

CONSTRUCTION PROCUREMENT SYSTEMS: A LINKAGE WITH PROJECT ORGANIZATIONAL MODELS

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This paper constitutes a literature review undertaken at the start of a two and a half year EPSRC funded research project. As such, its purpose is to present the details of the 're-search' concerning construction procurement and project organizational design. The paper shows that the 'post-Latham' construction industry provides several new developments (client power, partnering, concurrent engineering etc) which are altering the construction project process, and therefore prove worthy vehicles for investigation into project organizational structures.

Keywords: Communication, decision making, organizational structures, procurement systems.

INTRODUCTION

It is recognised that in the more traditional approaches to building procurement the organizational structures which have evolved carry with them an assumed understanding of roles, responsibilities and patterns of communication. As the industry evolves more varied approaches to procurement, the clarity of roles, responsibilities and communication within these developing approaches does not benefit from the reservoir of experience which exists in the traditional methods of procurement. It is clear that a major feature of any procurement process which requires careful and precise definition is the selection of the most appropriate organizational for the underpinning of the design and construction process (Turner (1990), Masterman (1992)).

PROCUREMENT SYSTEMS

Masterman (1992) referred to previous work describing 'the amalgam of activities undertaken by a client to obtain a building' as a 'building procurement system'. Masterman recommends that this term should be adopted within the construction industry to describe:

'The organizational structure adopted by the client for the management of the design and construction or a building project'.

The format of this section will be to review the building procurement systems within the categories defined by Masterman, they are:

- Separated and co-operative systems (traditional method and variants)
- Integrated systems (Design and Build and variants)

- Management orientated systems (Management Contracting, Construction Management, Design and Manage).

The concept of concurrent engineering with its implication for the project team will also be discussed.

SEPARATED AND CO-OPERATIVE PROCUREMENT SYSTEMS

Masterman (1992) refers to the difficulty in obtaining accurate comparative historical data on the level of use of different procurement systems. This type of information is now widely available from market research companies such as Glenigan and Market and Business Development albeit at a considerable cost. The problems which develop during the construction phase and which are attributed to the traditional method of procurement are examined by several writers.

Sharif and Morledge (1997) examining the procurement process in relation to small and occasional clients identify the concept of 'procurement catch'. 'Procurement catch' theory suggests that the architect consulted by the client will persuade him/her to use this method because the greater amount of design work will result in a higher fee for the architects consultancy.

Conlin *et al* (1996) examines the relationship between construction procurement strategies and construction contract disputes. In examining twenty one completed projects, covering five common procurement options they found that conflicts relating to payment and budgets, delay and time, negligence and performance are more prevalent on traditional projects.

Nahapiet and Nahapiet (1985) examine construction contracts from an organizational perspective with reference to ten building projects in the USA and UK. They emphasize the linkage between contractual arrangements - (Lump sum and Negotiated) Traditional method (construction management, management contract, Design and Build) and the inter-organizational relationships which result from them. They observe that:

'Although often regarded as being primarily concerned with defining the role of the building contractor, in practice contractual arrangements have a direct and significant implication for all the parties involved in construction project delivery. Moreover contracts are regarded as representing different organizational arrangements for defining and coordinating the contribution of the several bodies involved in building project delivery.'

INTEGRATED PROCUREMENT SYSTEMS

A report published by the Centre for Strategic Studies in Construction (1996) focuses its attention on the Design and Build (D&B) procurement route.

'[D&B] build currently exceeds the performance of traditional procurement approaches in terms of construction speed (by 12%) project delivery speed (by 30%) and cost (by 13%). Moreover projects procured using [D&B] are 50% more certain to be completed on time and more likely to be completed on budget or within 5% of budget. The best performance, where clients quality expectations were met on 72% of all projects, was found where contractors in-house designers are employed to undertake design from the earlier stage. Clear benefits to the client arise

from close communication between designers and construction personnel, where practical knowledge about construction issues can have the greatest influence. Performance dropped when the contractor employed external consultants to finalize design. The extent to which D&B procurement methods allow for increased management synergy of a construction project compared with traditional procurement has been examined by Dulaimi and Dalziel (1994). Their study revealed that D&B is seen to be providing the missing integration of the design and execution of the construction project. The results also suggested that there was an increased level of synergy in the D&B environment for procurement. Communication was seen to be more informal and greater satisfaction was reported.

MANAGEMENT ORIENTATED PROCUREMENT SYSTEMS

Research conducted by Mohsini *et al* (1995) has indicated that the level of sophistication of the various participants (particularly work package contractors) can have implications for coordinating mechanisms.

‘Coordination of tasks in the construction management process especially by using sophisticated computerized scheduling and progress accounting systems that are often beyond the comprehension of many subcontractors is often seen as dysfunctional.’

Mohsini *et al* notes that the negative impact of coordination on project performance in the building industry in general may partially be attributed to a particular deficiency of any temporary multi-organization namely that it lacks an effective mechanism for project to project feedback.

CONCURRENT ENGINEERING (CE)

The process of benchmarking the construction process with that of other industrial sectors has introduced the philosophy of Concurrent Engineering (CE) within the industry. Love *et al* (1997) refer to a ‘holistic approach to the design, development and production of a product’. Jaafari (1997) talks of Concurrent Construction (CC) a new term derived from (CE) and Anumba and Eubomwan (1997) propose a (CE) process model for [D&B] based on the assumption that construction can be modeled as a manufacturing process. Clearly, the development of the (CE) philosophy within the construction process is likely to alter the design and culture within project teams. It will be of interest therefore, to assess whether any (CE) practices are present in the case study projects to be investigated in this research project.

TEMPORARY PROJECT ORGANIZATIONS

The work of Cherns and Bryant (1984) in identifying temporary multi-organizational dynamics has been widely recognized by academic authors. Anumba *et al* (1996), Luck and Newcombe (1996) and Shirazi *et al* (1996), have all discussed various aspects of project teams. Cherns and Bryant proposed twenty hypotheses which they acknowledged were subject to modification and qualification due to further evidence, recognizing that very little research had been conducted in this area. ‘But with the appointment of consultants, contractors and subcontractors we are in the less well-chartered waters of multi-organizational dynamics’.

Shirazi *et al* re-emphasizes this contention over a decade later, suggesting that variables surrounding temporary project organizations remain uncharted waters.

'An additional issue which is rarely addressed in the organizational literature is the temporary nature of the construction team and the fact that the team is generally made up from team members who work for different organizations'.

Several current developments within the construction industry can be examined with reference to Cherns and Bryant. Anecdotal evidence, supported, by in large, the views of the Construction Clients Forum (CCF) and the Construction Round Table (CRT)

suggests that clients are taking a proactive approach to the design of project organizations (Cherns & Bryant, Point 10) . Moreover clients with a regular spend are also looking for contractors who understand their business and operating environment (e.g. Cherns & Bryant Point 15).

TEAM BUILDING INTEGRATION AND COORDINATION OF THE PROJECT PARTICIPANTS

Team work involves the effective co-operation of a group of people in activities that are directed towards a common goal. The whole point about teamwork is that the performance of the group as a whole is better than would be the normal sum of the performance of the individual comprising the group (Gabriel, 1991). Gabriel's paper 'Teamwork - Fact and Fiction' identifies the benefits derived from synergy, and suggests that there is a limited time for which the synergy of a team can be maintained.

Tampoe (1989) believes that project success can be obtained by the concept of the empowered team member whereby the team takes responsibility and accountability for meeting the project goals. This view tends to emphasize the need for less control by the project manager but requires three prerequisites for success.

Ahmad *et al* (1997) develop a contingency model involving an iterative approach of designing project teams to minimize the negative effects of Total Quality Management (TQM). Ahmad links aspects team design, project characteristics and project success factors (TQM) and provides a useful example of viewing organizational design process. The role of the parent organization client is also examined and Ahmad *et al* suggest that the factors of the project team are likely to mirror its parent organization.

PARTNERING ARRANGEMENTS AND PROJECT STAKEHOLDERS

The degree to which partnering may alter the decision making process regarding organizational design is observed by Barlow (1996).

'In some instances there had been an explicit attempt to reform a company's organizational structure to produce cross-functional teams (e.g. Simons Construction, contractors to NatWest Bank and Safeway)'.

Barlow *et al* (1998) conclude their ESRC funded research by discussing benefits of organizational learning that can be derived from partnering arrangements, specifically:

'This study shows that the currently the main driving force in typical construction industry partnering relationship is efficiency improvement, but clients and suppliers are beginning to recognize the role partnering can

play in promoting innovation and learning at an individual team and organizational level’.

Benham (1997) has also shown that partnering relationships between clients and contractors tends to alter the project organizational structure. Her study revealed that Balfour Beatty intends to test out new organizational designs in future projects.

‘A new organization design... [transforming the structure] into a matrix. This matrix organization will focus on an operational rather than on a hierarchical link and will structure the subcontractors coordination at a business unit level where decisions will be implemented quickly and the subcontractors kept informed of any developments’.

REDESIGN OF PROJECT ORGANIZATIONS

Two recent research projects, are examined here in the belief that the proposals presented by the Tavistock Institute (1997) and Cox and Townsend (1997) will require the parties involved in construction projects to participate in a ‘paradigm shift’. That is, the proposals move the current discussion requiring the design of organizational structures for construction projects into a new ‘arena’ where the current perceptions regard the design variables may require adjustment.

The Tavistock Institute are currently engaged in research which involves coordinating the redesign of inter-organizational arrangements in two demonstration building projects. The redesign involves the concept of ‘work clusters’. In each work cluster the designers, subcontractors and key suppliers are involved in a reasonably self-contained element of the building undertake a form of simultaneous engineering. Typical clusters include groundwork, frame and envelope; the swimming pools, mechanical and electrical services and internal finishes.

Research conducted by Cox and Townsend (1997) and sponsored by British Airport Authority (BAA) would also appear to provide researchers examining the organizational design of construction projects further data worthy of investigation. Their research differentiates between clients who have a regular requirement for construction work of a similar value and content (process spend) and clients with an infrequent purchase (commodity spend). They propose that ‘collaborative’ and ‘teamwork’ approaches as suggested by Sir Michael Latham are only possible when there is a long term relationship based on regular spending (i.e. process spend).

ENVIRONMENTAL INFLUENCES AND ORGANIZATIONAL DESIGN OF PROJECTS

Sidwell (1990) explores the nature of project management in complex dynamic environments. He examines research undertaken in the 1970s and notes that an organizations environment can range from stable to dynamic and that the higher the variability and uncertainty of that environment then the more the organization needs to be organic and adaptive. Indeed Sidwell recognizes that construction project are usually dynamic, complex, diverse and hostile and that this may occur across all components of the environment and may do so simultaneously.

Further studies have examined organization structures on construction projects include Hughes (1989) who developed his model based on the work of Walker (1980). Indeed Hughes observes that the strength of Walkers approach lies in its diverse origins based on many other authors. In combining the lessons learned from Walker’s study of

private sector projects Hughes proposes a nine step guide which he suggests can be used as a tool to set up project organizations. Although the guide seems overly prescriptive, it is likely that many of the roles, responsibilities and relationships (3R) which Hughes suggests should be defined are documented in projects today via safety (CDM Regulations) and quality (ISO9000) project manuals. However, research undertaken by McLellan (1994) indicates that all too often 'very little attention is paid to the setting up of an organizational structure in the management of construction projects'.

COMMUNICATIONS AND DECISION MAKING DURING THE CONSTRUCTION PHASE

Research conducted in the USA by Thomas *et al* (1997) has produced a diagnostic tool intended for measuring the effectiveness of project team communication. Their research produced evidence which showed a positive correlation between communication effectiveness and project success. The Communication Project Assessment Tool (COMPASS) is designed to measure six 'critical communication variables' (accuracy, timeliness, completeness, understanding, barriers and procedures) and will be used in this research project in conjunction with a communication model developed by Loosemore (1996). This will involve issuing diaries to project staff as a means of establishing a communication network analysis, with the results expected to show different patterns across the various procurement routes.

The need for such an investigation into communication and decision making has previously been identified by Langford *et al* (1987) in proposing two hypothesis which they suggest would 'spearhead research into the fundamentals of the building process'.

ORGANIZATIONAL DESIGN AND PROJECT SUCCESS FACTORS

The role of project management in contributing to project success is examined by Morris (1989) who keeps outlines explaining the factors necessary for the success of major projects. Although the study conducted by Morris focuses on 'mega projects'; (i.e. Channel Tunnel and NASA Space Station) his conclusion has relevance for construction projects of any size. These are, the need to 'manage' external forces acting on a project (see Hughes 1989), and the absolute importance of positive definition (workable in technical, financial and schedule senses) within an appropriate organization which has adequate support.

It is pertinent to refer to the research undertaken by Bresnen (1990) who comments on the applicability of constructs and models derived from the investigation of complex project systems. He observes that the majority of research conducted into matrix management does not take account of factors particular to construction projects - the greater relevance of inter-organizational relationships. He concludes his book by making a general point:

'By effectively treating the construction industry as a special case, important insights into contemporary organizations may well be lost. Whether the case of construction does indeed prove to be an exception to the rules after further consideration, or whether it in fact contributes towards further understanding of those rules still remains to be seen'.

A recent study undertaken by Liu and Walker (1998) casts doubts on previous studies regarding the evaluation of project outcomes. They pose questions which they proceed to answer throughout their paper, those being:- What constitutes satisfaction? Who are the claimants on the project whose feelings on satisfaction are important? What is the relationship between success and satisfaction? Should these issues inform our judgement of the outcome of construction projects?

Liu and Walker address the problems of evaluating the effectiveness of construction project organizations and suggest that these problems result from both temporary multi-organization and the shifting multi-goal coalition characteristics. They conclude their paper by observing that due to the variability and individuality of goal identification, definition measurement and evaluation the project critical success factors (CFS's) are likely to be highly individual and project specific and therefore a search for generally applicable CFS's may be misplaced.

CONCLUSIONS BASED ON LITERATURE REVIEW

It would appear that significant changes in the way in which the construction industry operates are taking place. The impetus for these changes (client power; partnering, CE, use of IT etc.) may be attributed to the Latham report or indeed may be a result of economic pressure bearing on the industry. It is clear however, that the combination of these 'change variables/concepts' is playing a major role in redefining the way in which the organizations participating in a project work together. It is therefore appropriate to investigate the design of project organizational structures whilst taking these changes into account. It seems unwise to ignore the idea of CE for example, as this brings contractors subcontractors and suppliers together at design stage, with the client and design team, and must surely result in different patterns of coordination, integration and communication than a project procured under traditional type arrangements.

The use of the 'work clusters' technique and project or strategic partnering arrangements offer alternative organizational arrangements which again would be expected to show different patterns of coordination integration and communication to those projects arranged traditionally. These changes, together with the influence that the top UK clients have over the construction process is therefore, it is suggested leading to a 'paradigm shift' whereby the academic researcher can examine project organizational structures in a 'new light'.

REFERENCES

- Ahmad, I.U. and Sem, M.K. (1997) Construction project teams for TQM: a factor element impact mode. *Construction Management and Economics*, **15**, 457-467.
- Anumba, C.J. and Evbuomwan, N.F.O. (1997) Concurrent Engineering in design-build projects, *Construction Management and Economics*, **15**, 271-281.
- Anumba, C.J., Kamara, J.M. and Evbuomwan, N.F.O. (1996) Encapsulating the Voice of the Consumer in Construction Projects, *Procs 12th Annual ARCOM Conference*, Sept 11-13, Sheffield, UK, 170-179.
- Barlow, J. (1996) Partnering, Lean Production and the High Performance Workplace. *4th Annual Conference of the International Group for Lean Construction*, Birmingham, UK, Aug 1996.

- Barlow, J., Jashapara, A. and Cohen, M. (1998) Organizational Learning and Inter-firm partnering in the UK Construction Industry. *The Learning Organization Journal*, **2**(5).
- Benhaim, M., (1997) Inter-firm Relationships in the Construction Industry: Towards the Emergence of Networks, PhD Thesis, Henley Management College, 1997.
- Bresnen, M. (1990) *Organizing Construction: Project Organization and Matrix Management*, Routledg.
- Centre For Strategic Studies in Construction (1996) Designing and Building a World Class Industry, Report from University of Reading.
- Cherns, A.B. and Bryant, D.T. (1984) Studying the Client's Role in Construction Management, *Construction Management and Economics*, **2**, 177-184.
- Conlin, J.T., Langford, D.A. and Kennedy, P. (1996) The Relationship Between Construction Procurement Strategies and Construction Contract Disputes, CIB W92 Procurement Systems Symposium, Durban, SA, January, 66-82.
- Cox, A. and Townsend, M. (1997) Latham as a half-way house: a relational competence approach to better practice in construction procurement", *Engineering Construction and Architectural Management*, **4**(2), 143-158.
- Dulami, M.F. and Dalziel, R.C. (1994) The Effects of the Procurement Method on the Level of Management Synergy in Construction Projects, CIB W92 Procurement Systems Symposium, Hong Kong, Dec, 53-60.
- Gabriel, E., (1991) Teamwork - fact and fiction, *International Journal of Project Management*, **9**(4), 195-198.
- Hughes, W.P. (1989) *Organizational analysis of building projects*, PhD Thesis, Liverpool John Moores University.
- Jaafari, A. (1997) Concurrent Construction and the Lifecycle Project Management, *Journal of Construction Engineering and Management*, Dec. 427-435.
- Langford, D.A., Newcombe, R. and Fellows, R.F. (1987) A perspective model for decision making and information flow in the building process. *Managing Construction Worldwide* **2** Productivity and Human Factors. Lansley, P.R. and Harlow P.A. (Editors), Spon.
- Liu, A.M.M. and Walker, A. (1998) Evaluation of project outcomes. *Construction Management and Economics*, **16**, 209-219.
- Loosemore, M., (1996) *Crisis Management in building Projects – A longitudinal investigation of communication and behaviour patterns within a grounded theory framework*, PhD thesis, University of Reading, 1996.
- Love, P.E.D., Skitmore, M. and Li, H. (1997) Towards an Innovative Procurement Process for Construction, CIB W92 Procurement Symposium, Montréal, Canada, May, 423-432.
- Luck, R.A.C. and Newcombe, R. (1996) The Case for Integration of Project Participant Activities within a Construction Project Environment, In: Langford, D.A. and Retik, A. (Ed), *The Organization and Management of Construction: Shaping Theory and Practice*, **2**, London; Spon.
- Masterman, J.W.E. (1992) *An Introduction to Building Procurement Systems*. Spon.
- McLellan, R. (1994) The Use of Project Management Procedures by Construction Contractors, PhD Thesis, University of Strathclyde.

- Mohsini, R.A., Sirpal, R. and Davidson, C.H. (1995) Procurement: A Comparative Analysis of Construction Management and Traditional Building Processes, *Building Research and Information*, **23**(5), 285-290.
- Morris, P.W.G. (1989) Initiating major project: the unperceived role of project management. *Project Management* **7**(3), 180-185.
- Nahapiet, H. and Nahapiet, J. (1985) A Comparison of Contractual Arrangements for Building Projects, *Construction Management and Economics*, **3**, 217-231.
- Sharif, A. and Morledge, R. (1997) The Insensitivity of the Procurement Processes in the UK Construction Industry to the Problems of Occasional Buyers from the Industry, *CIB W92 Procurement Symposium*, Montréal, Canada, May, 693-702.
- Shirazi, B., Langford, D.A. and Rowlinson, S.M. (1996) Organizational structures in the construction industry, *Construction Management and Economics*, **14**, 199-212.
- Sidwell, A.C. (1990) Project Management: Dynamics and Performance. *Construction Management and Economics*, **8**, 159-178.
- Tampoe, M. (1989) Project Managers do not deliver project, teams do project. *Project Management Journal*, **7**(1), 12-17.
- Tavistock Institute, (1996-7) *The Lost World, Virtual Organizations in the UK Construction Industry*, Discussion Paper from Review 44-50.
- Thomas, S.R., Trucker, R.L. and Kelly, W.R. (1998) Critical communications variables, *Journal of Construction Engineering and Management*, Jan/Feb, 58-65.
- Turner, A. (1990) *Building Procurement*, Macmillan.
- Walker, A. (1980) A Model of the Design of Project Management Structures for Building Clients, PhD Thesis, Liverpool John Moores University.