A Proposed Way for European Software Industries to Achieve Growth Within the Global Marketplace

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Global market expansion forces the competition in the field of software development to grow extremely fast. Accordingly, countries that base their brand in the field of information technologies are looking forward to quality and productivity improvement along with price reduction. One of the major trends in the global market is outsourcing, which is considered to be an opportunity to achieve best knowledge, extra resources and assurance of quality development, speed time to market, and cut costs. The role of emerging nations in this context increases every day, pushing out the old players. This article will therefore suggest how software development should change within the Northern Ireland (NI) software industry and adopt a global software development model in order to continue as a major player within the global software development industry. Copyright © 2006 John Wiley & Sons, Ltd.

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1. INTRODUCTION

In the new era of globalization, where the previous competition in the local market expands worldwide overriding the borders, each country tries to find its own place under the sun. Globalization provides new opportunities such as achieving best knowledge and extra resources, speeding time to market by using ‘follow-the-sun’ or 24-hour development, and cutting costs. In addition, global software development service providers often make significant investments in software process improvement (SPI) as this contributes to well-implemented processes and the quality of the product. Naureen Khan, in his evaluation of offshore IT outsourcing in India (Khan et al. 2002), reports that more than 200 Indian
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firms are quality accredited and from these around 36 firms have CMM® level 5 and 19 firms have CMM® level 4. According to McKinsey Quarterly (McKinsey 2001), the situation in terms of the global software development market considering labor costs, quality and productivity is as follows (Figure 1).

In the era of globalization, each country strives to popularize its brand. Considered as one of the major partners in software development outsourcing for a long time, the Republic of Ireland (ROI) attributes its success to several factors (Cochrane 2001):

- A strong software development and telecommunications infrastructure;
- A highly educated workforce;
- English is the first language;
- Legislative support;
- Quality;
- Government funding for research and development.

Unfortunately, the global market is constantly changing. Therefore, the Irish (both north and south) software industry can no longer rely solely on the factors that originally contributed to the success of its software industry. Emerging software development nations can now compete with Ireland in terms of the above factors and for a lower labor cost. This article will therefore suggest how Irish (focusing particularly on Northern Ireland (NI)) software development should change and adopt a global software development model in order to continue as a major player within the global software development industry.

2. THE CURRENT SOFTWARE DEVELOPMENT PICTURE WITHIN NI

The NI software industry has approximately 110 software companies that develop software either as a prime business activity or as an important part of their business function. The Centre for Software Process Technologies (CSPT) performed a survey within the NI software industry in 2003 (McCaffery et al. 2004). The survey was extensive in its scope encompassing more than half of all of NI’s software development companies, which together employed 80% of NI’s software engineering employees (the companies surveyed employ a total of 2428 software employees out of an entire industry with approximately 3000 software employees). For the purpose of this article, we define software engineering employees as those directly concerned with lifecycle work.

It emerged that even though 71% of the software companies in NI are home grown, they only employ 40% of the entire software engineering workforce. It appears that even though the multinationals make up only 12% of the number of overall software companies, significantly they employ 52% of the NI software engineering workforce. The majority of software companies in NI tend to be small, with two-thirds of the software companies in NI employing less than 20 people for lifecycle activities.

Like the ROI and the rest of the United Kingdom, the NI software industry is exposed to any downturn in the global software industry, and global economy in general, and this has been witnessed in recent years in the lay off of personnel from our larger software companies (Momentum Survey 2004). From research into software growth generally in other regions (Deependra 2001, Dehua 2001, Tomoo 2001, Turgay et al. 2003, EIU ViewsWire 2003), it appears that common factors influencing the growth of a successful software industry include:

- Financial support (either through government or venture capital) to establish and expand software companies, as well as to enable research and development;

Figure 1. Outsourcing market

1 CMMI/CMM is registered in the US Patent and Trademark Office by Carnegie Mellon University.

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• Prioritization of software as an important sector with special tax incentives offered by the government;
• An excellent telecommunications infrastructure;
• Protection against software piracy.

NI provides world-class financial support and has an excellent telecommunications infrastructure. Perhaps more interestingly and surprisingly, three other factors have also been identified as a concern including limited influence from overseas, lack of experience of our entrepreneurs, and a lack of encouragement for our entrepreneurs. Sixty-one percent of the founders of indigenous companies had no more than 10 years experience upon start-up, and significantly 27% of the founders of indigenous companies had no more than 5 years experience upon start-up. Many of these entrepreneurs are united on the view that, culturally, NI is adverse to entrepreneurial activity; many have expressed exasperation at the resistance to new ideas and the ‘can’t do’ or ‘you do’ attitude that permeates the culture. The nature of NI’s new World Wide Web order is a likely explanation for the youthful character of it’s entrepreneurs but nonetheless for some companies at least, this may be a growth limiting factor. Many have identified a need for a history of hardened entrepreneurial veterans, who like in countries such as the United States have been allowed to gain wisdom from a history of failure, which has been regarded as part of the learning process. In NI, failure is equated to limited ability.

Notwithstanding the positive influence of the presence of some multinational software organizations, many have suggested a limited influence from overseas and an inward looking culture. Even in the percentage of software engineering staff employed from overseas we can see issues. Homegrown companies have on average only 2% of their staff from overseas. While apparently NI can satisfy its workforce demands locally, evidence suggests that others around the world cannot (Deependra 2001, Dehua 2001). Some have seen this as a sign that NI universities do a great job of satisfying the local demand for computer science skills, others have seen this as an indication of under performance in the NI software industry.

Many small companies engage in the development of relatively small-scale web applications, often competing aggressively with each other for a share of a limited local market. Overseas markets have been targeted, particularly in the United States, but the percentage of revenue generated in those markets is relatively small, often not exceeding 20% (this overseas percentage value also includes companies whose products are produced for an American parent (McCaffery et al. 2004)).


Only 18% of NI software development organizations use a formal methodology such as Structured Systems Analysis and Design Methodology (SSADM) (McCaffery et al. 2004). Instead many software development companies adopt in-house methodologies that are far from formal and indeed many are no more than liberal embellishments to waterfall lifecycles. The surveyed companies typically perform full-lifecycle activities that include the following stages, which are performed either iteratively or sequentially depending upon the development methodology adopted by the company for a particular project:
• System/Information engineering and modeling;
• Software requirements analysis;
• Systems analysis and design;
• Code generation;
• Testing;
• Delivery and maintenance.

2.2. Areas of Concern for the NI Software Industry

Figure 2 illustrates the main areas of concern within the NI software development industry. Sixty-five percent of companies have experienced difficulty with managing risks and estimating task size. This is in many instances, because of, a lack of project management expertise and a lack of experience in developing products for a wide client base, which consequently means there is little opportunity to build experience in task size estimation. Small companies are immature in their handling of risks. This is a consequence of insufficient historical project data, which acts as a yardstick on which to assess risk, and many companies failing to implement any form of risk management strategy, content simply to gamble on outcomes rather than assess and mitigate potential problems. Smaller companies, in particular, exhibit low
adherence to standards and low tool usage, which lessens the chance of maintaining a repository of historical project information, with consequences for maturity.

For larger organizations that demonstrate proficiency in task size estimation the issue is one of certainty. Increasingly, in our competitive market, companies are being asked to produce confidence measures, illustrating how confident they are in their estimations for future projects. There is a need here for expertise in more analytical methods of task size estimation, where confidence measurement is a key feature.

Productivity is closely related to task estimation and is a major issue for both small and large companies alike, with many companies unsure as to how much actual time is spent working on tasks. Keeping up-to-date with new technology is a real issue for smaller companies as their business typically requires them to move with the latest technology in order to remain competitive, but they often suffer from a resource issue in that they cannot dedicate resources to such research, whereas this is less of an issue for larger companies. Also larger traditional companies often use more stable technology.

As you would expect, smaller companies are generally not concerned with either consistency across teams or team communication as, typically, there are few teams and the teams have on average three team members. With larger companies, more teams exist and the teams may also be larger and may even be distributed across different sites; therefore presenting consistency and communication issues.

After comparing the NI survey findings with reports from the emerging eastern software development nations (Deependra 2001, Dehua 2001, Tomoo 2001, Turgay et al. 2003, EIU ViewsWire 2003), it appears that currently NI is not well placed to attract overseas contracts as it cannot currently compete with emerging software development nations such as India, Turkey and China in terms of cost and quality certification.

Two types of software development contracts exist with NI—home-based or overseas. To date most domestic contracts are performed nationally, with all stages of the software development lifecycle being performed within the United Kingdom and Ireland. However, during the past year some of the larger British and Irish companies are beginning to outsource some of their software development
work. Such companies have been attracted by the lower cost of software development within the emerging nations compared to domestic software development rates. There is a fear within the NI software industry that this may be a trend that will increase over a period of time particularly if the initial outsourcing projects are successful and the proposed benefits of improved quality (owing to higher certification), quicker time to market, reduced cost, and the need for less full-time (more expensive) local software development staff required are realized. The fear is that if home-based companies are shipping their software development work overseas, how can the local industry possibly compete in terms of attracting overseas contracts (particularly from the United States). The answer perhaps is to concentrate on the more appealing aspects of the NI software development industry. For example, focus on the lifecycle areas that rely on good communication skills. As English is the first language of NI, this presents a natural advantage for western interaction (in particular, to US interactions). Additionally, the time difference between NI and the western industry presents more of a window of opportunity in terms of overlapping work times. As NI tends to produce a higher percentage of entrepreneurs than the emerging eastern nations, perhaps we are then more suited to working with the more initial stages of the software development lifecycle (McCaffery et al. 2004).

In the light of these findings, it seems that a possible solution to the problem of sustaining the NI software development industry is to focus both upon the strengths of this industry and to discover a way to utilize the potential benefits of the emerging eastern software development nations. This strategy may help to ensure not only the survival of the NI software development industry but perhaps even lead to long-term growth by changing the role that software development companies with NI fulfill within the global software development picture. What we propose is a way for the NI software industry to gain a market share within the global software industry, and we are aware that given the scale of the eastern software industries that these industries will also perform separate full-lifecycle development projects in addition to working with the NI software industry to fulfil western contracts.

3. POSSIBLE GROWTH SCENARIOS

The reality is that as eastern software development nations go from strength to strength over the next few years in terms of their ability to attract outsourced contracts (EIU ViewsWire 2003), this will greatly impact the scale of the software industry within NI, as domestic companies will have great difficulty competing in terms of CMMI® certification or cost. This means that a number of options exist for the NI software industry:

- Option #1: continue to approach software development as they have for the past several years;
- Option #2: try to improve the software industry by following a SPI path and try to compete with the emerging eastern nations in terms of quality;
- Option #3: revise their role within the global software development picture.

3.1. Option #1 – Continue as Previously

In terms of planning to make the NI software industry successful, option 1 may prove to be an alternative that could lead to the phasing out of software development within NI.

3.2. Option #2 – Improve the Quality

Option 2, if selected would be of benefit to the NI software development industry as it would eventually enable NI software development companies to compete with the eastern software development companies in terms of quality to attract contracts. However, the path to SPI is a long one and given the fact that most companies have previously not been engaged in ISO/IEC 15504 (ISO/IEC 15504-5: 2006) or CMMI® (Chrissis et al. 2003) certification programmes, it will be a number of years before a significant percentage of NI software companies would be in a position to seriously compete with the eastern software development companies in terms of quality. In relation to the current software development infrastructure in the NI software industry, many medium to large software companies are using sound processes governing a strong methodological base, but often many smaller indigenous companies are driven by their entrepreneurial managers and directors who know the processes well and act as mentors to other staff members. In such
companies, methodology is sacrificed in favor of a set of loosely defined techniques, with training being event driven for the most part even though it is part of almost all strategic plans. Many companies use what they regard as computer-aided software engineering (CASE) tools during software development; however, few of these instances are examples of full CASE tools. This is a consequence of limited methodology adoption and the small size of local organizations with limited funds for investment. The larger companies and multinationals, attracted by an educated workforce, employ a large proportion of the software engineers in NI and are very conscious of good standards and practices in software engineering. Many of the multinationals import a sense of urgency in the adoption of best practice from their parent structures and this has had a positive effect on some homegrown software organizations.

Most of the NI software companies are convinced of the importance of processes in their working environments and many want to engage in SPI. Although only proper assessment can be conclusive, for the majority of NI companies, particularly small indigenous companies, the characteristics of low maturity are evident. There is a reliance on individuals in a fire-fighting environment, low awareness of standards and problems experienced both at the managerial and technical level. Many of the larger companies employing most of the software engineers are process focused and have a much clearer understanding of the need for process improvement with a better appreciation of the global picture.

3.3. Option #3 – Act Globally

The adoption of option 3 is crucial to the long-term future of the software development industry within NI. Most software development projects in the NI software industry are produced by following a complete software development lifecycle such as the waterfall model for larger projects, and more agile iterative models for smaller, shorter lifecycle projects. However, in order for the NI software industry to remain viable as a software development nation, local software development companies may need to change from focusing upon full-lifecycle development to focusing upon higher value software development areas. This means playing to the strengths of the NI software industry and concentrating on the areas that involve critical interactions with western clients (in particular, cultural aspects and time zones favor US customers interacting with Irish and British based companies as opposed to companies from the eastern software development nations).

4. THE PROPOSED WAY OF DEVELOPING SOFTWARE WITHIN NORTHERN IRELAND

The preferred option to increase the chances of developing a successful software industry within NI is therefore to adopt both options 2 and 3 in parallel.

It is predicted that a quarter of all Europe’s IT jobs will have moved to the eastern software development nations by 2010 (BBC News 2004). It is therefore important that NI software development companies start to concentrate on changing the current software infrastructure from focusing on full-lifecycle coverage to the core areas of system engineering, and move towards outsourcing some of the processes to offshore service providers.

Considering the various options of distributing software development processes between the engaging party and offshore service providers, the first idea about splitting responsibilities is to send coding offshore. However, this scenario overestimates the value of coding against entire project expenses. The average industrial estimate of the software implementation process is around 20% of the entire project lifecycle. Today’s IT outsourcing frequently involves a much greater range and depth of services than in the past, with an increasing number of IT functions being transferred to IT service providers (Lee et al. 2003).

To illustrate a possible context that could be outsourced, the authors offer three different options from the market choices and experience: (see Table 1)

- Option #1 – MachroTech’s Global Software Delivery Model (Machrotech 2005);
- Option #2 – Skytechsolutions Global Software Delivery model (Skytechsolutions 2005);
- Option #3 – Latvian experience in global software development improvement (Smite 2005).

Anand Ramakrishnan (Ramakrishnan 2004) reports that areas such as system design and architecture, research and development
outsourcing provide higher returns (up to 60%). Besides, such an evolution scenario as a strategic partnership and moving from ‘body shopping’ to wide-ranging services is seen as the future of outsourcing (Lee et al. 2003, Outsourcing Journal 1999). Accordingly, there should be a deliberate distribution of software lifecycle processes between the outsourcing provider and the engaging party in order to make the multisite development reasonable.

In addition, using the findings of the NI survey it is apparent that in order for NI companies to work effectively with the emerging nations as described above, certain parts of their software development infrastructure will need to improve. To assist this, SPI programmes should be given priority within the NI software development industry as its software development companies will be responsible for managing the delivery of the overall project and will therefore require a higher level of software development maturity than was discovered in the findings from the NI software development survey. The CSPT is currently assisting the NI software industry with SPI programmes (Wilkie et al. 2004) and assessments based upon CMMI® (SEI 2001). Also a large number of companies within the eastern software development nations (particularly in India) are CMMI® certified and will expect their business partners to work to a similar level. Additionally, western contracts may at some stage in the future only be awarded to companies that are CMMI® certified.

The software professionals required to work within this new proposed lifecycle will differ from the majority of existing software professionals and recent graduates who received a university education that devoted the majority of the curriculum to generating codes. Software professionals will therefore require retraining to focus on business and management areas of software development, as well as consulting. Universities should also provide computer science postgraduate courses in SPI to help develop a software process improvement culture. To assist this development, the University of Ulster (NI) will deliver a postgraduate course in SPI in 2005/2006 (this course will be officially recognized by the Software Engineering Institute, Carnegie Mellon University). Additionally, universities should design new computer science undergraduate courses to focus upon the business and management disciplines associated with software engineering such as requirements management, project planning, managing outsourcing projects, configuration management and risk management, in addition to development disciplines such as requirements development, software analysis, design and testing.

5. SUMMARY AND CONCLUSIONS

Global market expansion forces the competition in the field of software development to grow extremely fast. Accordingly, countries that base
their brand in the field of information technologies are looking forward to quality and productivity improvement along with price reduction. One of the major trends in the global market is outsourcing, which is considered to be an opportunity to achieve best knowledge, extra resources and assurance of quality development, speed time to market, and cut costs. The role of emerging nations in this context increases every day, pushing out the old players. This article suggests how software development should change within software industries by adopting a global software development model. The article uses the NI software industry as an example and describes the current software development picture within NI, the areas of concern for the NI software industry and how the industry should alter its current software development strategy in order to continue as a significant player within the global software development industry.

If the NI software industry is to grow within the global software development industry, it may have to change the way its companies perform software development. The authors would like to emphasize the following major changes necessary for the industrial growth:

- Explore the options of outsourcing some of the software development lifecycle processes to an offshore service provider, by using the opportunities offered by the global market, including product cost reduction.
- As highlighted in the findings from the NI software industry survey (McCaffery et al. 2004), companies within the NI software industry should adopt SPI programmes to increase their software development maturity so that they will be able to work more effectively with both high maturity western and eastern software development companies.
- To accompany the industry in their aspirations, the universities should also redesign their computer science courses to provide computer science postgraduates with knowledge of the business and management areas of software development, consulting, and SPI to help grow an improvement culture.

This article focused upon how software development practices should change within the NI software industry in order to enable growth within the global software industry; however, the above conclusions may also be applied to other western European software industries wishing to grow within the global marketplace.

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Growth-oriented Strategies for European Software Industries


