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#### **Publication Date**

2010-07-01

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7/1/2010



# **OFFSHORING OF NPD IN THE ELECTRONICS INDUSTRY: PATTERNS AND RECESSION EFFECTS**

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July, 2010**

## **I. INTRODUCTION**

There has been rapid growth in offshoring of R&D and especially of new product development (NPD) in the electronics industry. It has been driven mainly by cost and access to skilled labor but also with the need to reduce time to market as well as to strengthen competitive advantage in the marketplace.

While manufacturing has been offshore since the 1980's, the offshoring of NPD has occurred since the mid-nineties. NPD has been pulled offshore by the establishment of manufacturing production hubs, initially in the major world regions of Europe, the Americas and Asia Pacific. Subsequently, electronics manufacturing has been concentrated in extremely large production hubs in China, such as Hon Hai's 300,000 person campus in Shenzhen, China. Our earlier paper on the PC industry showed how the production hubs of firms like Quanta, Compal, Wistron and Asustek were pulling laptop NPD of PC makers like Hewlett-Packard, Apple and Dell to the greater Shanghai area just as Hon Hai and other contract manufacturers had earlier pulled desktop NPD for these companies to the Shenzhen area (Dedrick and Kraemer, 2006).

In the past, NPD offshoring occurred mostly in times of high growth and a tight labor market in the U.S. electronics 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 these questions: "What are the current patterns of NPD offshoring?" and "What are the impacts of the economic downturn on offshore development?"

We had conducted an earlier survey of NPD offshoring by U.S.-based electronic companies in 2008 (Dedrick, et al., 2009). The topic was NPD offshoring in the electronics industry, including drivers and obstacles, location, performance, and management practices. The purpose of the research was to study the factors that influence the globalization of NPD and its impacts on the performance of firms in the computer and electronics manufacturing industry.

We repeated the survey in 2010 to determine changes in these features and particularly, the impact of the 2008 recession on offshoring of new product development. This report summarizes the main findings from the 2010 survey.

## Survey respondents

A telephone survey of electronics firms was conducted by Abt SRBI from January 21, 2010 to May 5, 2010.

The firms were selected from manufacturers of electronic devices (SIC codes 357, 362, 365, 366, 367, 381, 382, 384, 386, and 387). Table 1 shows the distribution of firms among different industry segments

**Table 1. Electronic Manufacturing Industries by SIC in Sample**

SIC Code	Percentage	Number
Electronic components and accessories (367)	23%	94
Measuring and controlling devices (382)	23%	92
Computer and office equipment (357)	16%	64
Communications equipment (366)	14%	55
Medical instruments and supplies (384)	14%	55
Search and navigation equipment (381)	4%	17
Household audio and video equipment (365)	4%	15
Other manufacturing (362, 386, 387)	2%	13

There are a total of 405 companies in the sample, 175 of which have new product development (NPD) activities outside the U.S. through their own subsidiaries, joint ventures, or an outsourcing relationship (Table 2).

**Table 2. Comparison of firms with and without offshore development**

	Some offshore development activities	No offshore development activities
Number of firms	175	230
Mean percent revenue from sales outside the U.S.	38%	25%
Mean number of NPD developers	171	28

Note: both mean differences are statistically significant.

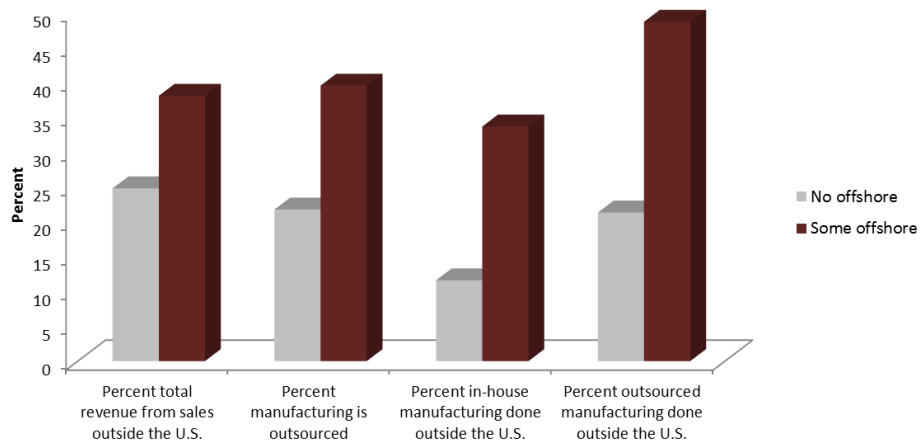
The people we contacted by telephone in each company were knowledgeable about new product development with respect to revenue, personnel allocation, outsourcing of new product development, and new product development practices and activities. Generally, the respondents were executives in Engineering, the R&D Department, or a CTO. In smaller companies the respondent was the CEO or President of the company. The response rate for the survey was 28.4%.

## II. OFFSHORE VERSUS NON-OFFSHORE COMPANIES

Using the full sample of firms, we compared companies that conducted at least some new product development offshore with those that did not. We found several significant differences between those companies with some NPD offshoring and those with no NPD offshoring.

Companies that did some NPD offshore earned a significantly higher share of their revenues outside the U.S. than those with no offshore NPD (38% vs. 25%). This relationship between selling products outside the U.S. and conducting NPD offshore is possibly because firms that sell in other markets need to be close to those markets to develop products for them (Table 2 and Figure 1).

**Figure 1. Comparison of offshore and non-offshore companies**

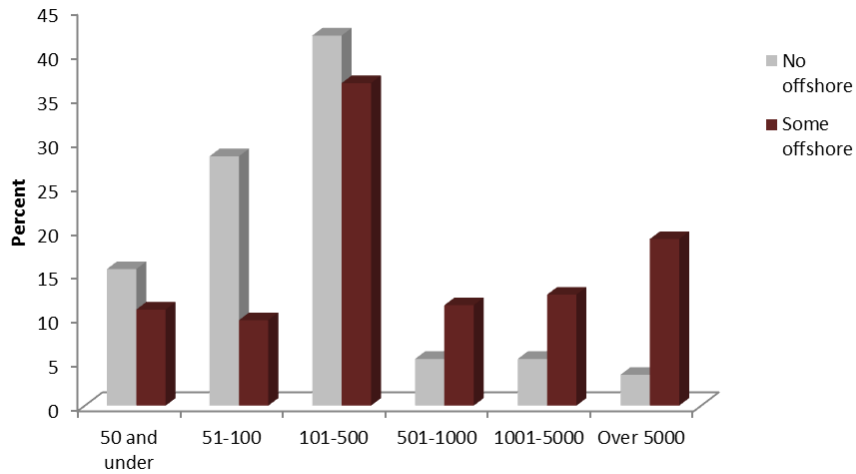


Firms that did NPD offshore also outsourced a somewhat greater share of their manufacturing to other firms (40% vs. 22%). And they also did a much greater share of manufacturing outside the U.S., whether it was their own in-house manufacturing (34% vs. 12%) or outsourced manufacturing (49% vs. 21%).

This suggests that manufacturing “pulls” NPD with it to offshore locations because of the need for some NPD activities to be near the plant where the product will be manufactured. Our earlier research showed that these activities usually included product testing and ramp-up as well as post-production engineering. In some instances they also included physical product development, prototype development and testing (Dedrick and Kraemer, 2006).

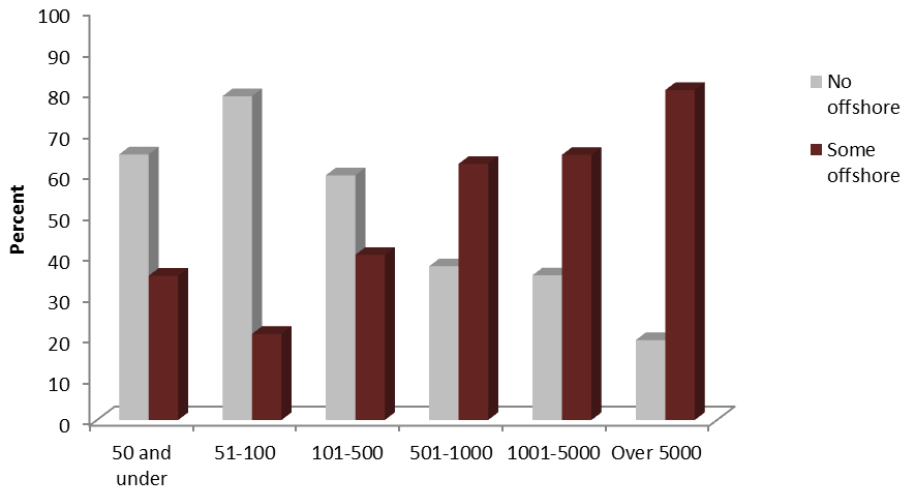
The companies were also differentiated by size. Those that did NPD offshore tended to be larger than those that did not (Figure 2). And the development staffs of firms that offshored NDP were also larger than those that did not offshore. The mean size of the NPD staff was 171 for firms that offshored versus 28 for firms that did not (Table 2).

**Figure 2. Firm size of offshore versus non-offshore firms**



Looked at another way, larger firms were more likely to have offshore NPD operations than smaller firms (Figure 3).

**Figure 3. Percent of firms with offshore NPD by firm size**

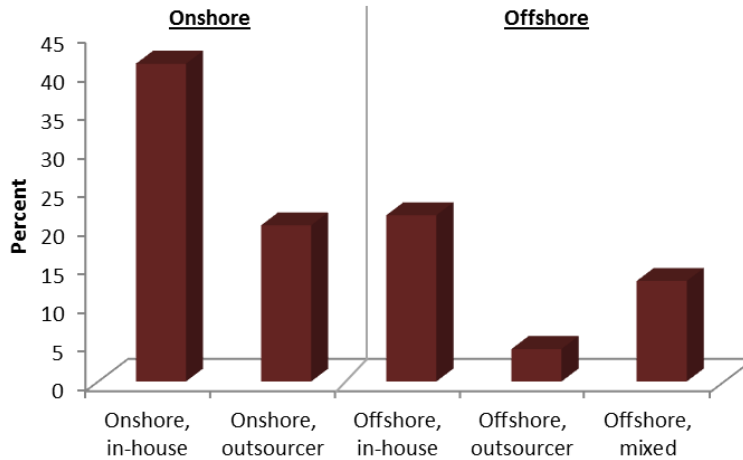


A final difference between firms that offshored and those that did not was the mode of offshore NPD, whether it was done in-house (captive offshoring), was outsourced, or if both were used (Figure 4).

Looking at the entire sample, the largest number of firms had no offshore NPD (41%).

Among those with offshore development, most firms had in-house only (22%) or both (mixed) (13%). Fewer relied entirely on outsourcers for offshore NPD (4%).

**Figure 4. Modes of sourcing NPD**





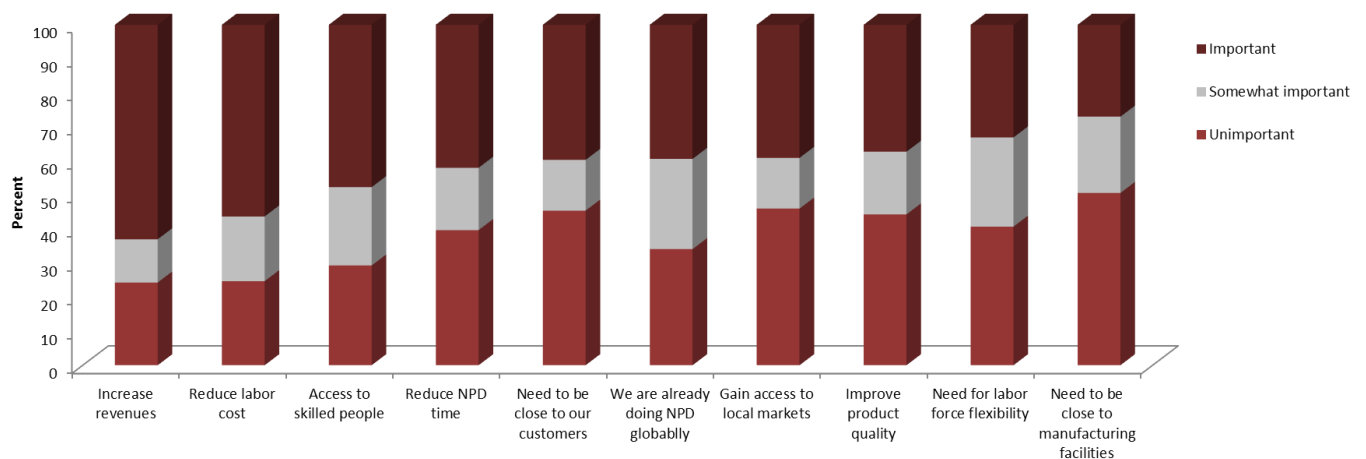
### III. COMPANIES OFFSHORING NEW PRODUCT DEVELOPMENT

In this section, we look only at firms that did some offshoring of NPD, whether captive or outsourced.

#### Drivers of offshore NPD

The biggest reason that firms had gone offshore for NPD was to increase revenues, mentioned as important by 63% of respondents whose firms had some offshore NPD (Figure 5). This could be because they already had markets abroad, or hoped to gain access to markets where they located NPD. It could also be that using offshore NPD enabled them to develop products faster, and thus increase sales at home or abroad. In fact, 42% said that reducing NPD time was an important factor in the offshoring decision. Fast development often enables a firm to gain first mover advantage over others, or at least to be a fast follower of the first mover.

Figure 5. Offshore drivers for NPD



The second biggest reason for offshoring cited by respondents was reducing labor costs, with 56% citing it as important. This is consistent with most surveys that look at why firms move business activities offshore.

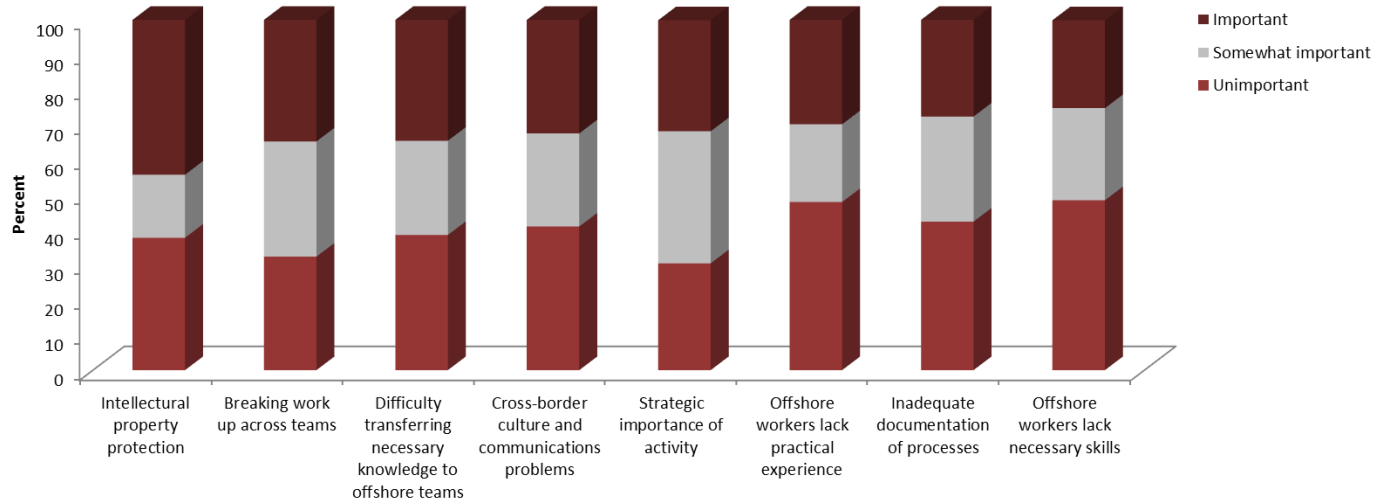
The third big factor was access to skilled people, cited by 48%. Generally, firms were looking for skilled local people who could be part of NPD teams near production sites and who also could communicate with design teams in the home country headquarters. Yet, only 40% said that the need to be close to manufacturing facilities was an important driver. This is somewhat surprising, given that firms with offshore manufacturing were much more likely to also have offshore NPD, as noted above. Given that many firms outsource to ODMs (original design manufacturers), it is possible that the ODM's product development and manufacturing sites are in different locations. For example, Taiwanese ODMs keep product design in Taiwan but do manufacturing in China. We cannot know for certain, however, as we did not probe this issue in the survey.

#### Obstacles to offshoring

The most commonly mentioned obstacles to doing NPD offshore were apprehensions about intellectual property protection, followed by concerns about breaking-up work across teams and difficulty transferring necessary knowledge to offshore teams (Figure 6). On the other hand, problems with offshore workers lacking necessary skills, inadequate documentation of processes, or practical experience

were mentioned least often, and is consistent with “access to skilled people” being cited as a key driver for offshoring (Figure 5 above).

**Figure 6. Obstacles to offshore NPD**

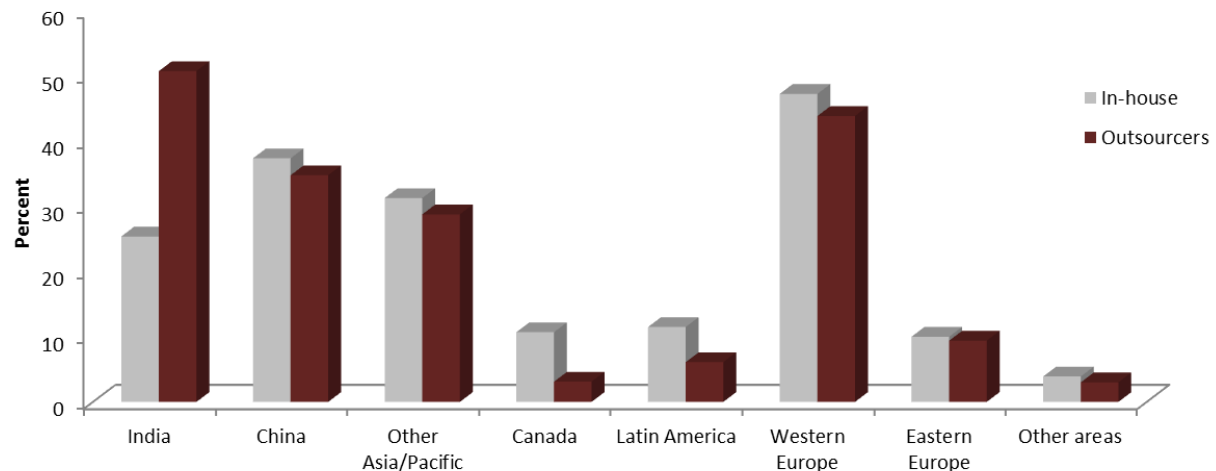


### Location of offshore NPD

The most frequent location for offshore NPD was Western Europe, where 47% of firms had in-house NPD activities and 44% had outsourced NPD (Figure 7). On the other hand, the total for India, China and other Asia-Pacific comes to 50% for in-house and 60% for outsourced NPD. This means that the Asia-Pacific region as a whole is a more frequented offshore location for NPD than Europe, even when Eastern Europe is included.

The Asia-Pacific dominance is consistent with the frequent characterization of the region, and especially China, as the world’s factory, because manufacturing tends to pull NPD to factory locations. Except for Europe, other areas of the world have only limited offshore NPD activity.

**Figure 7. Locations of offshore NPD**

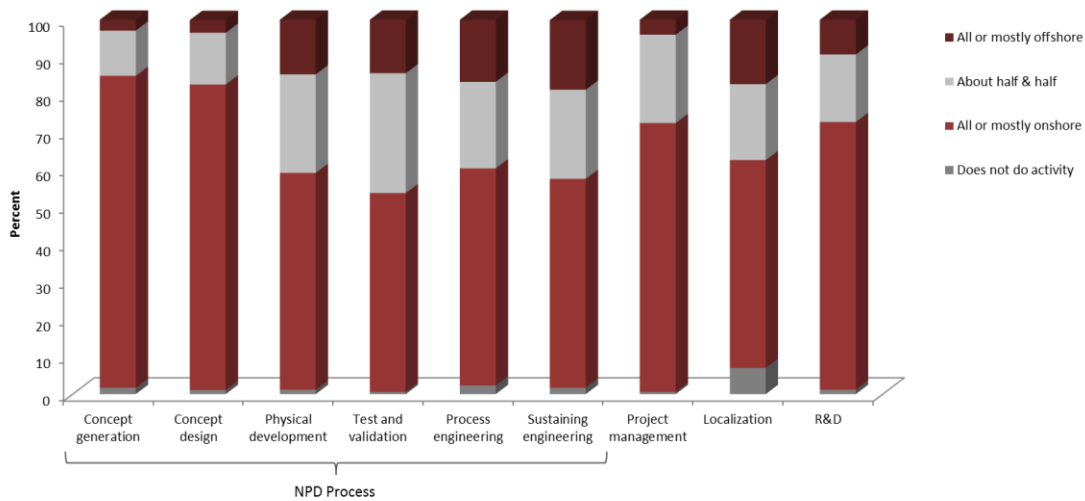


## NPD activities that firms conduct offshore

New product development can be divided into several phases or activities, from concept generation to sustaining engineering. In addition project management, product localization and R&D might occur offshore along with NPD.

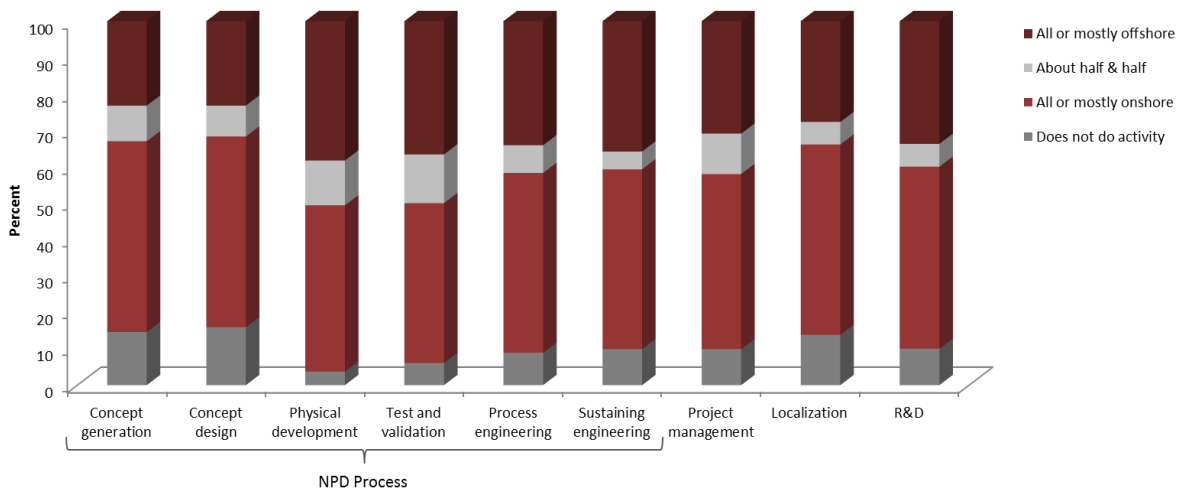
The most frequently offshored activities for in-house NPD were physical development, test and validation, process engineering and sustaining engineering (Figure 8). Those activities can be separated from the earlier concept generation and design activities and from R&D which tend to be done mostly in the U.S. to be close to the home market and where the most experienced personnel are likely to be available.

**Figure 8. Proportion of in-house (captive) NPD activities done onshore and offshore**



The pattern of offshore activities were similar for outsourced NPD, but the frequency of offshoring all activities was higher when NPD was outsourced (Figure 9). This is probably due to the fact that NPD is often outsourced to contract manufacturers or original design manufacturers, who do NPD in their own home country or close to their production facilities, which are likely to be offshore in low cost areas.

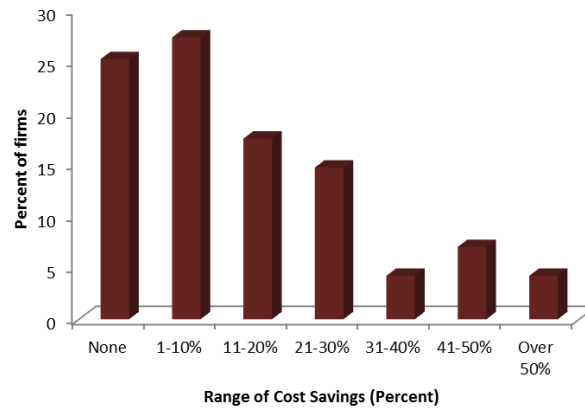
**Figure 9. Proportion of outsourced NPD done onshore and offshore**



## Performance of offshore NPD

As noted before, the most important reason for conducting NPD offshore was to reduce costs. Among our respondents, the mean cost savings associated with offshore NPD was 14%, with a median of 10%. However, cost savings varied significantly. One-quarter of the firms reported no cost savings at all, while 15% reported savings of 21-30% and 15% reported savings of over 30% (Figure 10).

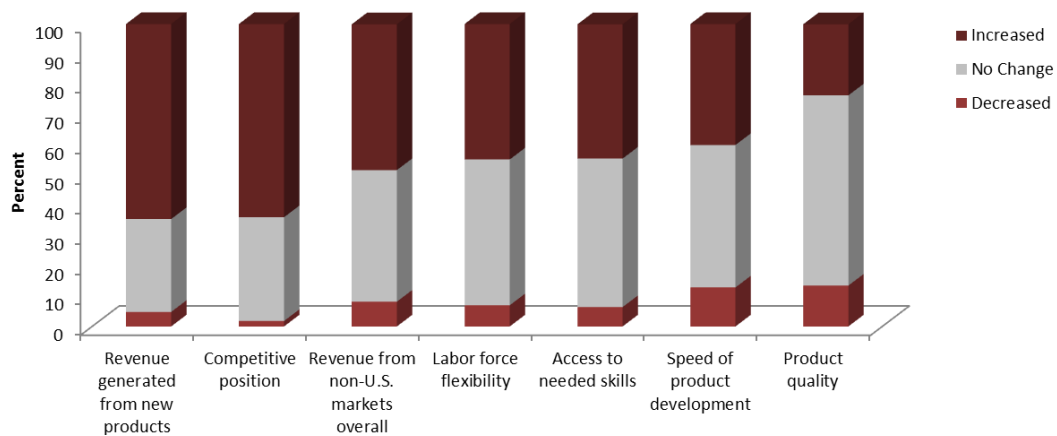
**Figure 10. Cost savings from offshore NPD**



In terms of qualitative measures of performance, the largest share of firms reported an increase in revenue from new products and improved competitive position; both were reported by almost two-thirds of the respondents (Figure 11). This result is consistent with the idea that offshoring enables firms to bring more products to market faster. Yet, only 40% reported an increase in speed of product development, while 13% reported a decrease in speed. So, it might be that offshoring allows some firms to speed-up product development, whereas it might allow other firms to work on more products at a time rather than increase the speed of development of any particular product.

Finally, nearly half of the respondents reported increased revenue from non-U.S. markets overall. With regard to product quality, most reported no change (Figure 11)..

**Figure 11. Impacts of offshore NPD on performance**

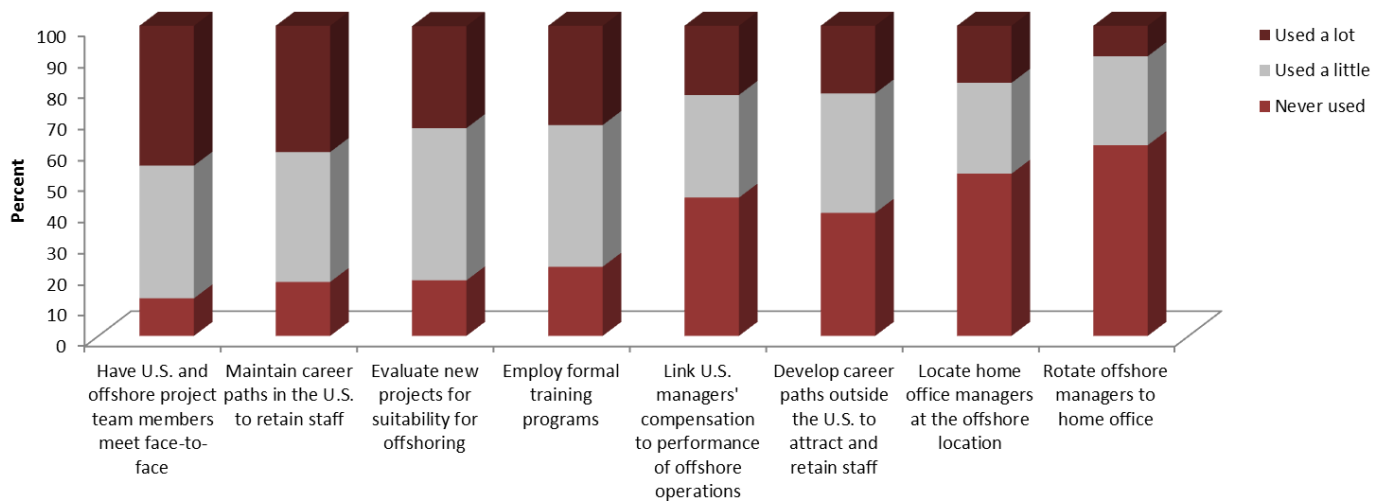


## Management practices

Firms used a variety of practices to manage offshore NPD processes. The most commonly used was having U.S. and offshore team members meet face-to-face; about 45% of the firms reported using this practice (Figure 12).

This suggests that it is still difficult to coordinate work between distant locations remotely, even with access to telecommunications, the Internet and other technologies, and that there is still a need for personal interaction. These interactions appear to be short-term, however, as it was much rarer for firms to locate home office managers (only 18% used this practice) at the offshore location or bring offshore managers to the home location (10% used this practice).

**Figure 12. Use of offshore management practices**

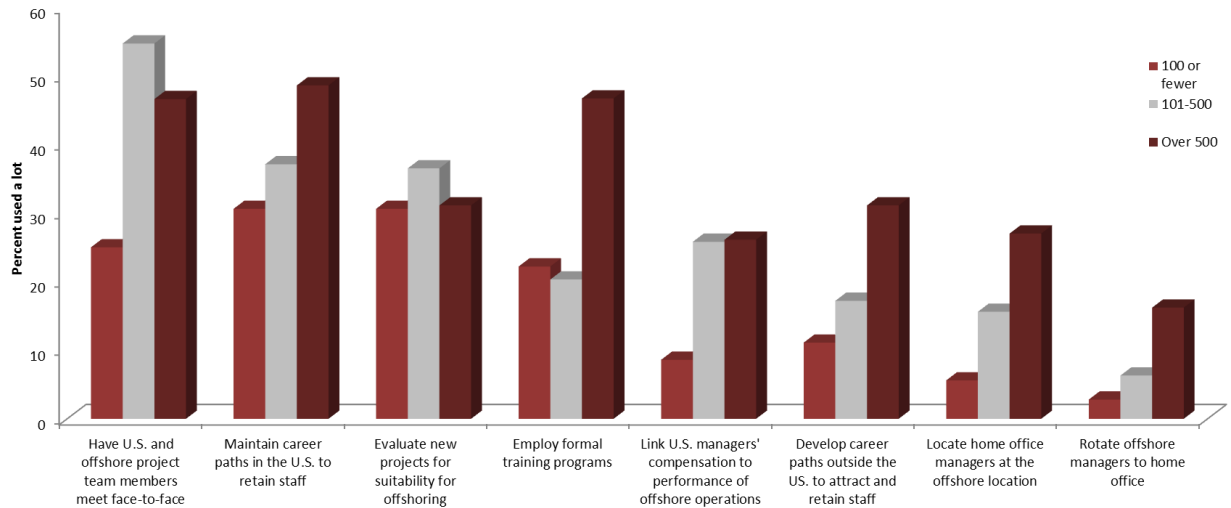


About one-third of the firms evaluated new projects for suitability for offshoring “a lot.” Those who did were probably more likely to locate NPD activities offshore. About 32% employed formal training programs to facilitate offshoring.

In terms of human resource practices, 41% reported maintaining career paths in the U.S. to retain staff “a lot”. This is an important issue when activities are being moved offshore as U.S. workers might be concerned about their own careers with the company. A smaller number of firms (22%) developed career paths outside the U.S. to attract and retain staff in offshore locations.

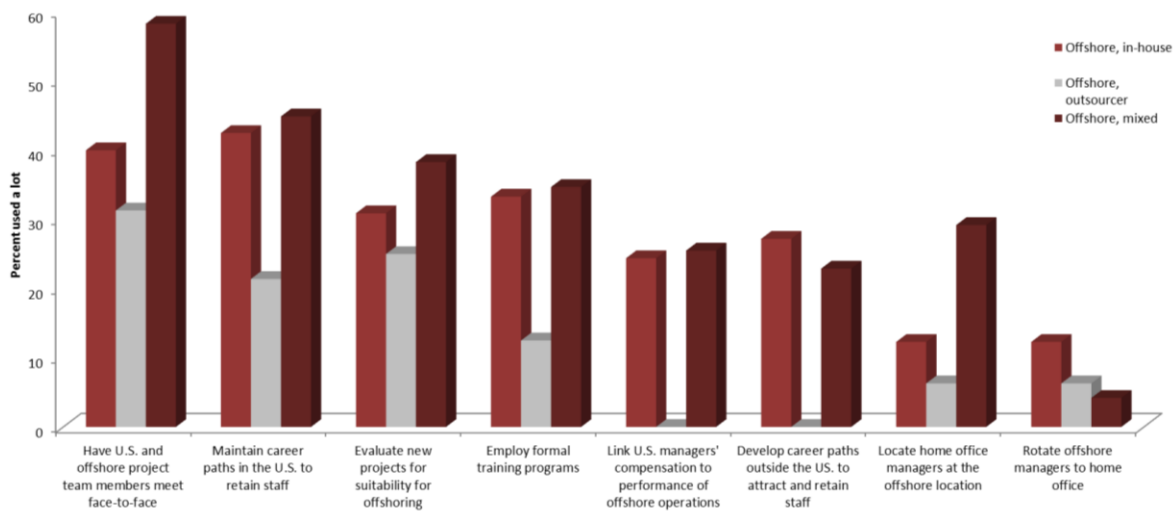
Interestingly, the use of these different management practices varied considerably by firm size (Figure 13). There were significant differences by size in the use of every management practice except for maintaining career paths in the U.S. and evaluating new projects for offshore suitability. In most cases, larger firms were more likely to employ a given management practice, perhaps because they generally have more formalized structures and processes, as suggested by the overall pattern in Figure 12.

**Figure 13. Offshore management practices by firm size**



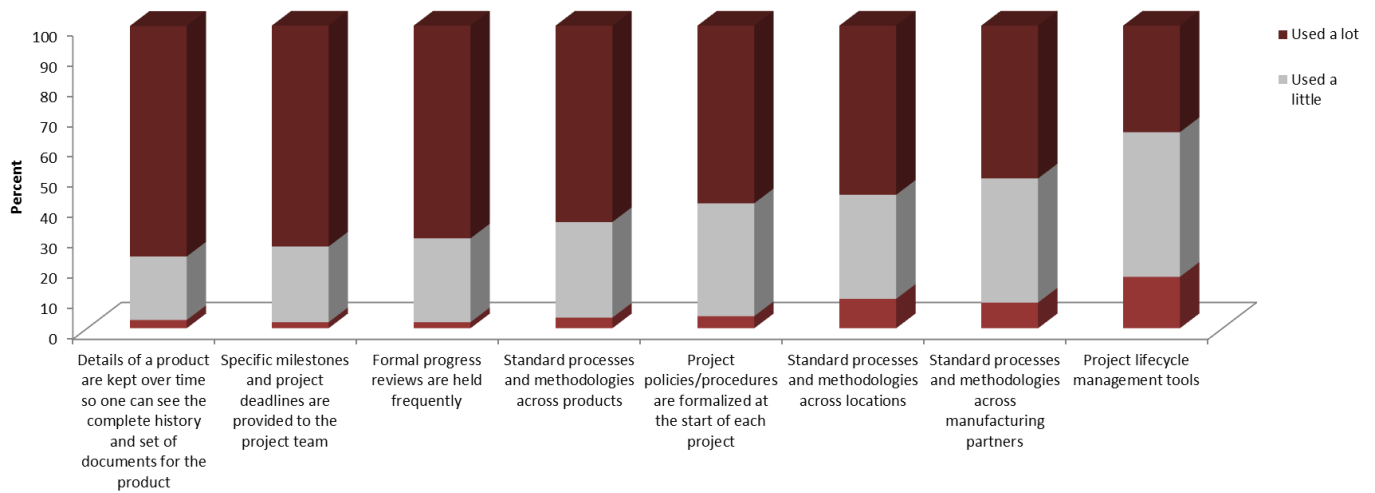
Firms also differed in their management practices depending on their mode of offshoring, whether in-house, outsourced or both (Figure 14). There were significant differences in employing formal training programs, developing career paths outside the U.S., locating home office managers as expats at the offshore location, and rotating offshore managers to the home office. In each case, it was firms with in-house (captive) NPD that were more likely to use such practices than those who outsourced only. Firms that go offshore through in-house subsidiaries apparently invest more in facilitating the offshore process, while those who outsource may leave more up to their outsource providers.

**Figure 14. Use of offshore management practices by mode of offshoring**



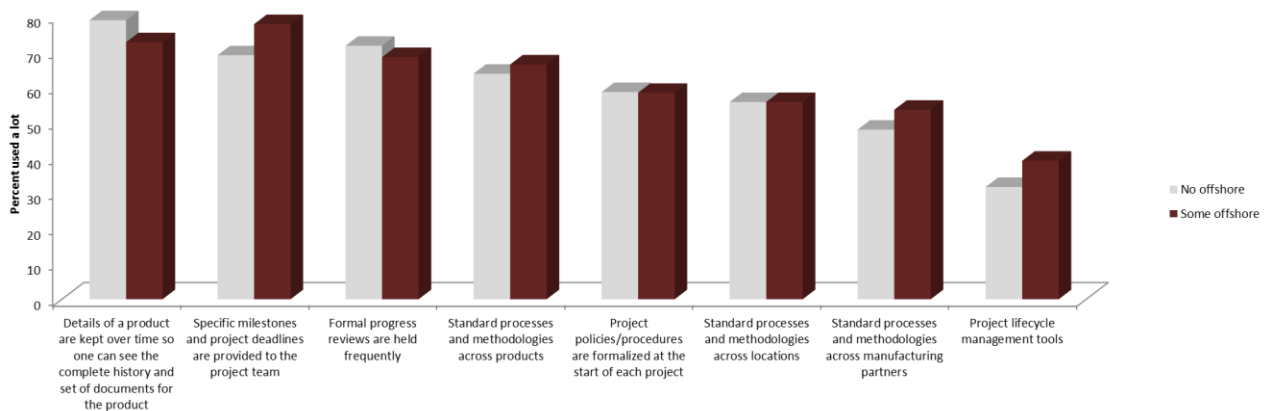
All respondents (including non-offshore firms) were asked about their management of the NPD process. The vast majority of firms kept product documentation over time (Figure 15). They also used well-defined development processes, such as specific milestones and deadlines and formal progress reviews. Least common was the use of project lifecycle management tools.

**Figure 15. New product development practices—all firms**



It is expected, based on other studies, that firms that go offshore would tend to make greater use of formal NPD processes in order to coordinate such activities over long distances. Yet, we find little difference among those who are offshore and those who are not in our full sample (Figure 16). Offshore firms were more likely to provide specific milestones and deadlines, and less likely to use project lifecycle management tools. Other differences were not statistically significant.

**Figure 16. NPD process—offshore versus non-offshore companies**



#### IV. EFFECTS OF THE RECESSION ON U.S. ELECTRONICS FIRMS

During an economic recession, changes in market opportunities or costs can pressure a firm to reduce costs. Changes in market opportunities might be due to continued growth in foreign markets or a downward shift of demand in U.S. and other developed markets, while changes in costs might be due to fluctuations in exchange rate or alleviation of talent shortages in the U.S.

In response to a severe recession, a firm could reduce its total work force, shift the mix of onshore and offshore employees, and/or change the mix of in-house versus outsourced workers. It could also consolidate NPD to fewer locations, cancel development projects, or increase/decrease efforts in international markets.

In order to assess the effects of the 2008 recession, we first looked at change in international sales over the past two years, then re-examined the drivers of offshoring and then looked at reported changes in offshoring due to the recession.

##### International sales

As previously mentioned, a firm’s reaction to an economic recession might be to increase international market sales to counteract the downturn at home. This seems to be a common trend, as international sales have increased for nearly three-fifths of the firms, while they have stayed the same for about 30% of firms, and decreased for about 12% (Figure 17). The increased growth in sales in international markets might be the reason firms have increased their offshoring of new product development.

Figure 17. Effects of recession on international sales

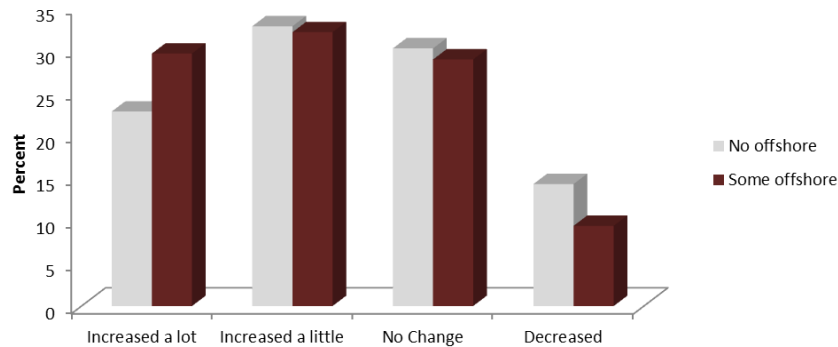


Figure 17 also shows that the number of firms who did offshore NPD and who reported that international sales “increased a lot” was approximately 7% greater than those which did not offshore. Supporting the trend, we see that the number of firms that reported a decrease in international sales was about 5% greater for firms that did not offshore, as compared to firms that did. In contrast, firms that offshored NPD, 30% reported that their international sales increased a lot, while 29% reported that sales did not change.



## Offshoring drivers during the recession

We noted earlier (Figure 4) that there are more firms involved with NPD onshore than with NPD offshore. Among those firms with NPD offshore, the main drivers were to increase revenues and reduce labor costs, with the “need to be close to the customer” a moderately important reason (Figure 5). The firm’s involvement in offshoring could be due to little or no growth in U.S. markets. Such firms may already be “close to the customer” in the U.S., but need international sales to stay afloat or grow during the recession. This could be why the greatest driving force for firms that offshored NPD is to increase revenues.

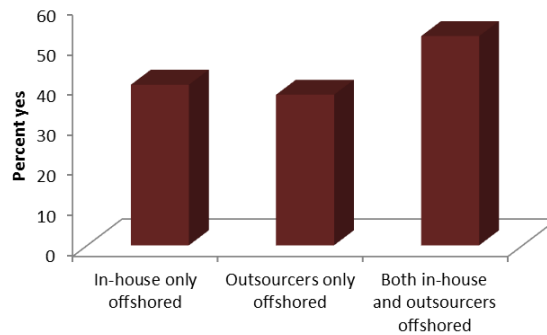
## Recession effects on offshoring

The survey focused on two types of recession effects on the electronics firms engaged in offshoring of NPD: 1) the overall impacts of the recession on the level of offshoring, and 2) the change in the number of software developers located offshore.

Overall, 43% percent of the firms in the sample reported that the recession had had an impact on the level of offshoring in the company. Among these, 52% indicated that the recession had led to an increase in offshoring, while 36% reported that it had led to a decrease. Roughly 12% reported that it was too soon to know the full directionality of the effect, but believed that there had been an impact.

The firms that did a combination of captive (in-house) and outsourcer offshoring were more likely to report recession effects than those that did either alone (Figure 18).

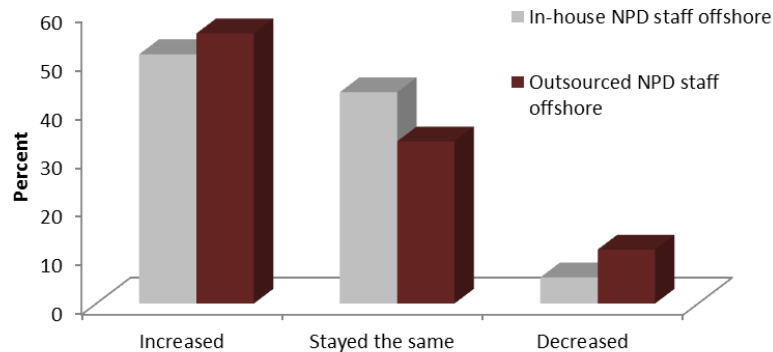
**Figure 18. Recession effect on offshoring**



The recession has also had an effect on the number of software developers offshore. During the past two years, 51% of the electronics firms with captive NPD and 56% of those with outsourced NPD reported increasing the number of development staff offshore.

Very few of the firms reported that they had decreased NPD staffing. However, the outsourcer firms were more likely to decrease staffing (11% outsourcers) than the captive firms (5%) (Figure 19).

**Figure 19. Effects of recession on new product developers in electronics firms**



## Summary of findings

Of the 405 electronics manufacturing firms in our study, 43% were doing new product development offshore. They tended to have more international sales, were larger firms and had more NPD developers than the firms that did not offshore. They also were more likely to have outsourced manufacturing offshore. And they used captive offshoring more than outsourcers, or tended to use both modes.

Of the 175 firms that did offshore, the primary motivation was to increase revenues. This was followed by the desire to reduce labor costs and gain access to skilled people. The biggest obstacles that firms faced in offshoring were intellectual property protection, breaking-up work across teams and difficulty transferring needed knowledge to offshore teams.

The most common offshore locations were the Asia Pacific region (China, India, and “other”), followed by Western Europe, and then followed by Eastern Europe. Canada and Latin America were much less common locations for offshoring of NPD.

The NPD activities that were most often carried out offshore were the intermediate processes between concept design and manufacturing such as physical development, test and validation and process engineering. Higher level activities such as concept generation, concept design and R&D were less likely to be done offshore. A greater proportion of NPD activities were done offshore when NPD was outsourced to contract manufacturers (CMs) or original design manufacturers (ODMs) as these firms offered the entire set of NPD activities.

The average cost savings from offshoring were 14%, with a median of 10%, but there was wide variance in the savings reported, with 25% of the firms reporting no cost savings at all while 15% reported savings greater than 40%.

The greatest qualitative impacts were in revenue generated from new products and improved competitive position, with 65% and 64% respectively of the firms reporting improvement. Nearly half of the firms reported increased revenue from non-U.S. markets.

Finally, the global economic recession has increased the offshoring of NPD. Around 52% of the firms reported that the amount of offshoring increased. Another 36% said they have decreased offshoring, mainly through consolidation of development centers or other reorganization.

When offshoring has increased, it has been mainly in captive or in-house NPD, whereas when offshoring has decreased, it has been mainly in outsourced activities.

## **Acknowledgements**

This research has been supported by grants from the U.S. National Science Foundation (SES0941213) and the Alfred P. Sloan Foundation. Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation or the Sloan Foundation.

## **References**

Dedrick, Jason and Kenneth L. Kraemer (2006) Is production pulling knowledge work to china? A study of the notebook PC industry. *Computer*, vol. 39, no. 7, pp 36-42.

Kenneth L. Kraemer, Jason Dedrick and Debora Dunkle (2009). Offshore hardware development: survey results. Irvine, CA: Center for Research on Information Technology and Organizations, University of California, Irvine.

PricewaterhouseCoopers (2008). U.S. offshoring plans not slowed by financial crisis: recession may accelerate offshore sourcing, PricewaterhouseCoopers and Duke University research shows. GlobeNewswire. December 11, 2008.  
<http://www.globenewswire.com/newsroom/news.html?d=156241>.