of the recession.

Figure 17. Recession effect on offshoring
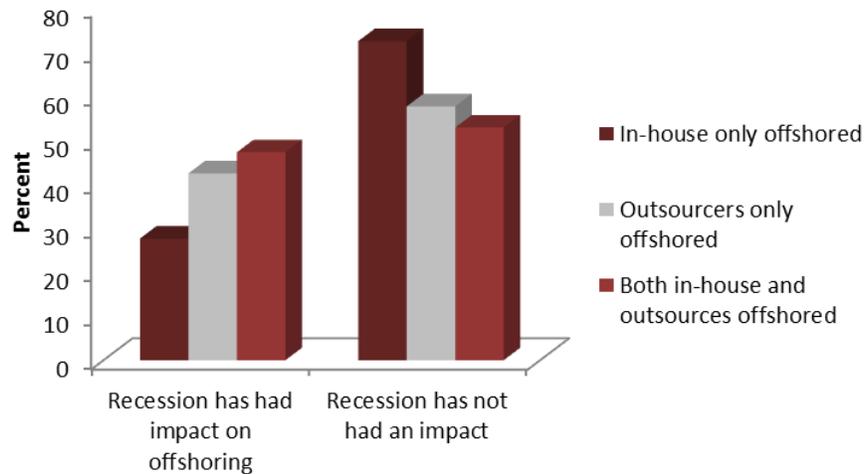
Summary of findings

Of the 254 firms in our study, 64% were doing software development offshore. They tended to have more international sales, were larger firms and had more software developers than the firms that did not offshore. They also used captive offshoring more than outsourcers, or tended to use both modes.

Of the 150 firms that did offshore, cost was the primary motivation, followed by need for labor force flexibility and access to skilled people. The biggest obstacles that firms faced in offshoring were the transfer of knowledge to offshore locations, cultural differences and communication difficulties, in part due to language differences.

The most common offshore location is India, followed by Western Europe, other Asia Pacific (outside China) and Canada, China, Eastern Europe and Latin America.

The activities that are most often carried out offshore are the more routine tasks of testing and coding. Higher level activities such as analysis, design and R&D are less likely to be done offshore.

The average cost savings from offshoring were 25%, with a median of 20%, but there was wide variance in the savings reported, with 29% reporting no cost savings at all while 22% reported savings greater than 40%.

The greatest qualitative impact was seen in labor force flexibility with 61% of the firms reporting improvement. About half of the firms also reported improvements in competitive position, speed of product development and access to needed skills.

As regards the global economic recession, we find that the effect of the recession on offshoring of development activities is mixed. Around 45% of the firms report that the amount of offshoring has stayed the same, while only 21% say they have increased offshoring and 34% say they have decreased offshoring. The primary driver is the need for cost reduction in the face of the economic downturn.

When offshoring has increased, it has been mainly in captive or in-house software development, whereas when offshoring has decreased, it has been mainly in outsourced activities. This is consistent with one of the major reasons that software firms used outsourcers—for flexibility in increasing or decreasing their labor force.

Contrary to predictions by some economists, there is little evidence of a decline in wage differentials as a result of the recession. However, international market opportunities and revenues have grown as the U.S. experienced recession.

Acknowledgements

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