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Item Type	Meetings and Proceedings
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Download date	2026-03-11 07:21:39
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Link to Item	https://hdl.handle.net/10344/2188

The Software Development Culture of Northern Ireland

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Abstract

The Northern Ireland (NI) software development survey was developed by the Centre for Software Process Technologies (CSPT). CSPT was established in September 2002 and is jointly funded by Invest Northern Ireland (an economic development agency) and the University of Ulster. One of the centre's early priorities was to obtain an understanding of current local software engineering practice. The vehicle chosen to obtain this information was a questionnaire, administered through face-to-face interviews. Key personnel in fifty-six software development organizations were surveyed in this way. This paper presents a subset of our findings with a focus on quality and software process improvement issues in NI software development organizations.

Keywords

Software industry survey, process area issues, process improvement and quality issues.

1. Introduction

From a business perspective there have been studies of the NI software industry carried out by organizations such as local trade associations [1] but no detailed technical perspective of the industry has ever been produced. While some surveys provided a clear indication of 'who was doing what' in terms of software production there was little about how this was achieved in a technical or quality sense. The CSPT needed to understand these processes because one of the centre's objectives is to assist software development organisations in NI with their software process related needs; the survey then seemed like an obvious initial task.

2. The Structure of the Survey

During the period September 2002 to June 2003 the survey data was collected. It was then analysed over the period from July 2003 to September 2003. The survey targeted only companies who engaged in working on all or part of the software development lifecycle. It was also important that we engaged the senior people in the company as the survey may not have been completed accurately by other staff.

NI has approximately 110 software companies that develop software either as a prime business activity or as an important part of their business function. The following categories of company participated in the survey:-

Indigenous: NI (home grown) software company for which the main part of their business is software development;

Multinational companies whose main business is software development;

Any company whose main business is not software development but nonetheless engage in lifecycle activities (these might include banks, civil service or smaller businesses developing software in a more limited capacity).

The survey was extensive in its scope encompassing more than half of all of NI's software development companies, which together employ 80% of NI's software engineering employees.

3 Survey Findings

3.1 General Issues.

It emerged that even though 71% of the software companies in NI are indigenous, they only employ 40% of the entire software engineering workforce. Other companies employ 60% of the NI software engineering workforce. It appears that even though the multi-nationals 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 on lifecycle activities.

Using the Republic of Ireland (ROI) [2] software industry as a yardstick it is possible to envisage what growth NI might have achieved within the software industry. The NI software industry employs approximately 7600 people across approximately 110 software companies. By way of context, the

ROI has 800 software development companies that employ more than 25,000 people. In terms of population, NI has 1.5 million people and the ROI has 4 million people. Accepting the recent downturn in the software economy since the 'September 11th' disaster, and applying ROI statistics to NI, one might expect NI to have 9400 people employed in the software industry. Therefore, the NI software industry is only 75% of the size that it should be if it had realized the same growth.

3.2 Quality and Software Process Improvement Issues

Due to the slowdown in the world economy training is one of the areas that companies have cut-back. In terms of the fifty-six software companies surveyed the average number of days training per year planned for each software employee was approximately six days. In the case of indigenous companies one-third assign training only on demand, with over half receiving no more than three days training, and only 13% receiving more than six days training (see figure 1).

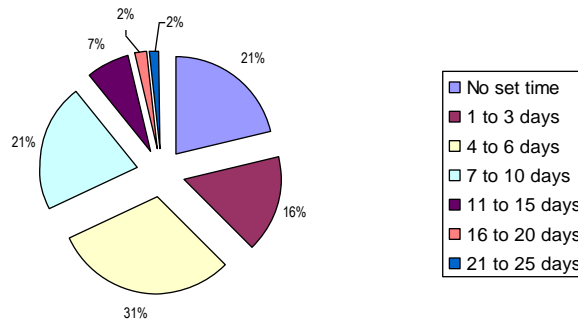


Figure 1: Training

This presents an issue for maturity, especially as management principles need to be in place for any software company to be at the lowest levels of maturity in any of the capability maturity models used in the global software industry. The reality is that despite some good intentions and the position taken in strategic documents, most employees in NI's indigenous software companies have received little or no training within this past two years.

Approximately half of the software development companies surveyed have a team or person who is dedicated to ensuring quality assurance throughout the organization, with only 43% of indigenous companies having a dedicated quality team. These statistics initially give the impression that quality is not given enough priority within the NI software industry. However upon analysis of these statistics it emerges that 86% of companies with more than ten software employees have a team responsible for quality, therefore reflecting that assigning someone to concentrate entirely on quality within a small software development organization is a large overhead in comparison.

For small organizations each person may be given individual responsibilities for ensuring quality. The exception to this is in small companies where there is a mandatory standard and in this case it is considered important to have a dedicated quality team. There is a generally a low awareness of the need to address quality and significant differences between how different companies define quality. Larger companies and companies with mandatory standards place more emphasis on adhering to

quality standards and procedures than smaller companies without any procedures in place, for some of these smaller companies quality is simply based on meeting the requirements.

38% of the companies surveyed adhere to a mandatory standard. A mandatory standard means that products can only be marketed if compliance and approval have been obtained from the appropriate regulatory standards bodies. Mandatory standard compliance varied greatly depending upon which market sector the company belongs to. Sectors adhering to these standards typically tend to produce life critical, real-time or highly secure systems.

All of those companies requiring a mandatory standard have of course obtained that standard and in addition three-quarters of these companies have achieved ISO9001 accreditation. But the situation is different when it comes to other non-compulsory standards, with 50% of all companies and 47% of indigenous companies being certified to ISO9001. Evidence obtained during the survey suggests that ISO9001 is a hurdle for many indigenous companies and is not viewed as having a continuous improvement effect and is instead viewed as simply a badge for marketing.

Large software development companies stressed the fact that it is essential to have efficient generic processes in place in order to cope with the complexities of managing a large number of employees. It was also emphasized that process is vital whenever companies experience a large growth over a relatively short period of time. Medium to large companies expressed a degree of contentment with the processes they had in place but many had concerns in particular with project management and control.

Many NI companies are small and in such environments it is of course much easier to communicate. When communication is straightforward it takes away the urgency for processes. This explains why for some, process is not an issue of importance and of course for some companies, where software development is not their main business, software processes are never going to be an issue.

So even though almost all recognise the importance of process, for some it has not become imperative to do anything about it and for many, the war of day to day trading moves process down the priority list. It appears that only when communication becomes very problematic and the lack of processes makes expansion and diversification difficult is any action taken over it and even then NI's smaller software companies find it difficult to navigate the road forward. Many simply do not know how good or bad their processes are let alone how to improve them.

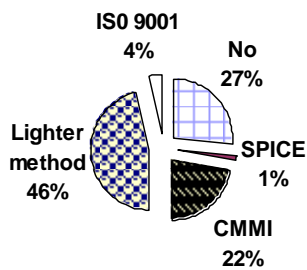


Figure 2: Desire for Software Process Improvement frameworks

A number of the medium to large companies have some awareness of software process improvement (SPI) frameworks. Most of the small companies had little awareness of such approaches. Figure 2, shows that 27% of companies had no desire at all to improve software processes through the use of a framework even though many of these companies identified processes as being important.

4% of companies were content with the process improvement brought about by ISO9001 (even though ISO9001 was not actively used for it's improvement potential). Only one company expressed an interest in SPICE [3] in our survey, though other NI companies participated in the SPICE trials and reported some gain through their participation. Encouragingly, 69% of companies had a desire to improve their processes through the use of a framework with 22% of companies firmly in favour of CMM/CMMI [4] based process improvement; several of these companies having experienced problems in the marketplace as a direct result of not being involved in a CMMI programme while their competitors were. Almost half of the companies in our survey desire some form of software process improvement although they expressed doubt about its applicability and concern over cost.

While some companies currently utilise the SPI aspects of ISO9001, the dominant SPI framework is CMM/CMMI, accepting of course that the overall numbers involved are small.

4. Conclusion

In the NI software industry, awareness of standards that can be applied to software is limited and while there is some awareness of SPI, there is a distinct lack of familiarity with it. Several NI software companies have already experienced difficulties in competition with software development organizations worldwide, for work in the U.S.A. Interestingly the prime factor here was not simply cost, but the quality agenda as a whole, with competitor companies having engaged in process improvement programmes.

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 indigenous software organizations.

Most of the NI software companies are convinced of the importance of process 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. Reliance on individuals in a fire fighting environment, low awareness of standards and problems experienced at the managerial and technical level. Many of the larger companies employing most of the software engineers are process focussed and have a much clearer understanding of the need for process improvement with a better appreciation of the global picture.

A 'titanic' analogy is a natural one as the ship was built in the once great shipyard industry in Belfast. NI's software industry is mimicking the storyline of the titanic but the difference between now and then is that the quality iceberg can be seen from a distance, it's there waiting in the seas ahead. Yes, many countries have acted a little bit earlier and steered another course away from the quality iceberg. Maybe in a strange sense, it is the 'improvement' action of NI's software industry competitors across the world in countries such as India [5] and China [6], that has enlarged the ice berg. The NI software industry, particularly the indigenous industry, needs to minimise the threat of this ice berg by paying due attention to software development processes and doing what is possible to improve them so that they can be competitive in a global marketplace. The cultural attitude of 'Steady-as-she-goes' is not an option.

5. Literature

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6. Acknowledgements

The Centre for Software Process Technologies is supported by the EU Programme for Peace and Reconciliation in Northern Ireland and the Border Regions of Ireland (Peace II).

7. Author CVs

Dr Donald McFall

Don is involved in the Software Process Improvement Frameworks area. He is in the process of acquiring CMM/CMMI qualification as a lead Assessor and trainer. He has been a member of academic staff at UU since 1989. He has worked with a variety of European and North American software companies including O2, MARI, DataMat, ITC and Nortel on a range of sponsored projects involving software maintenance and re-engineering. Don has been a Visiting Research Scientist at Carnegie Mellon University for the past 2 years.

Dr Fergal Mc Caffery

Fergal is a full-time research associate in the CSPT. His research is focused in the areas of Requirements Management and Project Management. He has 6 years experience as a Team leader/senior software engineer for Nortel Networks and 1 year as a software engineer for Aldiscon Ltd. This period in industry was preceded by 2 years as an academic member of staff at the University of Ulster, during which time he published various papers within the area of adaptive multimedia systems.

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George is the Director of the CSPT. His principal area of involvement is with Software Process Improvement Frameworks. He is in the process of acquiring CMM/CMMI qualification as a lead Assessor and trainer. George has 12 years experience with Object Technology initially gained through a 3 year period of employment at the Institute of Software Engineering. He has lectured and consulted world-wide on object technology to organisations including NYNEX, AT&T, Ericsson, HP, ITT, KPMG, Lucas Management Systems and J.P.Morgan. Prior to this, George spent 5 years as a Software Engineer with British Telecommunications plc. He joined the University of Ulster in 1992 and has been engaged for the most part in research into the use of object oriented complexity metrics to support software engineering project management. George has been a Visiting Research Scientist at Carnegie Mellon University for the past 2 years. His publications include one book and a range of papers on complexity metrics for object oriented software systems. Fergal is a full-time research associate in the CSPT. His research is focused in the areas of Requirements Management and Project Management. He has 6 years experience as a Team leader/senior software engineer for Nortel Networks and 1 year as a software engineer for Aldiscon Ltd. This period in industry was preceded by 2 years as an academic member of staff at the University of Ulster, during which time he published various papers within the area of adaptive multimedia systems.