THE STRIVE FOR PRODUCTIVITY AND QUALITY: VIEWS OF UK PROJECT MANAGERS

David G. Proverbs and Gary D. Holt

Built Environment Research Unit, School of Engineering and the Built Environment, University of Wolverhampton, West Midlands, WV1 1SB, UK

Simultaneous improvement in productivity and quality has long been a goal in construction. Previous research and modern management philosophy postulates a positive relationship between these goals. However, the feasibility of consistently achieving this on a construction site remains rather a contentious issue. The views of 38 UK contractors' project managers regarding this and other (related) hypotheses are presented. Comparative evaluation of factors known to impact productivity and quality is presented, embracing the contribution of different project coalition members towards these performance aspects. The views of project managers are divided, but the majority subscribe to the view generally held, that a trade-off (i.e. inverse) relationship exists. It is shown that contractors are considered to have more control over these performance aspects than other coalition members and that, partnering would appear to be widely perceived as having a significant impact on both productivity and quality.

Keywords: contractor, productivity, project manager, quality.

INTRODUCTION

There is deep-rooted belief in the construction industry that an inverse relationship exists between productivity and quality (P&Q) (Lundvall 1974). This is analogous to the 'trade-off' concept proffered by Griffith (1990) regarding time, cost and quality, i.e. that an improvement in one of these objectives has a negative effect on others. Despite this traditional view, continuous and simultaneous improvement in P&Q is an attractive concept. Indeed, the automotive industry (led by Japanese and American firms) has demonstrated that this ideal is perfectly feasible.

UK construction is often characterized by low productivity, fragmentation, divided responsibility, conflicting objectives and dissatisfied clients. A decline in UK construction productivity growth has been an issue of concern for some time (d'Arcy 1993). Recent research has revealed UK construction productivity to be lower than in Germany and in France (Proverbs *et al*. 1999, Proverbs 1998). Latham (1994) and Egan (1998) have both reported industry-wide problems and called for significant performance improvement.

The 'quality revolution', brought about Japanese management philosophy in the 1970s, led to the integration of P&Q through concepts such as Total Quality Management (TQM). Indeed, many of the improvements made in other industries, (particularly in manufacturing), were founded on such philosophy. More recently, Mefford (1991) explored positive linkages between construction P&Q, and conjectured that a strong positive relationship existed. Lema *et al.* (1994) considered conceptual linkages between benchmarking, TQM and construction productivity, and

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developed a series of models linking these concepts. Hence, theoretical research and modern concepts (such as TQM) suggest that there is a positive relationship between P&Q. However, whether this relationship is sufficiently robust to withstand the 'hostile' environment of a construction site is a contentious matter. This paper presents the views and opinions of practitioners (contractors' project managers) on these and related issues.

METHODOLOGY

Following a detailed literature review, factors known to impact construction P&Q were identified. A structured questionnaire survey of 100 UK contractors including the top 40 UK contractors (Bill 1997) and 60 others selected from the Kompass directory (1997) was administered. Project Managers were targeted and asked to consider a range of questions linked to construction P&Q.

Respondents

Thirty-eight completed respondent questionnaires were received. The response was dominated by medium-sized firms, defined as those with a turnover £50m to < £300m (52 %), and included equal proportions of smaller (< £50m) and larger (£300m or more) organizations (24 % each). Two companies had turnovers in excess of £700 million.

To gauge the experience of respondents, they were asked to indicate the number of years they had held managerial positions within the industry. Ninety five % of respondents had at least ten years experience, hence solicited views were regarded as those of experienced managers.

RESULTS

Survey questions were designed to reveal perceptions of the relationship between P&Q. The results of the survey.

The importance of key construction performance criteria

Perceived importance of key construction performance criteria (productivity, quality, cost and time) were measured on a five-point Likert scale ranging from *unimportant* to *very important*. Figure 1 presents these findings.

On the basis of *very important* responses, cost (79%), time (74%), quality (68%) and productivity (57%) were ranked in descending order. When responses for *very important* and *important* are summed, the ranking was somewhat different, with cost (100%), productivity (95%), time (92%) and quality (89%) ranked in descending order. Cost seemingly remains the number one priority for contractors, but generally the other performance criteria are of equal importance. Productivity is still very much an important issue for UK contractors. Despite recent efforts to alter traditional industry views, cost remains the principal concern and the basis on which most contracts are awarded (Egan 1998).

The relationship between P&Q

Opinion was sought (on a five point scale, ranging from *strongly agree* to *strongly disagree*) concerning the relationship between P&Q on construction projects. Five hypotheses concerning the nature of the relationship were explored:

1. An increase in productivity will cause an increase in quality.

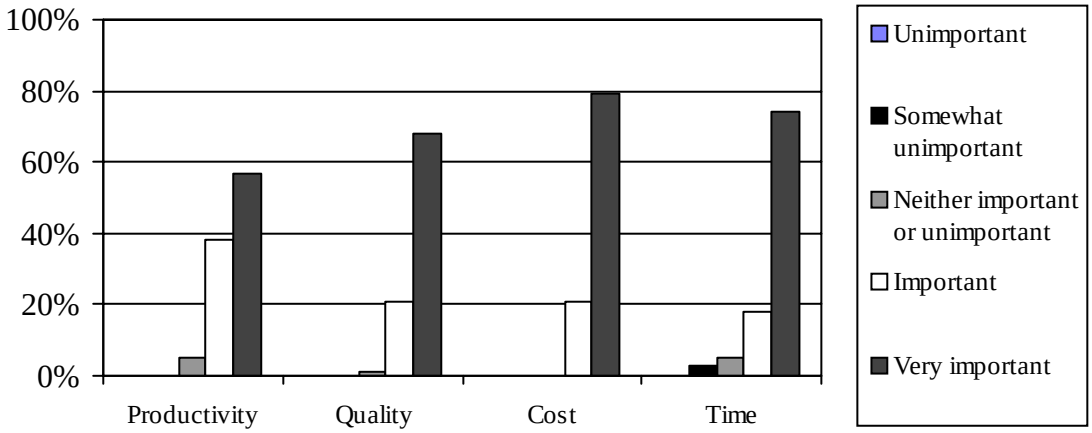

Figure 1: The importance of key performance criteria

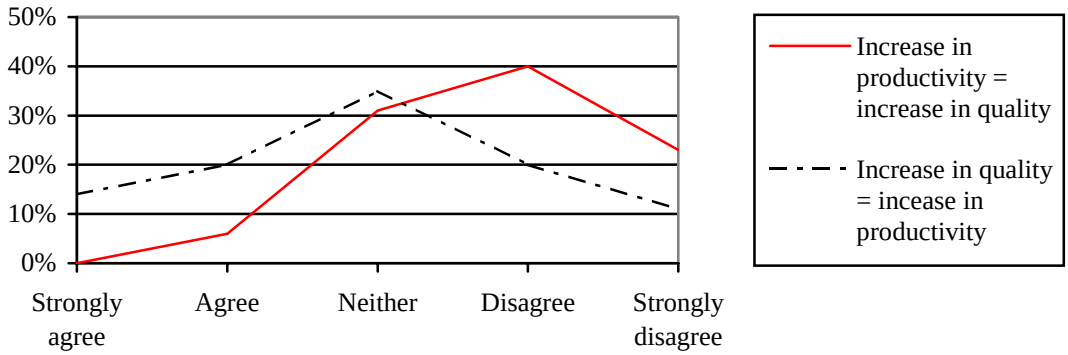

Figure 2: A positive relationship exists between P&Q

2. An increase in quality will cause an increase in productivity.
3. An increase in productivity will cause a reduction in quality.
4. An increase in quality will cause a reduction in productivity.
5. Productivity and quality are not related.

Hypotheses 1 to 4 inclusive, postulate a direct causal relationship, while hypothesis 5 concerns no relationship at all. Furthermore, hypotheses 1 and 2 are positive relationships, while hypotheses 3 and 4 are inverse relationships.

A positive relationship?

Response to the positive relationships are presented in Figure 2. Clearly project managers' views are mixed. Only a very small minority (6 %) are in agreement that an increase in productivity will cause an increase in quality. The majority do not consider there to be such a relationship (40 and 23 % disagree and strongly disagree respectively). With regard the converse hypothesis, views are almost equally divided with approximately one third agreeing, disagreeing or being uncertain.

An inverse relationship?

Figure 3 shows opinion of the response in respect of the hypotheses proposing inverse relationships. Forty % concur (i.e. 6 % *strongly agree* and 34 % *agree*) with the hypothesis that increases in productivity will cause a reduction in quality, compared to only 23 % who are in disagreement. Alternatively, the majority (40 %) do not support

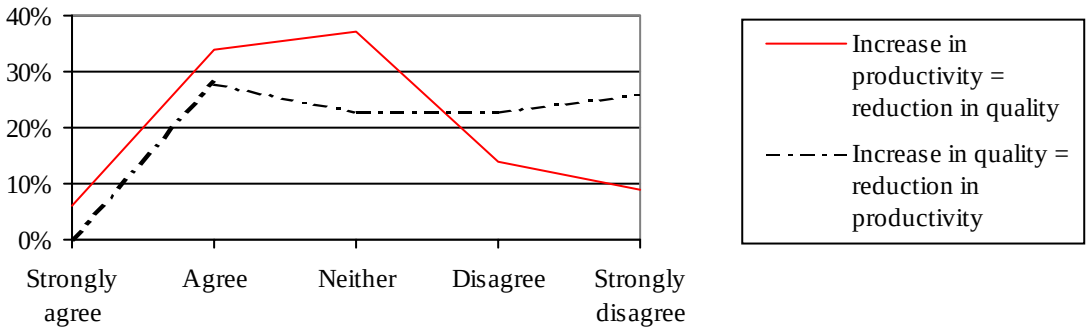

Figure 3: An inverse relationship exists between P&Q

Table 1: Factors impacting both P&Q

I.D.	Factor	I.D.	Factor
1	Planning	8	Location of site
2	Level / quality of on-site supervision	9	Procurement method
3	Motivation of staff / workforce	10	Rules and regulations
4	Education / training of staff / workforce	11	Cost and funding of the project
5	Constructability of design	12	Health and safety levels
6	Level of overtime working	13	Construction methods
7	Weather and climate conditions	14	Investment in research and development

the converse hypothesis. Nevertheless, a significant proportion of respondents (37 and 23 % respectively) are undecided.

These graphs show that opinions are to some extent divided, but the majority of respondents support the notion that an increase in productivity will reduce quality.

P&Q are not related?
A majority (19 % *disagree* and 43 % *strongly disagree*) contend this presumption, indicating that the sample consider there to be some kind of relationship between the two criteria.

The impact of factors on P&Q
Following a review of literature, fourteen factors known to impact both P&Q were identified. These are presented in Table 1.

Respondents indicated perceived impact of these factors on both P&Q. A three point scoring system, comprising high, medium and low levels of impact with respective scores of three, two and one respectively was used. For each factor a total score was obtained from the sum of the individual scores given. Therefore, the maximum score possible would be where all respondents considered there to be a high impact (i.e. 38 respondents multiplied by a score of 3 = 114). Total factor scores were used to rank the impact of factors.

Table 2: Impact of factors on productivity

I.D.	Factors	Impact (Number of respondents)				
		High (3 score)	**Medium (2 score)**	**Low (1 score)**	**Total factor score**	**Rank**
2	Supervision	37	1	0	113	1
1	Planning	36	2	0	112	2
4	Training	33	5	0	109	3
13	Methods	32	6	0	108	4
5	Constructability	32	4	2	106	5
3	Motivation	30	7	1	105	6
12	Health and safety	29	6	3	102	7
11	Funding	20	6	12	84	8
7	Weather	12	19	7	81	9
14	R & D	14	12	12	78	10
9	Procurement	11	14	13	74	11
6	Overtime working	9	13	16	69	12
10	Regulations	7	5	26	57	=13
8	Location of site	2	15	21	57	=13

Table 3: Impact of factors on quality

I.D.	Factors	Impact (Number of respondents)				
		High (3 score)	**Medium (2 score)**	**Low (1 score)**	**Total factor score**	**Rank**
2	Supervision	36	2	0	112	1
1	Planning	33	4	1	108	=2
4	Training	32	6	0	108	=2
3	Motivation	28	10	0	104	4
5	Constructability	28	8	2	102	5
13	Methods	27	7	4	99	6
11	Funding	22	10	6	92	7
12	Health and safety	20	8	10	86	8
14	R & D	15	8	15	76	9
7	Weather	9	16	13	72	10
9	Procurement	9	10	19	66	11
6	Overtime working	2	12	24	54	12
8	Location of site	2	10	26	52	=13
10	Regulations	4	6	28	52	=13

Table 2 demonstrates that *supervision*, *planning*, *training* and then *construction methods* have the most impact on productivity. All these factors fall under the control of contractors, thereby demonstrating their influence on productivity. The four highest ranking factors having impact on quality were: *supervision*; *planning; training* (ranked equal second); and *motivation* (refer Table 3). Again, these factors are all the responsibility of contractors demonstrating the key role they play regarding this performance criterion.

A comparison of the total factor scores and ranks presented in Tables 2 and 3, reveals a degree of correlation, confirmed by a Spearman's coefficient of rank correlation of 0.97. Evidence suggests that in the opinions of Project Managers, the same factors impact P&Q.

The impact of project coalition members

Respondents considered the impact of project coalition members on P&Q by using the same scoring system as described previously (i.e. scores of three, two and one

Table 4: Impact of coalition members on productivity

Coalition member	Impact (No of respondents)				
	High (3 score)	**Medium (2 score)**	**Low (1 score)**	**Total factor score**	**Rank**
Contractor	38	0	0	114	1
Project manager	27	9	2	101	2
Engineer	20	13	5	91	3
Architect	21	10	7	90	4
Client	16	13	9	83	5
Quantity surveyor	8	9	21	53	6

Table 5: Impact of coalition members on quality

Coalition member	Impact (No of respondents)				
	High (3 score)	**Medium (2 score)**	**Low (1 score)**	**Total factor score**	**Rank**
Contractor	37	1	0	113	1
Project manager	28	7	3	101	2
Architect	25	12	1	100	3
Client	26	6	6	96	4
Engineer	16	18	4	88	5
Quantity surveyor	5	8	25	56	6

represent high, medium and low levels of impact respectively). Tables 4 and 5 present these scores and rankings.

For both P&Q, contractors are clearly considered to have most impact, followed by Project managers. This may in part be due to the bias in response because project managers will obviously consider their role, i.e. impact, to be important. However, this also reasonably conforms to the findings of the preceding section, i.e. in that contractors controlled the factors found to have most impact on P&Q. Evidently, in the opinions of project managers, (structural and consulting) engineers have more impact on productivity (ranked third) than on quality (ranked fifth). Also architects have greater impact on quality than on productivity and it seems the poor old quantity surveyor carries least weight here!

The impact of modern controlling techniques and processes

A section of the questionnaire concerned modern controlling techniques and practices known to impact productivity and / or quality. Six such techniques were identified from the literature: Just-In-Time (JIT); Total Quality Management (TQM); Quality Assurance (QA); Work study; Partnering; and Benchmarking. Respondents were first asked to indicate whether their company practised such techniques (Figure 4).

Of the contractors surveyed, almost fifty % employed each technique. The vast majority (92 and 82 %) practised QA and Partnering methods respectively. Benchmarking was practised by two thirds (68 %), while approximately half were currently practising JIT, TQM and Work study techniques.

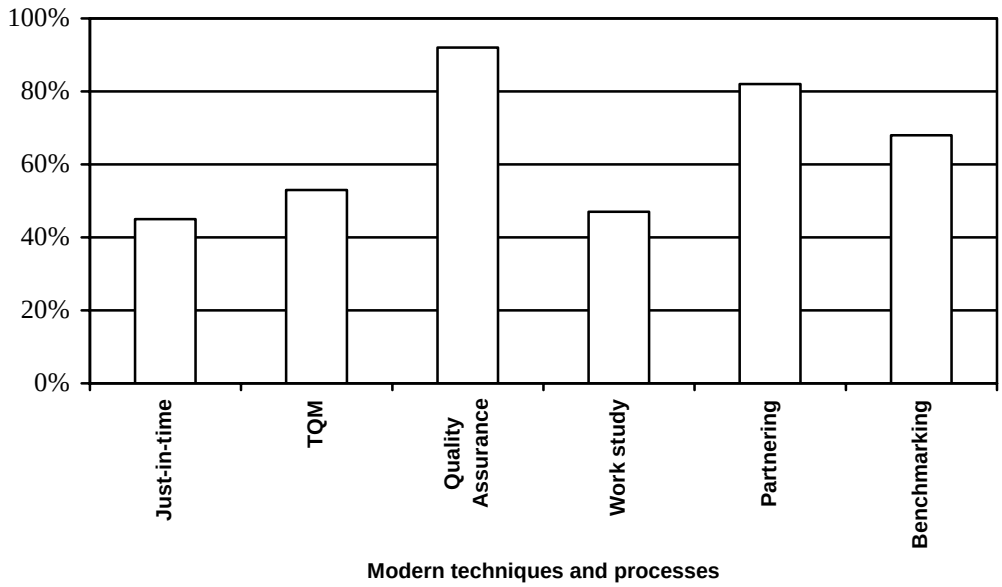

Figure 4: Modern controlling techniques and processes currently in use

Table 6: Impact of modern techniques and processes on productivity

Technique	Impact (No of respondents)				
	High (3 score)	**Medium (2 score)**	**Low (1 score)**	**Total factor score**	**Rank**
Partnering	20	12	6	90	1
Work study	14	12	12	88	2
Benchmarking	17	14	7	86	3
Quality assurance	17	13	8	85	4
Total quality management	18	10	10	84	5
Just-in-time	9	12	17	68	6

Table 7: Impact of modern techniques and processes on quality

Technique	Impact (No of respondents)				
	High (3 score)	**Medium (2 score)**	**Low (1 score)**	**Total factor score**	**Rank**
Partnering	21	13	4	93	1
Quality assurance	22	10	6	92	2
Total quality management	22	9	7	91	3
Benchmarking	13	19	6	83	4
Work study	10	14	14	72	5
Just-in-time	9	9	20	65	6

The impact of these techniques on P&Q were elicited using the same scoring system. Results are provided in Tables 6 and 7, respectively and display some unexpected findings.

With respect to productivity, work study and benchmarking practices are ranked quite high in second and third place, respectively. This is not surprising since one of the main purposes of these practices is to promote productivity improvement. Partnering is ranked as having most impact on productivity. All but JIT acquire fairly high scores (i.e. exceeding eighty).

The results for quality share some similarity with the above. Here, Partnering and JIT are again ranked first and sixth respectively. However, the practices ranked second to fifth are different, with QA, TQM and Benchmarking in order of impact. According to Project Managers, Partnering has significant impact on both P&Q.

CONCLUSIONS

Project Managers currently consider cost and productivity to be the most important performance criteria, followed by time and then quality. Cost is ranked the number one priority, which is of no surprise since it is on this basis that most contracts are still awarded. Productivity will impact construction cost (and time) hence it is understandably rated second. Notwithstanding this, time and quality are also considered with a degree of importance.

In regard to the relationship between P&Q, Project Managers opine contradicts with modern management concepts and previous research. Indeed, a majority considers there to be an inverse relationship, that is if productivity improves, quality will deteriorate. One can empathize with this point of view. For example, if the speed of work increases then one might expect a lower standard of workmanship. Clearly, the relationship between P&Q remains a contentious and subjective issue as demonstrated by the mixed response elicited.

Factors considered to significantly impact productivity were also considered to impact quality. This was demonstrated in Tables 2 and 3, where the top three factors for both criteria (level / quality of on-site supervision; planning; and education / training of staff / workforce) were the same. However, what is unclear from these findings is whether the extent / nature of impact of such factors is the same. For example, a high level of supervision may have a positive effect on the quality of workmanship, but have a negative impact on productivity (refer to Thomas *et al.* 1990; Horner and Talhouni 1990). Such simultaneous negative and positive effect supports the hypothesis that the relationship shared by the criteria is an inverse one. Nevertheless, there are a number of factors that could reasonably be considered to have either a positive (e.g. effective planning) or negative (e.g. inclement weather) impact on both P&Q. It is difficult to draw conclusions from these factors alone without conducting a more detailed investigation.

Impact of the project coalition members on P&Q is considered much the same, with contractors and project management organizations, regarded as having the greatest leverage. This suggests that in the opinion of project managers, contractors have a greater influence and control over these performance criteria, and hence any processes aimed at bringing about improvement in them would best be implemented via such organizations.

At least half the respondents were practising modern techniques and processes aimed at improving productivity and / or quality, with over 80 % employing QA and Partnering methods. Most contractors have now adopted one or more of the practices in the strive for performance improvement. Recent research confirms that Partnering procedures are now common within UK contractor organizations (Holt and Fraser 1999).

Surprisingly, Partnering is regarded as having more impact on P&Q than other techniques specifically designed to achieve such impact, e.g. work study and QA techniques respectively. Indeed, according to the views of project managers (a majority of which having experience of the process) of the practices considered,

Partnering is considered to have the highest impact of any of the practices on both P&Q. This raises the question of whether Partnering has a positive, negative or inverse impact on such performance criteria. If the earlier findings are considered, then the impact is more likely to be inverse, i.e. causing an increase in productivity but a reduction in quality.

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