
AN ANALYSIS OF THE USE OF INFORMATION TECHNOLOGY FOR PROJECT MANAGEMENT IN THE NEW ZEALAND CONSTRUCTION INDUSTRY

*Dr Suzanne Wilkinson, Senior Lecturer, Department of Civil and Resource Engineering
The University of Auckland, Auckland, New Zealand*

Introduction

Information technology usage for project management planning and control is becoming increasingly sophisticated. However, within the construction project management environment in New Zealand there seems to be a lack of appreciation of the tools and techniques available to assist project managers with the effective running of their projects. This paper discusses some of the deficiencies in the use of project management software in the New Zealand construction industry. It draws on original research in the form of a questionnaire that was designed to assess the level of information technology use, the effectiveness of this use and the overall willingness to change.

Project Management in New Zealand

Project management as a means of achieving completion of projects is now in common use in New Zealand. Whereas the traditional organisational management of residential and commercial construction projects was primarily used in New Zealand, a recent trend has seen a move towards other types of procurement methods. In other countries this trend has also been happening. Chappell (1991) from his work in the UK, stated that "...until comparatively recently, virtually all building contracts were constructed using traditional procurement methods, which means that the employer commissions an architect to design a building...The work then proceeds on site with the architect inspecting and carrying out certain functions under the contract...". This was certainly the case in New Zealand and the traditional way of procuring projects is still in popular use. However, there has been a gradual erosion of this tradition and now projects are managed in New Zealand by any number of methods, such as Design and Build, Management Contracting and Project Management. Wilkinson (1998)

suggested that with this change of tradition, there has been, within New Zealand, an expansion of project management companies or project management divisions within companies offering project management services. Again, this is not a New Zealand specific phenomenon. In the United States, work by Meredith and Mantel (1995) commented that "The use of projects and project management continues to grow in our society...The past several decades have been marked by a rapid growth in the use of project management as a means by which organisations achieve their goals..." .

In New Zealand, the quantity surveying profession has been quick to adopt project management as one of its key services. Lamb (1994) suggested 67% of quantity surveying companies in New Zealand offered project management to their clients as one of their key services. The study suggested that project management is becoming a large part of the business of quantity surveying companies. One quantity surveyor commented that "10% of business at the moment [is] in project management and we are forecasting that ...in 5 years time...it will be 20%". This was backed up by another quantity surveyor from another company in New Zealand who suggested that project management was a main service. He said that as a percentage of business "project management...[is] about 10%, it's quite big". In addition to the growth of project management in quantity surveyors' business, there has been a rise in the number of project management companies starting in business. These companies focus solely on providing project management services and many of them provide it to the construction industry.

Having seen that project management is in common use in New Zealand as a

means of procuring construction projects, the next section examines the use of information technology for project management planning and control, in both New Zealand and internationally.

Information Technology for Project Management

Doherty (1997) researched the use of information technology in the New Zealand construction industry. Doherty's survey considered the use of software packages generally and also briefly for project management. He reported that 32% of construction companies nationally were using project management software. The results suggested that the most common software system was Microsoft project (39%) but that many users used spreadsheets for project management rather than a customised project management package. He suggested that the most common barriers to increasing the use of computers, including those for project management use, in the New Zealand construction industry were satisfaction with existing methods and lack of finance to update systems.

Other than reporting how many companies were using project management software, Doherty did not assess the technology specific to project management use. However, Doherty did report that there are a large number of people working in the construction industry who maintain their existing system because they are unaware that other systems exist. Another research project by Igbaria et al (1998) specifically directed at small firms in New Zealand found that mainly customised software packages were being used. They also found that, amongst other things, system usage and user satisfaction were positively correlated with perceived ease of use and perceived usefulness.

Internationally, Cox and Hampson (1998) have examined, among other things, the use of project management software. They found that the highest level of importance of application for the successful management of their project

was given to Excel. Of the packages available specifically for project management, they found that Primavera was marginally preferred to MS Project. Similar work, analysing project management software, can be found in an article by Colin and Retik (1997). They analysed the role of project management software and advanced information technology techniques in reducing construction delays.

Their research analysed the characteristics, technical features and specialist features for sixteen project management software packages. They divided the packages into base level, mass market level, advanced and sophisticated packages. They found that, when analysing these packages for their ability to assist with delays and claims, base level packages (databases presumably something like MS Excel) were not suitable for the construction environment, while mass market packages were suitable but had limited application for delays and claims.

They suggested that advanced packages (such as Primavera) were best suited to the purpose of claims and delays and that sophisticated packages offer an integrated system and were the most expensive. The research did not provide details of how many companies in the UK were relying on which software system. From the work of Doherty (1997) and confirmed in this research, it is possible to show that mass market packages are the packages most likely to be used for project management by New Zealand construction companies (eg Microsoft project and timeline). Advanced packages, such as Primavera, are not being used by a large number of companies in New Zealand and sophisticated packages are, at the moment, not being used at all.

Other reports tend to confirm the under-use of computer technology in the construction industries in various countries. Dawood (1999) reports that the construction industry in the United Kingdom is behind other industries in terms of the utilisation of information

technology for production planning and scheduling and other technical and managerial operations. Similarly, the results of a questionnaire by Stewart et al. (1998) to Australian firms to evaluate the use of information technology in the Australian construction industry found that new technology was largely being ignored. The research found that the current use of information technology within the Australian construction industry and the quantity of resources devoted to research and development of information technology were both low.

This is also the case in Hong Kong construction industry where another study found that Hong Kong construction companies are quite conservative in their adoption and use of information technology (1999).

There has been much literature that focuses on the benefits, such as increased productivity and competitiveness, that information technology use can bring to the construction industries in various countries. For instance, Sarshar et al (1994) commented on a method for improving the information technology use in the construction industry to increase productivity. Froese et al (1997) discussed the integrated computer system for supporting construction management. Cox and Hampson (1998) believe that improving computer skills of project managers can provide construction firm with a competitive advantage in an increasingly competitive international market. A similar discussion was presented by Mitropoulos and Tatum (2000) who found that, along with technological opportunity, one of the key forces driving construction firms to adopt new information technologies was competitive advantage.

Meredith and Mantel (1995) argue that there are many problems with the current trend in Project Management Information Systems (PMIS) towards the integration of software. Most commonly there are errors in managing the PMIS rather than the project itself, excessive computer

involvement with computer activity replacing project management, PMIS reports which mask real project problems, too much information overwhelming managers and thus hiding problems, PMIS reports which replace direct communication, a dependence of project managers on computer reports before reacting to problems, and the management of symptoms of problems rather than the problems themselves.

Research Methodology

The research discussed in this paper aims to identify the use of information technology for project management in construction companies in New Zealand. In the first instance a literature review was undertaken which identified the current use of project management companies managing construction projects. From this a questionnaire on project management service use was sent to construction companies in Auckland. All companies surveyed offered project management as one of their main service. The types of companies chosen were engineering consultancies, quantity surveyors, contractors and project management companies.

The companies were identified through Web sites, construction institutions (New Zealand Institute of Quantity Surveyors (NZIQS), Institution of Professional Engineers New Zealand (IPENZ), New Zealand Institute of Building (NZIOB)) and telephone listings. Auckland was chosen for the study since it contains one-third of New Zealand's population (of approximately 3.8 million) and the majority of construction company headquarters. Currently, in Auckland, there are, in the telephone listings, 93 engineering consultants, 47 quantity surveying companies and 29 building project management companies.

The engineering, quantity surveying and building contractors had to be contacted to see whether they offered project management as a service before sending the questionnaire. Finally, 80 questionnaires were sent to those

companies offering project management as a service. The questionnaire contained a mixture of open and closed questions. Of 80 questionnaires and follow-up letters sent to companies in Auckland, 35 responses to the questionnaire were received, a response rate of 44%. Although the research was limited to Auckland, given that New Zealand has a small population, and many of the Auckland companies operate out of the other three major cities (Wellington, Christchurch and Dunedin), the results can be seen as representative of the whole country. In addition, the issues raised in the research can be compared to other countries and, as will be seen, many of these results are applicable internationally.

This paper discusses the results relating to numbers of companies responding to various questions and an analysis of their comments. Statistics are provided for the profile questions relating to the companies surveyed. For information technology use, discussions relating to the various aspects

of information technology use then presented.

Results

The results discussed here are in two sections. The first are the results from the questionnaire that discuss the general composition of the companies responding to the survey. The second section provides the detailed analysis of technology use for project management when managing construction projects in New Zealand.

Company Profiles

Table 1 shows the types of companies responding to the survey. A spread of companies is apparent which gives an indication of the placement of project management services within the New Zealand construction industry. As stated earlier, there has been a growth in the project management services offered and the range of companies offering these services are a reflection of this growth. (Table 1)

Table 1 Company Type

Type of company	Number/24	Percentage
Project Management	5	21
Engineering consultant with project management division	4	17
Quantity surveyors with project management division	6	25
Contractors with a project management division	4	16
Engineering consultants without separate project management division	3	13
Contractors without separate project management division	2	8

Companies in the survey had a range of experience in providing project management services (Table 2).

However, the spread of results does tend to suggest that project management is relatively new as a service offered to the New Zealand construction industry, with

71% of companies having less than 21 years project management experience. New Zealand has a small construction industry where few companies employ large numbers of staff. This means that the numbers of employees working in project management are likely to be small. Table 3 illustrates this point and shows that the majority of companies, 74%,

responding to the survey said that they had 10 or fewer employees involved in

project management or their project management division.
(Table 3)

Table 2 Years Experience with Construction Project Management

Years	Number/24	Percentage
1-10	9	38
11-20	8	33
21-30	2	9
31-40	1	4
41-50	1	4
51-60	1	4
61-70	1	4
71+	1	4

Table 3 Numbers Employed in Project Management Services

Numbers Employed	Number/23	Percentage
1-10	17	74
11-20	1	4
21-30	3	13
31-40	0	0
41-50	0	0
51+	2	9

Given the smallness of the New Zealand construction industry, it is hardly surprising that the usual size of projects in financial terms is small. Table 4 illustrates this point where only 29% of companies work on projects of a NZ dollar value greater than

10 million. The most common dollar range for projects was the category 1 million to 10 million with 52% of companies working on projects in this range.
(Table 4)

Table 4 Typical Costs of Projects

Costs (NZ\$ value)	Number/23	Percentage
<50,000	1	4
50,000-250,000	8	33
250,000-500,000	5	21
500,000-1,000,000	8	33
1,000,000- 10,000,000	12	52
10,000,000+	7	29

Collectively, these results provide a picture of the current New Zealand

construction industry and its association with project management. They confirm the small nature of the construction industry and show that project management is relatively new as a means of managing construction projects.

Results: Information Technology Use

Of the companies responding to the survey, 58% used project management software packages for project management planning and control. This means that 42% of companies are not using any current software, even though they are offering project management as one of their services.

Of those 58% using project management software packages, by far the most popular package in use was Microsoft project (71%), with only 28% of the companies were using Primavera, Suretrack and/or Timeline. 21% of the companies had developed their own in house project management systems. Integration of Microsoft Excel and Microsoft Project was used by 28% of the companies as their main project management software.

The companies who offered project management as one of their services but were not using project management software were usually relying on Microsoft Office as their main software, using spreadsheets and databases as their main source of project management documentation.

The profiles of the companies using project management software and those not using project management software varied. The average number of years experience in providing project management services for those companies using the software was thirty years. The average number of years experience in providing project management services for those companies who were not using the software was significantly fewer at eleven years. This leads to the conclusion that companies with less experience are less

likely to invest in the specialised project management software.

Companies with fewer employees working on project management are also less likely to use the project management software. The average number of employees working in project management in a company which used project management software was nineteen, whereas the average number of employees working in project management for those companies who were not using the software was four.

There was also a difference in the cost of the projects that the companies were undertaking. 75% of those companies not using the software had projects of usual size below one million dollars, compared with 53% of those companies using the software. Only 8% of companies not using the software did projects of a dollar value greater than 10 million, whereas 17% of companies using the software said that the usual dollar value of their projects was in this range. In summary, the smaller the usual dollar value of projects undertaken by the company, the less likely the company is to use the software.

Those companies using project management software provided insights into the advantages and disadvantages of the software and allowed an assessment of whether the software packages were being effectively used. The survey found that the packages were not being used to their full potential. Packages were frequently being used for project planning and developing a schedule, but not being integrated to include budgeting and cost control which was often being carried out in parallel on other software. It appeared, from this research, that the project management software was primarily being used for time management. To this end, the software was used for time control, monitoring, updating, re-planning and as early warning of potential time related problems.

The research shows that there is an awareness of the advantages of the software available but a reluctance to

make full use of the software. Those companies that were users of the software for time management commented that the packages were essential for a range of things such as determining critical path, establishing milestones, repairing /highlighting progress and slippage, performing complex calculations quickly and recalculating scenarios quickly.

Others commented on their use for assisting with communication, monitoring ability and reporting control and time management. Given the complexity of construction projects, comments about the volume of the data and the need to update the programmes frequently was a common reason for using the software. As an aid to communication in the capacity of report standardisation and production, the packages were seen to be invaluable. Companies commented on the usefulness of providing presentations to client and project teams.

However, an acceptance of the limitations of project management software was evident from the survey. The main problems, as specified in the survey, were to do with the lack of information technology control, people's dependence on the system, and the lack of adequate monitoring.

For information technology control, the main problems appear to be with interfacing with other software and hardware, understanding the software, and with finding the software inflexible. Configuration issues between software and hardware and incompatibility with in-house control systems were mentioned as the main problems.

Problems associated with people's dependence on the software were the second group of comments that showed an acceptance of the limitations of the software. Issues which need to be carefully managed related to people having a blind acceptance of the output to the extent that they thought that printing out the results was the solution. Similarly, comments about the general mistakes being made were common such as people

not setting initial parameters/constraints correctly or failing to identify all logic connections, 'forcing' dates to 'look right'. These comments tend to suggest a lack of experience with the software when developing the initial stages of projects. Another important problem highlighted was a suggestion that a reliance on the software could stop personnel from doing the real tasks such as keeping in contact with clients and others. Lack of experience with the software was a cause of concern, one respondent commented that often the people who knew the process logic best had no project management package skills or experience. As a summary of these concerns, the following quotation provides some insight into the people aspects of the use of project management software "The software is meaningless if you do not have the sound knowledge and experience of how projects are investigated, designed, built and commissioned. Project management is primarily a 'people' activity with technology, software etc a tool to assist. Personality and experience are assisted not replaced by technical skill."

Finally, there were also problems relating to the software that suggested monitoring using the software was difficult and not being effectively carried out. It was thought that this lack of ongoing monitoring reduced the effectiveness of the software.

As mentioned earlier, the project management software did not appear to be used for cost control during construction project management. Most companies (80%) were using other software, which was not project management specific, as their main cost control systems. The question arises as to why this was happening. Mostly, the answers relate to the use of the companies' own cost control package, either a customised Excel spreadsheet or a specific cost control packages. One of the reasons given for this was that these packages further limit the possibility of errors. One respondent replied "Cost control is achieved by being alert to the progress of the project and proactive to

respond to problems. [project management] software packages do not provide this...".

Of the 20% of the companies using integrated systems, including for cost control, on some of the projects there was recognition of some benefits. These were that the project management software was useful for comparing progress vs. time with payment claims vs. time and also could be useful in checking budgets and reporting on variances to cost plan. Similarly, another advantage to using an integrated system allowed for the production of time risk scenarios to assess time related cost overruns or savings.

The results presented here provide an analysis of the current use of project management software in the New Zealand construction industry, suggesting that there are areas, e.g. for controlling costs, where the software is not generally not being used.

Discussion

Given that project management is now in common use as a means of achieving completion of projects in the New Zealand construction industry and internationally, it may be thought that companies ought to have the latest technological capabilities in order to be effective and competitive. From the literature discussed, this is the current mode of thinking. However, looking for a competitive edge was not raised as one of the reasons for using project management software in this research survey. In New Zealand, it appears that a lack of state of the art project management software does not prevent companies competing for project management contracts. Given New Zealand's unique size and position internationally, it seems that the companies undertaking project management for construction projects in New Zealand are not internationally up to date, in software terms, or particularly concerned about this situation. They seem to choose to stick to tried and tested methods of project management rather than invest time and money in new

integrated systems. This is not to say that the best technological capabilities do not lead to a competitive advantage in countries without the peculiarities of the New Zealand market. But, most New Zealand companies offering project management as a service are small and do not tend to compete internationally. Little experience, companies with few employees and companies working on projects below one million dollars are those companies less likely to use the specialised project management software. However, the New Zealand construction industry is characterised by such companies so it is hardly surprising that the findings show a reluctance to invest in sophisticated software. The barriers to the use of the project management software raised by Doherty (1997) hold, although this more detailed research has uncovered other problems associated with project management software use. These problems fall into three distinct categories; lack of information technology control, people's dependence on the system, and the lack of adequate monitoring.

Where software packages are in use, base level packages, as described by Colin and Retik (1997), are the packages most likely to be used by New Zealand construction companies (e.g. Microsoft Project and Timeline). Advanced packages, such as Primavera, are not being used by a large number of construction companies in New Zealand and sophisticated packages are, at the moment, not be used at all.

Even when using project management software, most New Zealand construction companies choose not to use the packages to their full advantage. Packages being used for project planning and developing a schedule, but, despite their capabilities, were not being integrated to include budgeting and cost control which was often being carried out in parallel on other non integrated software. This may lead to inefficiencies, but it appears that, specifically within the New Zealand construction environment, companies have developed their own means of operating. Where software

packages are being used is in larger companies and/or on higher cost projects and/or in companies that are likely to compete internationally.

Conclusion

The results of this research shed light on the use of project management software for the New Zealand construction industry. It seems that whilst some use of the software is apparent, the New Zealand construction industry is far from using integrated project management software to effectively manage construction projects. The results suggest that there are problems associated with using the current software. Many of the problems outlined tend to stem from the lack of confidence that New Zealand companies have with the software available and with the capabilities of the personnel using it. Relevant factors associated with the lack of software use in New Zealand have been discussed. The results of this research point to an internal industry that appears to be working without the need for sophisticated software, which, as some respondents point out tends to get in the way of the more important tasks, such as face to face reporting with the clients. Although of interest, future sophisticated project management software will only gain full use when the benefits of the software can be seen to outweigh the costs. Currently, in New Zealand, this does not seem to be the case.

Acknowledgements

The author wishes to acknowledge the work of two graduate students, Ousama Mutada and Gamal Hussain, in assisting with the collection of the data.

References

- [1] Chappell, D., 1991, Which form of building contract?, Architecture Design and Technology Press, London, pp. 33-39.
- [2] Wilkinson, S., 1998, The Growth of Project Management in the New Zealand Construction Industry, Second

International Conference of Construction Project Management, Singapore.

[3] Meredith, J., Mantel, S., 1995, Project Management: A Managerial Approach, John Wiley & Sons, New York, USA. pp. 4-8.

[4] Lamb, W., 1994, A Survey of Services, Information Technology and Quality Assurance in Quantity Surveying Firms in Auckland, Report for Unitec School of Architecture and Construction, Auckland, New Zealand

[5] Doherty, J., 1997, A survey of computer use in the New Zealand building and construction industry, Building Research Association of New Zealand, Study Report no 80, Wellington, pp 10-13

[6] Igbaria M, Zinatelli N & Cavaye A, (1998), Analysis of information technology success in small firms in New Zealand, International Journal of Information Management, Vol 18 (2), pp103-119.

[7] Cox, R.F., Hampson, K.D., 1998, Construction project managers and computer usage: an international review, in J. Yang and W.P. Chang (eds.), Building Education and Research, E & FN Sppn, London, pp 214-223,

[8] Colin, J., Retik, A., 1997, The applicability of project management software and advanced techniques in construction delays mitigation. *International Journal of Project Management* Vol. 15(2), pp 107-120

[9] Dawood, N., 1999, A proposed system for integrating design and production in the precast building industry, *The International Journal of Construction Information Technology*, Vol. 7(1), pp 72-83

[10] Stewart, P., Beswick, S., Lingard, H., 1998, Strategic use of IT in the Australian Construction Industry, *The International Journal of Construction Information Technology* Vol 6(2), pp 27-38.

[11] Shen, Q.P., Fong, P., 1999, A study of information technology applications among contractors in Hong Kong, *The International Journal of Construction Information Technology*, Vol. 7(1), pp 1-19

[12] Sarshar, M., Aouad, G., Brandon, P., 1994, Improving project organisation through strategic planning of information, *The International Journal of Construction Information Technology*, Vol. 2(3), pp 77-94

[13] Froese, T., Rankin, J., Yu, K., 1997, Project management application models and computer assisted construction planning in total project systems, *The International Journal of Construction Information Technology*, Vol. 5 (1), pp 39-62

[14] Mitropoulos, P. & Tatum, C.B, 2000, Forces Driving adoption of new information technologies, *Journal of construction engineering and management*, Vol 126 (5), pp340-348