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KEY CONSTRUCTION MANAGEMENT SKILLS FOR FUTURE SUCCESS

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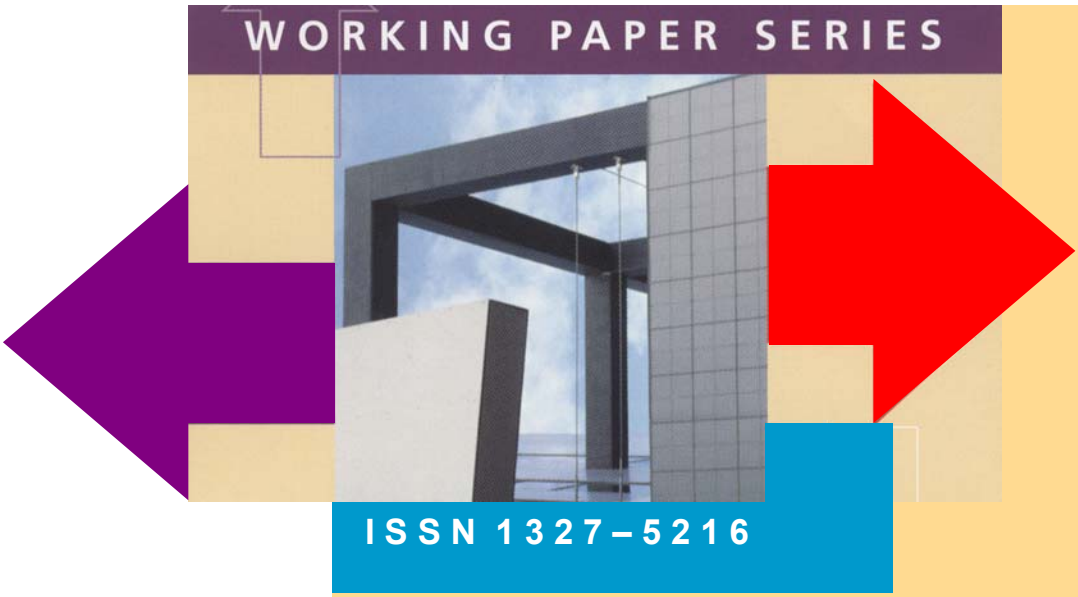

Abstract

Construction management (CM) graduates are employed in various organisations in the construction industry. These include building and civil engineering contracting, project management consulting, construction and project management consulting, client organisations (public and private) and developer organisations. Considering the diversity of employment opportunities for CM graduates, they need to have the necessary skills to be able to work effectively and efficiently with other professions in the industry. The objective of the research presented in this paper was to determine if CM graduates were meeting the expectations of their employers. Bearing in mind the dynamic forces impacting the industry, can CMs identify key skills needed for future success? Are CM graduates meeting the expectations of contractors? This information is critical for the successful formulation of curricula. To answer these questions, a questionnaire survey was distributed to CMs in contracting organisations regarding their expectations and observations of recent CM graduates. The survey is analysed and the results discussed. The results of the survey indicate that managers are generally satisfied with the skill level of CM graduates. Several important skills that were considered to be lacking in CM graduates were also identified. Acknowledging that there is always a need to improve the skill level of graduates, recommendations for improving the content CM curricula are proposed.

DEPARTMENT OF MANAGEMENT

KEY CONSTRUCTION MANAGEMENT SKILLS FOR FUTURE SUCCESS

INTRODUCTION

The construction industry is regarded as being inherently uncertain and complex in its structure. The complex nature of the construction industry, coupled with the challenges of global competitiveness and changing regulatory requirements has created the need for highly educated and competent construction management (CM) graduates. Essential attributes include: intelligent, flexible, adaptive, and the ability to deal with uncertainty and rapid change. Construction management graduates are employed in various organisations in the construction industry such as, building and civil engineering contracting, project management consulting, construction and project management consulting, client organisations (public and private) and developer organisations. Considering the diversity of employment opportunities, CM graduates need to be equipped with the necessary skills to be able to work effectively and efficiently with other professions in the industry.

The objective of the research presented in this paper was to determine if CM graduates were meeting the expectations of their employers. Bearing in mind the dynamic forces impacting the industry, can CMs identify key skills needed by CM graduates for future success? Are CM graduates meeting the expectations of contractors? This information is critical for the successful formulation of curricula. To answer these questions, a questionnaire survey was distributed to CMs in contracting organisations regarding their expectations and observations of recent CM graduates. The survey is analysed and the results discussed. The results of the survey indicate that managers are generally satisfied with the skill level of graduate CM students. Several important skills that were considered to be lacking in CM graduates were also identified. Acknowledging that there is always a need to improve the skill level of graduates, recommendations for improving the content CM curricula are proposed.

EDUCATION AND PROFESSIONALISM

Definitions of CM abound the construction literature, with some focusing on project management and others on site management (eg, Sears and Clough, 1991; Fryer, 1997; Farrell and Gale, 2000). For the purposes of this paper, however, CM has two dimensions, *project management* and *business management*, which are, in practice, interdependent in construction. Construction management education is not new, as it has been a part of many early civil engineering programs (Abudayyeh *et al*., 2000). Since 1980s CM has emerged as a separate distinct profession with institutions such as the Chartered Institute of Building (CIOB), Chartered Institute of Building Services Engineers (CIBSE), and Australian Institute of Building (AIB) supporting and recognising its important role in the construction industry. From the time when CM was recognised as a professional discipline, undergraduate and postgraduate degree courses in CM have proliferated into many university curricula in countries such as Australia, Hong Kong, UK, USA and Singapore. In addition, the discipline has steadily gained status and recognition in the eyes of industry clients and other built environment professionals (Fryer, 1997). In defining a CM professional, Murdoch and Hughes (1996) suggest they should:

- possess a distinct body of knowledge or identifiable corpus of expertise;
- hold the appropriate qualifications required by the appropriate professional body such as the AIB or CIOB;
- provide a service to the public by considering their needs before the needs of their own; and
- hold mutual recognition of other professions.

While recognising the professionalism of CMs, Fryer (1997) notes that CM may fall short of being a profession in the traditional sense. Fryer (1997) states that there is no shortage of a corpus of knowledge but, barriers to entry, that is, the qualifications needed to be a CM professional, are somewhat ill-defined inasmuch as there is no single body professional regulating entry or single qualifying route. In fact, architects, engineers and quantity surveyors (QS) may perform the role of a CM if they have the necessary skills and experience. For example, a QS may progress from a contract administration role to a project or

contract management role and thus gain professional recognition from the CIOB and AIB, if they have a degree or equivalent qualification. The reason for this is that there are various categories of membership that professionals can hold with the CIOB and AIB, which has, to some extent, resulted in the abatement of mutual recognition from other professions. Furthermore this is exacerbated by the fact that there is currently no system of registration for CM, as there are with other professions such as the architectural and engineering disciplines.

EDUCATION AND TRAINING

Construction managers' jobs are demanding, complex and varied and, are heavily dependent on their managerial skills (specifically social skills) so that they can deliver their projects effectively and efficiently to the customer (Thurston, 1992; Akintoye, 1998). Research about what CMs do has been ubiquitous over the last three decades so we can identify what skills they require and the types of training and education needed to improve their performance (eg, Hatchett, 1971; Haltenhoff, 1986; Mustapha and Langford, 1990; Farrell and Gale, 2000). There appear to be contrasting views in the literature for more graduate education of CM while others advocate for more training (Farrell and Gale, 2000).

Hammer and Champy (1993) suggest that 'training' increases skills and competence and teaches employees the 'how' of a job, where employees are taught how to perform a particular job or handle a specific situation, whereas 'education' increases their insight and understanding and teaches them why. Similarly, Farrell and Gale (2000) suggest that education implies that people develop skills such as creativity, critical analysis of accepted practice and understanding of theoretical concepts. Training, on the other hand, suggests that emphasis be placed on a person's ability to perform productively in the early months on employed. Thus, Haltenhoff (1986) asserts that educated people are less productive when first employed but are able to take on a broad area of responsibility over the full span of their careers, whereas training produces individuals who confine their productivity to a narrow area of responsibility. In fact, Shirazi and Hampson (1998) suggest that CMs generally lack the managerial knowledge and skills to enable them to perform at their optimum.

Research undertaken by Finnigan *et al.* (1986) found that many members of the CIOB in the UK, who were practicing Chartered Building Professionals were in need of managerial knowledge and skills. Finnigan *et al*. (1986) also found that the building professionals sampled were inadequately prepared for problem-solving related issues in human relations, organisation, contractual matters, and motivation of others. More recently the Egan Report (1998) in the UK identified the need for better education and training of CM personnel, which have also been echoed in Australia through the Guthrie (1994), Karpin (1995), Turpin (1996), Shirazi and Hampson (1998), and the DIST (1998). Akintoye (1998) describes the informal and formal acquisition of construction management skills. In doing so, informally acquired skills are obtained through on the job training and in-service training. The formal procedure to acquire CM education is through an educational institution such as Tertiary and Further Education Institutions (TAFE) and Universities. The academic content of a CM course typically covers topics such as management principles and theories, the construction business environment, project management, construction economics, construction law and management practice. A CM program should equip graduates with both skills and techniques necessary for the decision-making involved with construction at a business and project level. Furthermore, a CM program should aim to strike a balance between the strategic, technical and operational aspects of managing construction operations in a wide range of construction settings.

CONSTRUCTION MANAGEMENT SKILLS

Sears and Clough (1991) suggest that CM graduates must possess three essential attributes. First they should have practical experience so that they are thoroughly familiar with the workings and intricacies of the industry. Without such a basic grounding of construction fundamentals, the CM graduate would be unprepared to carry out their tasks and responsibilities. Second, the graduate must be familiar with various tools and techniques for planning, scheduling and controlling construction operations. Thirdly, the graduate must have the personality and insight that will enable them to work harmoniously with other people, often

under very strained and trying circumstances. After all, graduates must be able to acknowledge that they cannot achieve everything through their own efforts alone. They need to be able work with and through people to perform their duties. Back and Saunders (1998) states that engineering graduates are required to possess an array of skills (personal, business and technical), as they are required to deal people at strategic, technical and operational levels. Similarly, Eunson (1999; p.20) states "job advertisements clearly show that employers are looking for people who can communicate well, write reports, work well in teams and negotiate with and influence".

Graduates must be good active listeners, as the information they require to, perform their daily task jobs, solve problems and work effectively with others, will come from verbal interaction in team environments (Backs and Saunders, 1998). Similarly, Rance (1999: p.22) states "employers are looking for people who can communicate clearly and concisely, and who work well with others and build up networks and relationships both in the workplace and with customers". In addition, graduates who are able to stay abreast with managerial and technological developments within the industry have also been found to be important skills that graduates should possess (Davis and Creste, 1998). Together with a strong academic record, employers want CM graduates who are team players and leaders, good personal attributes, information technology skills, language ability, problem solving skills and a good awareness of the business environment (Riggs, 1988). While CM skill levels are important for immediate employment and future career developments for graduates most managers' tend to target graduates whose qualifications and skills match their own (Davis, 1996; Neilsen, 1998).

Guthrie (1994) found that graduates were often seen as having, communication skills (verbal and written), an inability to relate to others, a lack of understanding for other employees (especially those at a trade level), and a lack of ability to manage facilitate others working in the same organisation. Consequently, managers in construction organisations believe that graduates need greater skill levels in law and building contracts and more practical experience (Davis and Csete, 1998). According to Neilsen (1998) CM graduates are often unfairly criticised by their employers because they are new to the workforce and thus have limited, if any, practical experience. Good management skills as the central tenet to improving the industry's productivity performance, which to date has been considered to be poor when compared to other industries such as manufacturing (CIDA, 1993). In Australia, it is generally recognised that there is a shortage of qualified managers in the construction industry (Karpin, 1995; Hayton *et al*., 1995). This major shortage is expected to continue with the increasing complexity of design and construction, and the demand from client for higher quality and faster completion time of construction. Thus, it is important that CM programs produce graduates who have the necessary skills to meet these demands and are also able to work and interact in a collaborative and cooperative manner with people.

RESEARCH METHODOLOGY

A questionnaire survey was used as the research instrument for this study. The survey was mailed to 50 construction managers in contracting organisations in the State of Victoria, Australia. Completed questionnaires were received from 27, representing a response rate of 54%. The questionnaire contained 18 factors (as identified in Table 1) that were identified from the literature as being important graduate skills. Construction managers were asked to indicate the level importance attached to the 18 variables for expected and observed skills of their graduates. Using a 5-point Likert scale CMs were asked to rank each factor. The response was scored as follows: 5 extremely important, 4 very important, 3 moderately important, 2 slightly important, 1 not important. They were then asked to comment on the possible areas that needed attention in CM courses, skills that may needed additional attention, and the hours that graduates are expected to work.

Development of Graduate Student Importance Index

Information obtained from the respondents was used to develop a Graduate Student Importance Index (GSII), which can be used by universities as benchmark metrics for monitoring how their course meet the needs of the construction industry. In calculating the GSII the mean and standard deviation of each individual factor were considered not to be appropriate statistics (although presented in Table 1 for analysis purposes) to evaluate the overall rankings, as they do not reflect any relationship between them. Thus, all the

numerical scores of the each identified skill factors were transformed to relative importance indices to assess the relative ranking's of the factors (Olomolaiye *et al*., 1987; Okpala and Aniekwu, 1989; Shash, 1993; Holt, 1997).

The GSII was calculated using the following formula:

$$\frac{\sum w}{AN}\ , (0 \le \text{GSII} \le 1)$$

where w = weighting given to each factor by the respondent, which in this case ranged from 1 to 5 where 1 is not important and 5 is extremely important;
A = the highest weighting (ie, 5 in this case); and
N = the total number of respondents

Determination of the Maximum Absolute Difference and Percentage Agreement

For any two groups, let the rank for ith in group 1 be R_{i1} and in group 2 be R_{i2}. Then the absolute difference D_i between the ith item by the groups would be:

$$D_i = \left|R_{i1} - R_{i2}\right| \quad (1)$$

where = 1, 2,……N (2)

and there are N items.

$$\text{Define } D_{\max} = \sum_{i=1}^{N}\left|R_{i1} - R_{i2}\right| \quad (3)$$

$$\text{where } j = N - i + 1 \quad (4)$$

As the maximum absolute difference between the rankings of all N items by the two groups, when the two groups are in complete disagreement (ie if they are ranked the items in opposite orders). For example, for 18 items (N = 18), when i = 1, j = 18 - i + 1 = 18. Each of these values was computed so that they could be used to derive the Rank Agreement (RA) factor). The RA factor is defined as:

$$\text{RA} = \frac{\left(\sum_{i=1}^{N}\left|R_{i1} - R_{i2}\right|\right)}{N} \quad (5)$$

with a maximum RA: $\text{RA}_{max} = \dfrac{\left(\sum_{i=1}^{N}\left|R_{i1} - R_{j2}\right|\right)}{N}$ (6)

which decreases with an increase in the number of items. The percentage disagreement is defined as:

$$PD = 100 \times \frac{\left(\sum_{i=1}^{N} \left|R_{i1} - R_{i2}\right|\right)}{\left(\sum_{i=1}^{N} \left|R_{i1} - R_{j2}\right|\right)} \quad (7)$$

where j is defined in equation 4. Thus, the Percentage Agreement (PA) expressed as:

$$PA = 100 - PD \quad (8)$$

The analysis is assumed that an absolute difference in rank of two, for example, implies that the groups agreed more than when did the absolute difference in rank is three, even though for each case there was no perfect agreement. In addition, the rank agreement factor can be greater than one, which implies a greater disagreement between groups. For 18 variables that contributed to skill importance the maximum $RA_{max} = 8$. A lower value however implies closer agreement.

ANALYSIS AND DISCUSSION

In determining whether CM graduates were meeting the needs of industry, CM were asked to indicate the expected skill level of CM graduates, (who had been employed for 12 months or less) for the 18 variables identified from the literature (eg, Nielsen, 1998). CMs were then asked to identify what they observed from their graduates. To test the inter-item consistency reliability of the scale used in the questionnaire the Cronbach's Coefficient Alpha (α) were calculated. It was found that $\alpha = 0.81$ for the expected scale and $\alpha = 0.79$ for the observed scale. As a threshold value of $\alpha = 0.70$ for reliability (Nunnally, 1978:p.245) was exceeded so the scales were considered reliable for measuring expected and observed graduate skill levels. Table 1 presents the GSII, descriptive statistics and the percentage agreement (PA) of CMs for skills for the questionnaire survey.

A RA factor of 0.44 was calculated which indicates that there was a degree of agreement between the ranking of expected and observed skill factors. There was however a high PA between the expected and observed values of CM for the skill factors identified for graduates (in Table 1). Using the Spearman's Rank Correlation the degree and direction of relationship between the expected and observed GSII it was found that there was a significant positive relationship between the expected and observed values $r_s = .74$, n=27, $p < 0.01$, two tails. There was a high degree of agreement (PA>90%) for 12 skill factors amongst the CMs for observed and expected skills factors as noted in Table 1.

Table 1: Graduate selection importance index and descriptive statistics

Item	Skill Factors	Expected GSII	Rank (R_{i1})	Mean	SD	Observed GSII	Rank (R_{i2})	Mean	SD	PA
1	Academic Achievement	0.64	16	3.22	1.05	0.67	5	3.33	0.62	79
2	Accept Responsibility	0.83	1	4.15	0.91	0.65	6	3.26	1.1	94
3	Adaptable to Changing Work Environment	0.83	1	4.15	0.82	0.47	18	2.37	1.04	0
4	Computer Literacy	0.76	11	3.81	0.88	0.64	11	3.22	0.8	67
5	Time Management	0.82	4	4.11	0.85	0.59	14	2.93	0.83	44
6	Exercise Professional Judgement	0.79	10	3.96	0.81	0.64	11	3.22	0.89	97
7	Practical Building Knowledge	0.79	10	3.96	0.94	0.72	3	3.59	0.93	94
8	Interpersonal	0.81	5	4.04	0.9	0.64	11	3.33	1.14	89
9	Leadership Capability	0.65	15	4.04	0.9	0.64	11	3.22	1.09	97
10	Numeracy	0.71	13	3.56	1.05	0.59	15	2.93	0.92	98
11	Oral Communication	0.79	10	3.96	0.94	0.58	16	2.89	0.85	95
12	Problem Solving	0.56	17	2.78	1.01	0.6	12	3	0.62	97
13	Environmental Awareness	0.7	14	3.52	0.89	0.63	12	3	0.82	98
14	Teamwork	0.73	12	3.67	0.76	0.69	4	3.44	0.93	85
15	Trust and Honesty	0.79	10	3.96	0.76	0.74	2	3.7	0.82	94
16	Update Professional Knowledge	0.79	10	3.93	0.78	0.62	13	3.11	0.85	96
17	Work Autonomously	0.82	4	4.11	1.12	0.81	1	4.04	0.98	99
18	Written Communication	0.45	18	2.26	0.71	0.53	17	2.67	0.96	94

It was surprising to see that that there was a significant relationship between what CMs expected and what they had observed. As the authors had heard many complaints about the quality of graduates from employers they had interacted with, it was considered that CM graduates were not meeting the expectations of employers. Contrary to this proposition it would appear that CM graduates are generally meeting the expectations of industry, though the 'expectation gap' that exists needs to be narrowed considerably if universities are to match or exceed the expectations of contracting organisations.

Skill factors that were found to have a low PA were time management (44%) and computer literacy (67%). While the skill factors of 'exercise of professional judgement', 'interpersonal', and 'up-date professional knowledge' had high PA there expected GSII differed significantly from that what was observed. The ability to 'exercise professional judgment' is developed over time through practical experience and on-the-job experiential learning. As many graduates are new to their work environment and thus may not be able to effectively communicate to the various professions involved in the procurement of a project, especially if have not been exposed to other graduates studying degrees related to the built environment during their studies. It is important for CM graduates to be exposed to architects, QSs, engineers and the like so they can understand how and why make they decisions. A CM stated that "graduates fail to realise the importance of networking. They don't realise that they'll be working with many of these consultants and subcontractors again in the future. They need to realise that building relationships is important to getting the project finished on time, to budget and the desired quality." The authors proffer that the use of a mentor during the first year or so of their employment can play a vital in developing their skills, particularly those of an interpersonal and leadership nature.

Teamwork and being able to 'work autonomously' are essential skills that should be acquired through a CM course. Students are expected to become self-directed learners and complete their assignments by

themselves. In addition, students also work in-groups and thus expected to complete set projects within a specified time period. The expectations of CM of graduates' ability 'work autonomously' were generally achieved, with the observed rank for when the GSII's for expected (0.82) and observed (0.81) values. Similarly this was the case for 'teamwork', although the gap between expectation and observed values for GSII's and the PA is slightly larger than that for being able to work 'autonomously'. Noteworthy, the aforementioned factors were ranked significantly higher than the expected value identified by the CM, which suggests that CM course provides graduates with the necessary skills to work in teams and work autonomously.

Surprisingly 'written communication' skill factor marginally exceeded the expectations of CM, whereas 'oral communication' and 'numeracy' were skill factors that did not reach the required expectation levels. More attention needs to be spent on educating CM students about how to write business reports and communicate to their ideas to different disciplines. In addition, the poor levels of numeracy can be tackled by implementing introductory mathematic courses, which are specifically applied to construction. Many CM courses have eliminated these units over the last ten years in an attempt to streamline courses, perhaps it is now time they were re-introduced. There was complete disagreement between the expected and observed values for the 'adaptable to changing work environment' as CMs expected this skill to be the most important but they observed that it was the worst skill that CM graduates possessed. Construction managers typically expect graduates to be able to fit into their workplace almost immediately and deal with the problems that are thrust upon them. In fact, it would be reasonable to say that many expect too much of graduates in this instance. For example, one CM stated "I expect my employees to work at least 9 hours a day because this shows dedication, enthusiasm, interest and hard work". Another CM stated " I expect graduates to work at least 50 hours a week though this may vary depending on our workload, project status etc". Because CMs work very long hours, (at times over 80 hours week, when on-site) they also expect graduates to work long hours. Such long hours can be taxing and stressful for graduates (Sutherland and Davidson, 1989).

Graduates often find it difficult to cope with the long hours expected of them and as a result their time management skills may suffer because they are overworked and suffer from fatigue, which would explain why there is a discrepancy between expected and observed skills. A CM stated that "initially most graduates will struggle to cope with what is required of them but they do eventually adapt to the lifestyle of the industry. I think they need at least a 6-months to adapt". Other comments received by CMs were "being young, the graduates seem to struggle in the morning, but get better as the day goes on" and "those with enough ambition put in the time and effort seem to cope". The demand for long working hours has become an industry norm. This had detrimental effects on project productivity and quality (eg, Li *et al*., 2000) and the health of CMs eg, high levels of anxiety, stress, burnout (Sutherland and Davidson, 1993; Sommerville and Langford, 1995; Djebarni, 1996).

The expected GSII for 'practical building knowledge' was found to be 0.79 and for the observed GSII 0.72. There is no significant difference between the indices, which is confirmed by the PA (93%) identified in Table 1. Thus, it would appear that CM degree courses are providing adequate practical knowledge. Almost all CMs however made comment that they would like to see graduates posses a greater understanding and knowledge of technological developments (eg, piling and scaffolding systems etc) and practical construction methods and techniques used on-site. In terms of course content, Harriss (1998) suggests that many CM courses are teaching graduates subjects that they are unlikely to use until 10-15 years after they graduate, by which time the knowledge they have gained may be out of date. In fact, Harriss (1996) suggests that CM courses should be aiming to educate a general practitioner that will become a specialist after graduation by undertaking post-graduate education (eg, construction law, design management, facilities management, and project Management)

It can be seen that there is a gap, though not significant between expected and observed levels academic achievement as noted in Table 1. By obtaining a degree in CM it is expected that graduates have demonstrated that they have the intellectual ability, the capacity to learn, motivation to pursue and achieve high goals. Thus, from this finding it is suggested that practitioners may assume that graduates already have developed skills as they have obtained an undergraduate degree. The degree programs in CM are demanding, as students are required to undertake a variety of subjects in areas such as technology, management, economics and law. This provides students with a solid educational background to work in a

number of professional roles in the industry. Overall it would appear that there was a high degree of agreement between ranks for skill factors. For example, 'environmental awareness' was not considered to be an important skill as it was ranked 14. CM graduates were observed to perform slightly better than expected and thus received a rank of 12. While environmental awareness is not considered important, Zhang *et al*. (2000) suggest that the growing requirement for contractors to be certified to ISO 14000 will bring about changes in CMs attitudes toward the importance of the environment in workplace. Naturally CM course will have to broaden their courses to enable environmental management to form a part of the curriculum.

Similarly, the expectation of graduate CMs to possess computer literacy skills was considered to be low in importance. In fact, CMs observed that CM graduates matched their expectations in this instance. A possible reason for such low importance given to computer literacy is because the construction industry lags behind other industries in its use of communication and information (DIST, 1998). Thus, it is proffered that CMs did not consider this to be an important skill. Despite this finding, Li *et al*. (1999) found that employers expected CM graduates to have a high degree of skill and knowledge about the use and application of information and communication technologies in construction at an enterprise and project level. Li *et al*. (1999) found that employers recommended that university CM programs should place greater emphasis on the use of information and communication technologies in their curriculum, as they did not have time to provide on-the-job training to graduates. Li *et al*. (1999) suggests that CM courses should place greater emphasis on providing education about information and communication technologies as it is considered to be ~~a~~ fundamental to improving the inherent communication problems that plague the industry.

CONCLUSION AND RECOMMENDATIONS

This paper aimed to answer the following questions: *Can CMs identify key skills needed for future success*? Are CM graduates meeting the expectations of contractors? Besides the skill factors identified in the questionnaire, CMs were not able to suggest additional skills needed by CM graduates for future success. The only factor respondents identified as being critical related to 'practical building knowledge' by gaining a greater understanding and knowledge of technological developments, practical construction methods and techniques used on-site. From the findings presented in this paper, it can be concluded that CM graduates are generally meeting the expectations of contractors. There are however, CM graduates that fell below the expectations of contracting organisations for example, practical building knowledge, interpersonal, time management, and ability to exercise professional judgement. Such skills can only be acquired through experience and experiential learning. In addition, asking graduates to work long hours will invariably lead to mistakes being made, which will ultimately be a cost to the organisation. Managers need to recognise that graduates very rarely have experience before they enter the workforce and therefore they need to be tolerant of their inexperience. In fact, it is suggested that contracting firms provide mentors to help graduates acquire the necessary skills to succeed. New graduates, as entry-level professionals should bring new skills, concepts and ideas to the organisation that employing them. Fundamentally, they are a source of corporate re-vitalisation and energy. Construction management graduates must have patience if they are to be effective in the workplace, as the successful transition from university to employment is a challenge that requires time and commitment to lifelong learning.

The authors acknowledge that graduates of CM related courses must be able to master more skills than just technical details in order to be productive in the workforce. They must be prepared to meet customer requirements, to work within teams, to manage information, to work efficiently and effectively and comply with legislative constraints. It is no longer sufficient for a course to concentrate solely on specific detail relevant to the professional practice and principles of the CM profession. While there must be a focus on the science and technology aspects of the discipline there is a need at other applications such as design management, e-commerce, environmental management, facilities management, which prepare students for a variety of roles in the industry. Construction management courses need to be broader in their curriculum if they are to exceed the expectations of employers. Considering the findings presented herein it is proffered that CM courses should strive to provide graduates with skills to make them more attractive to contracting organizations. These skills include:

- a degree of specialist knowledge which reflects the latest research and its application in the workplace;

- an understanding of *how* information and communication technologies (eg, Internet, E-Commerce) can be used improve business practices;
- ability to communicate (written and orally) to different professions within the industry; and
- problem solving skills applicable to solving complex problems where the answer can no easily be found in a text book and where solutions may be ambiguous.

Given the challenges being imposed on the construction industry today, it is imperative for universities to re-evaluate existing CM curricula, modifying where necessary, so they can better equip their CM graduates to meet the challenges that lay ahead. The industry has high expectations of entry-level CM professionals. Graduating without the skills necessary for professional success in CM may damage the individual, the firm and even the industry. Students committed to CM should be able to confidently rely on the university experience to guide their skill development in a manner that permits future industry expectations to be fulfilled. Regularly collecting feedback from employers about their expectations of CM graduates acts as a quality assurance measure for providing useful information that can help improve curricula.

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