CAREER PROGRESSION PATH AS A DETERMINANT OF SITE MANAGER SKILLS

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Three distinct career progression paths (CPPs) exist for site managers: (1) through the crafts, (2) craft training followed by undergraduate study, usually on a part-time basis, and (3) undergraduate study. An analysis of the problems associated with the role of the site manager found that CPP is sometimes an important criterion used by employers in the appointment of site managers. There is no evidence that supports any one CPP being better than another. It is argued that craft site managers do not have the academic tools and underpinning knowledge required to manage construction projects, but they do command the respect of the workforce. Graduate site managers have difficulty managing practical problems and they have few life-time experiences that they can share with the craftspeople they supervise. Opportunities for graduate site managers to gain some craft appreciation skills are limited. The research question that arose was 'which site manager CPP, if any, contributes best towards the development of site manager skills? Twelve site management skills were selected from the literature. The methodology comprised a postal questionnaire supported by a literature review, a pilot study and exploratory interviews. The sample size was 1286, and the response rate 26.9%. Parametric statistical techniques were used to analyse the data. It is found *inter alia* that CPPs can be ranked in sequence of how they contribute towards the development of site manager skills. The craft training with graduate study CPP, and the graduate CPP were jointly ranked first. The craft CPP was ranked last. It is concluded that more craft site managers should be encouraged to supplement their practical experience with some academic learning. The Construction Skills Certificate Scheme card for site managers should be considered as only the first step for craft site managers in enhancing their qualifications.

Keywords: career progression, craft training, site manager, skills.

INTRODUCTION

A site manager is defined as the person in sole charge of a construction site that is identifiable by physical boundaries. Duties of the site manager include: being in charge of production and administration; directing, supervising and controlling the work of operatives; also coordinating the work of subcontractors and liaising with the client, consultants and third parties (adapted from Constable 1993: 6).

Problems relating to the role of the site manager are evidenced by a conclusion to work by Langford (1988); 'there is an awareness amongst older site managers that retirement is all too often followed by a sudden death'.

A site manager's CPP may be either craft or graduate or a combination of both. For the purposes of the study graduate education is defined as being up to Higher National

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Farrell, P and Gale, A (2003) Career progression path as a determinant of site manager skills. *In:* Greenwood, D J (Ed.), *19th Annual ARCOM Conference*, 3-5 September 2003, University of Brighton. Association of Researchers in Construction Management, Vol. 1, 183-92.

Certificate (HNC) level or equivalent and above. It can be argued that craft site managers do not have the academic tools and the underpinning knowledge required to manage construction projects. Graduate site managers may have difficulty managing practical problems, and they have few common life experiences that can be shared with the craftspeople they supervise (Healey and O'Loughlin 1994: 9). Craft training combined with graduate education may best seem to develop site manager skills; however opportunities to achieve both qualifications are limited and difficult. In some companies the CPP of the individual is a key criterion in the recruitment process, indeed advertisements appear in the national press inviting applications only from persons with a particular CPP. However there is no evidence in the literature to support any particular CPP. The study starts with the question, 'which site manager CPP is best?, and the question becomes the determinant of the key hypothesis:

Site manager career progression path (independent variable) influences those skills that contribute to the successful outcome of construction projects (dependent variable).

METHODOLOGY

The study commenced with a review of the literature (Farrell and Gale 1996, 1999a, 1999b, 1999c and 2000) and a pilot study (Farrell and Gale 1998). Semi-structured interviews were conducted with four practising site managers. The main research instrument was a postal questionnaire.

The population for the study was practising site managers. The precise population parameters were difficult to define. It could be estimated that there were 58 000 managerial staff employed by contractors in all sectors of construction in 1997 (DETR 1997). The term 'managerial staff' can have a broad definition; not all managers will have experience as a site manager. The number of site managers is lower than this figure, but it could not be determined from available data. The study was concerned with new build construction sites of medium value - defined as those in the range £1 million-£10 million -, and on projects where the Joint Contracts Tribunal Standard Form of Contract 1980 (JCT 80) was agreed between the employer and the contractor.

The postal survey sample comprised 1 285 companies or persons. Subjects were identified primarily through two sources: (1) members of the Chartered Institute of Building who had registered with the Institute an interest in site management; and (2) contractors identified by their listing in Construction News Top 100, Building Magazine Top 500 Companies, Building Employers Confederation Directory and Yearbook and Chartered Building Companies.

A total of 346 responses were received; a response rate of 26.9%. Thirty people returned the questionnaire incomplete. Two responses were not used because they contained substantive missing data. Only 193 responses were used in the main analysis. The remaining 153 respondents did not meet the population inclusion criteria; they were generally from senior line managers and service staff.

To test the hypothesis the research instrument asked the respondents to grade all three CPPs for how they contributed towards the development of site manager skills. A grade was given for twelve skills: leadership, social skills, decision making, verbal communication, written communication, numeracy, information technology, technical skills, organizational skills, managing change, judgement and managing self.

A five-point scale was used, as suggested by Fink (1995: 53). Labels were given to each individual grade to assist in reliability ratings; thus grade four was labelled 'contributes very significantly to skill development', grade three 'contributes significantly …', grade two 'contributes moderately …', grade one 'contributes a little …' and grade zero 'does not contribute …'. Summated multiple item scales were used to test the hypothesis, thus a total score is calculated for how each of the three CPPs contributed to the development of site manager skills. The total score was the summated mean of the grades recorded for the twelve skills; the maximum score was forty-eight and the minimum score was zero. The scale was then converted to a 100-point scale by multiplying by the factor 2.08 (e.g. 24 x 2.08 = 50%, 48 x 2.08 = 100%). The percentage symbol was used to resemble an examination type scale, assisting interpretation.

The independent variable in the study was the three different CPPs, viz: (1) through the crafts, (2) craft training followed by undergraduate study, and (3) undergraduate study. The dependent variable in the study was the CPP gradings. The demographic details of respondents were considered as intervening variables or subject variables. The study is a within subjects design, and tests are executed to determine whether there are differences between three groups, viz.: the three CPPs. The alpha level was set at $p = 0.05$.

The opinion scales within the survey questions were based on the underlying assumption that there is a 'true' opinion that is relatively stable, just as in the case of factual questions where there are true facts (Oppenheim 1992: 147).

ANALYSIS AND RESULTS

Test results are detailed in tables 1 to 3 inclusive. Descriptive statistical analysis comprised calculation of mean scores and standard deviations. Mean scores were the basis for analysing where differences lie when significant results were found in both non-parametric and parametric statistical tests. Table 1 indicates the mean scores in each of the twelve site manager skills. It is noted in the analysis that there is a tendency for site managers to score their own background/CPP best. To eliminate the effect of respondent background, weighted mean scores were determined. The calculation merely comprised taking the mean of the means in each of the three separate backgrounds. Weighted mean scores, are shown in this Table 1.

Reliability and validity

External reliability (test and re-test) is not possible using anonymous surveys. It is acknowledged that opinion questions produce much less reliable results than factual questions (Oppenheim 1992: 143). Survey reliability is enhanced by use of the pilot survey, by large sample size (Litwin 1995: 4-5), and by the use of the multiple item scales (Oppenheim 1992: 147).

Two internal reliability checks (whether each scale is measuring a single idea) are used: (1) Spearman's non-parametric Rho correlation coefficient; each individual variable is paired with the total summated mean score for that category, and (2) Cronbach's alpha is calculated in each of the three CPP categories.

The range of the Spearman correlation coefficients is 0.45 to 0.74. An argument to suggest that the scale is reliable is supported by the Cronbach alpha scores detailed in Table 2, which range from 0.85 to 0.89.Litwin (1995: 45) refers to five measures of validity: (1) face validity assessed casually by lay people; (2) content validity assessed

Table 1: The contribution of three CPPs to the development of twelve site manager skills; mean scores on a 100-point scale

Site manager skills	Craft CPP	Craft/ graduate CPP	Graduate CPP
Leadership	55.00 (57.50)	76.50 (79.50)	59.50 (58.50)
Social skills	57.00 (59.00)	69.25 (70.50)	61.50 (63.00)
Decision making	54.25 (58.50)	75.75 (77.75)	69.50 (69.50)
Verbal communication	56.00 (59.50)	75.50 (78.00)	70.25 (69.00)
Written communication	34.50 (37.25)	73.00 (74.25)	87.50 (87.75)
Numeracy	47.25 (51.50)	72.50 (75.00)	84.25 (84.25)
Information technology	32.75 (37.75)	68.00 (71.25)	84.75 (85.00)
Technical skills	42.25 (49.75)	73.25 (74.75)	77.50 (77.00)
Organizational skills	59.25 (62.75)	79.50 (81.25)	68.25 (66.75)
Managing change	42.25 (46.00)	71.50 (74.50)	69.00 (69.75)
Judgement	61.50 (65.25)	74.50 (76.50)	59.00 (75.50)
Managing self	63.50 (67.50)	77.00 (80.25)	70.75 (70.25)

Key: CPP = career progression path. Figures in brackets are weighted means.

by a panel of say ten experts; (3) criterion concurrent validity, whereby data are correlated with an established 'gold standard' (4) criterion predictive validity, whereby data can be used to predict future performance using correlations, and (5) construct (convergent or divergent) validity which is established after years of experience with an established research instrument. The validity check within this study falls somewhere between the face validity and content validity checks as defined by Litwin. This is assured by the four exploratory interviews, and more particularly by feedback received from three construction professionals during the design stage of the research instrument.

Determining whether the data are parametric

Tests were carried out to determine whether the data meet parametric or non-parametric criteria. Parametric data are required to meet three conditions: (1) the level or scale of measurement should be on interval or ratio scales; (2) the distribution of the population scores normal, and (3) the variances of variables in comparison groups or samples are homogeneous (Bryman and Cramer 1997: 117). Whether the data are parametric or non-parametric determines to some extent the type of statistical tests that can be applied to the data.

With respect to condition one, the opinion scale for individual questions (which ranges from zero to four) provides ordinal data; clearly a contravention of parametric data requirements. However, Bryman and Cramer (1997, p. 57) suggest that there is a compelling argument to treat the totals in multiple item scales as interval data. The total summed scale, having a range of 0 to 48, have been considered as interval data.

Condition two, compliance for normality, is checked by the application of four tests, as recommended by Tabachnick and Fidell (1996: 71-73): (1) the Kolmogorov-Smirnov test for one sample; (2) the Kurtosis test for distribution 'peakedness'; (3) the Skewness test for symmetry of the distribution, and (4) observation of variable frequency histograms with an overlay of a normal distribution superimposed. The

Kolmogorov-Smirnov results in table 2 show p = 0.00 in all three cases; the distributions were non-normal. In tests (2) and (3) the distribution was deemed normal if the values of Kurtosis and Skewness are zero, or nearly zero. Table 2 indicates that most of the Kurtosis and Skewness values are not zero, thus indicating a non-normal distribution.

Condition three, the variance ratio (square of the standard deviation) test, was undertaken as a test for homogeneity between variables. In paired comparisons the larger figure was used as the numerator and the smaller figure the denominator. The 'F' value in Table 2 of 1.89 was considered to be too large to permit the data to be classified as parametric.

It was proven by analysis that there are arguments to suggest that the data do not strictly meet the requirements of parametric data. It is however desirable to use the more powerful parametric tests. Boneau (1960) and Games and Lucas (1966), cited in Bryman and Cramer (1997: 118), artificially set up samples from populations which violated the conditions for parametric data. Tests on these samples were found not to differ greatly from tests on samples drawn from populations that do meet parametric data requirements. The parametric ANOVA tests are described as being robust enough to stand abuse and violations of parametric data requirements. There is also an argument that large sample size 'n' automatically implies that the data are parametric. Since there is some dispute in the literature as to whether the data meet parametric requirements, as a measure of prudence, both parametric and non-parametric data analyses are performed on the total summed scores. Analysis of grades relating to the twelve separate site manager skills is limited to non-parametric tests.

Testing the hypothesis using non-parametric techniques

The Friedman non-parametric test for 'K' related samples was used to test the hypothesis. With respect to total summated mean scores, table 2 shows that a significant difference occured, with p = 0.00. Significant differences were also found in separate Friedman tests on the twelve site manager skills. The CPP were ranked in each category, according to the mean scores in table 1. The craft/graduate CPP contributes best in eight skills: leadership, social skills, decision making, verbal communication, organizational skills, managing change, judgement and managing self. The graduate CPP achieved the best score in written communication, numeracy, information technology and technical skills. The craft CPP achieved the worst score in all skills except judgement.

Data homogeneity

Demographic data of respondents were collated by the research instrument to detect whether differences found were really due to the effect of subject variables. The Kruskal-Wallis non-parametric test was used for three or more unrelated samples and the Mann-Whitney non-parametric test was used for two unrelated samples. The demographic subject variables considered were: (1) whether respondents had experience of the Joints Contract Tribunal Standard Form of Building Contract 1980 (JCT 80), (2) whether respondents had experience of new build projects, (3) whether respondents had experience of medium-size projects – those projects in the range of £1million to £10 million, (4) age of respondents, (5) years' site management experience of respondents, and (6) respondents' own CPP. To avoid possible misunderstanding in the study, the CPP of the respondents is referred to as 'background'. Test results reported for total summated mean scores in table 2 show

Table 2: Data summary and results

	Total summed scores		
	Craft CPP	Craft/ graduate CPP	Graduate CPP
Typical subject response: summed scores (minimum = 0, maximum = 48)	12	37	41
Conversion to 100 point scale	25	77	85
Descriptive statistics			
Mean grade n = 193	50.13	73.73	71.42
Mean grade craft background n = 30	46.69	47.86	43.83
Mean grade craft/ graduate background n = 56	45.31	48.31	45.78
Mean grade graduate background n = 106	41.98	46.75	46.00
Weighted mean grade	44.60	47.64	45.20
Standard deviation n = 193	77.80	62.80	68.40
Equal variance checks			
Variance n = 193	60.52	39.44	46.79
Maximum 'F' ratio		1.89	
Tests for normality n = 193			
Kolmogorov-Smirnov 'p' value	0.00	0.00	0.00
Kurtosis 'K'	-0.02	0.63	1.79
Skewness 'S'	-0.16	0.52	0.81
Visual inspection for normality	Yes	Yes	Yes
Test for reliability			
Cronbach's alpha	0.89	0.87	0.85
Non-parametric tests for data homogeneity: significance levels			
Mann-Whitney JCT80	0.56	0.59	0.94
Mann-Whitney new build	0.76	0.51	0.04
Mann-Whitney size	0.80	0.52	0.85
Mann-Whitney age	0.02	0.35	0.96
Kruskal-Wallis experience	0.41	0.25	0.66
Kruskal-Wallis background	0.00	0.00	0.87
Non-parametric tests for differences: significance level			
Friedman test		0.00	

that the data are substantially homogeneous with respect to all subject variables except for respondents' background. There is only one significant difference with respect to age ($p \leq 0.05$), and one difference with respect to new build experience; it can therefore be assumed that respondent backgrounds listed in this table did not influence opinion on the influence of CPP.

Testing the hypothesis using parametric techniques

Application of parametric tests to the data was undertaken using the two-factor mixed factorial or mixed plot ANOVA. For this study only one within-subjects factor is relevant: CPP. Guided by results from the non-parametric tests, two between subject factors are included; respondent background and age.

The ANOVA executes a test to examine the following post-hoc hypothesis: 'the development of site manager skills is influenced by career progression path (CPP). Site managers' opinions on the influence of CPP is determined by their background and age'.

The main effect of age is not significant at $p = 0.23$. However, the key between subject factor of interest is the main effect of background with $p = 0.00$. Differences in background are explored by the one-way unrelated ANOVA, which is applied to the data to make comparisons on background at each level of the within subjects factor CPP; all test results are significant.

Table 3: Range for means at the 95% confidence interval

	Craft/graduate CPP	Graduate CPP	Craft CPP
Highest possible mean score	75.50	73.30	52.50
Sample mean score	73.73	71.42	50.13
Lowest possible mean score	72.00	69.50	47.70

It is therefore noted that there is a tendency for site managers to score their own background/CPP best. As noted in Table 1, to eliminate the effect of respondent background, weighted mean scores are determined. Eye ball observation of the resulting data suggests that differences, as demonstrated by statistical tests on the raw data, still occur.

Confidence intervals

Confidence intervals are calculated and shown in table 3. These intervals are calculated in recognition that the mean scores used in the analysis and interpretation may not be truly reflective of the mean for the population.

According to Howell, (1995: 227-230) these data can be interpreted on the basis that the probability is 0.95 that the range 75.50 to 72.00, for the contribution of the craft/graduate CPP to site manager skill development, includes the population mean μ.

It is noted that the interval for craft/graduate to graduate on SM skill development overlaps, and therefore it is not possible to distinguish between these two CPPs. The differences between the craft CPP and the other two CPPs for the development of SM skills are very large – 69.50 – 52.50.

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Career progression paths were ranked in terms of how they contribute towards site manager skill development. Arithmetical means with respect to the development of SM skills showed a ranking of the three CPPs, in the order of joint first craft/graduate CPP and graduate CPP, and third craft CPP. Mean scores were 73.73, 71.42 and 50.13 respectively. Small differences between the craft/graduate CPP and the graduate CPP were not significant. The margin between the craft CPP and the other two CPPs (71.42 - 50.13), can be considered to be of a large magnitude. Analysis of the data for each of the twelve skills separately showed the craft/graduate CPP contributes best in eight of the twelve skills. The graduate CPP contributes best in four skills (which may be classified as the academic skills): written skills, numerical skills, IT skills and technical skills. Differences in tests on individual skills were statistically significant. In eleven of the twelve site manager skills the craft CPP is the 'worst' CPP for site managers.

The influence of respondent background on the results is found to be significant, but calculation of weighted means eliminates this effect. Other subject variables within the study do not influence the data set nor the conclusions.

This study did not make an attempt to rank or rate the importance of each skill. In the literature, Fryer (1979) found social skills and decision making skills to be important. In these skills, the craft/graduate CPP was found to be the lead route. It could therefore be argued that in respect of a summative judgement on SM skill

development, the craft/graduate CPP should be rated more highly than the graduate CPP.

At the outset of the study it could have been reasonably anticipated that the craft/graduate would be the lead route. It was not anticipated that the graduate CPP would be of equal standing, nor that the craft CPP would achieve such poor scores. There is evidence in the construction press to show that employers frequently advertise SM positions for ex-craftspeople; also they may promote existing craftspeople within their own organization with no additional education or training.

This study and the literature (Lemarie 1982: 6) suggest that craft SMs benefit from exposure to academic study. It can be argued that craft training is not acceptable as a lone route into site management, particularly at a time when UK construction aspires to excellence and world class performance (Egan 1998). It is concluded that a craft SMs should receive training before being allowed to be the sole person in charge of a construction site.

Voluntary training schemes are not pervasive: Harris (1991: 3) suggests that the culture of many organizations is one whereby training is considered optional. Three existing initiatives are likely to contribute towards implementation of recommendations in respect of SMs originating in the crafts: (i) the return to direct employment status for craftspeople initiated by the Government and the Inland Revenue (Inland Revenue, 1998). This scheme will have the effect of increasing the pool of craftspeople who are potential SMs, (ii) the growth of national vocational qualifications and assessed experiential learning, and (iii) the site manager skills card initiative launched by the Construction Industry Training Board (CITB) parallel to its Construction Skills Certificate Scheme (CSCS. These initiatives are to be encouraged. But it can be argued that their ability to bring all SMs to craft/graduate, or graduate status is limited.

Further improvement may be sought through legislation. It is argued that all persons responsible for a construction site should have a national training certificate in safety management, which has more rigourous test regime than CSCS. It is recommended that an investigation be carried out to determine the practicality of legislation to ensure that all SMs possess a national training certificate in safety management. Safety may be 'used' as the vehicle to force otherwise unwilling organizations to expose their craft SMs to the education process. After completing programmes of study for a safety certificate, some craft SMs may be encouraged to develop their knowledge in other fields of construction. Legislation may be enforced alongside the review of the Construction (Design and Management Regulations) 1994 currently being undertaken by the Health and Safety Executive (HSE 2002). The concept may be 'sold' to the Government and the construction industry on the basis that SMs are responsible for the lives of people on construction sites, and therefore need appropriate education in this field.

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