A FUNCTIONAL APPROACH TO MODELLING PROCUREMENT SYSTEMS INTERNATIONALLY AND THE IDENTIFICATION OF NECESSARY SUPPORT FRAMEWORKS

Asif Sharif, Department of Surveying, The Nottingham Trent University

Roy Morledge, Department of Surveying, The Nottingham Trent University

KEYWORDS

Procurement Systems, International, Functions, Indigenous, Support Frameworks

Summary

This paper examines the development of a Functional Model which will provide a unique framework to enable the objective identification, comparison and appraisal of procurement systems globally. The paper illustrates how the use of existing classification criteria for building procurement systems (CIB 1991) is uninformative in the context of an international investigation, since account is not taken of the differences which exist in terms of language, meaning, and culture.

It is contended that building procurement systems are composed of five generic functions which include; i) Initiate/ Promote, ii) Fund, iii) Design, iv) Construct, and v) Risk allocation. The nature and the arrangement of each of the various functions and processes adopted will enable the modelling of procurement systems in any given country.

The paper explains how the Procurement Systems Model (PSM) relates the generic functional roles with the processes, risks, and formal relationships in the construction industry, in a country.

Finally, the paper investigates the necessary indigenous competencies and the particular indigenous organisational support frameworks required for the operation of a specific procurement system to operate.

This research paper forms part of a wider portfolio of building procurement research being conducted by the International Procurement Research Group (IPRG); which comprises of a collaborative agreement between the University of Glamorgan, Liverpool John Moores University and the Nottingham Trent University.

Introduction

Current research into international building procurement systems at The Nottingham Trent University is indicating that it is possible to model procurement systems by the pattern of the generic functions involved. The ability to model procurement systems by the functional approach will facilitate the identification and comparison of procurement systems internationally.

In the international arena many procurement systems have been inconsistently identified and described, perhaps due to their titles being misleading or uncertain. This research project attempts to redress this problem, providing a functional model of the dominant procurement systems in a country and the specific indigenous organisational support frameworks which must be in place for the operation of a particular procurement system.

It is anticipated that the outcome of this research will allow advice to be provided to the construction industries of the developing world on the most appropriate procurement systems for their construction industries, in the context of their social, political, legal and economic climates.

Context

For the purpose of this investigation, Building Procurement has been defined as;

> **".....the framework within which construction is brought about, acquired, or obtained"** CIB (1991).

The works of Masterman (1992) and Morledge (1991) amongst others, have highlighted that the selection of procurement systems in the UK, can be haphazard, ill-timed and lacking in logic and discipline. The construction industries of the Western world are increasingly concerned with the selection of appropriate procurement strategies for construction projects, bringing the building team closer to fulfilling the clients needs in terms of the main criteria, of Cost, Time, Quality and in terms of a equitable distribution of risk.

During the last 40 years in the UK there has been the development of various 'alternative' procurement systems, in an endeavour to suit the changing face of the construction industry, the changing needs and expectations of its clients, and the specific needs of projects, which are becoming increasingly complex.

The choice of the correct procurement system for a particular project is of paramount importance, to achieve success for the client in terms of Cost, Time and Design/Quality. The correct procurement choice should reflect the needs of the client and the specific characteristics of the project. As Masterman (1992) states;

> **"There is no standard solution or 'best buy' amongst procurement systems .....no single method of procurement can be suitable for every project for all of the time".**

The importance of the implementation of the most appropriate procurement system to suit a clients requirements has been illustrated by Nahapiet and Nahapiet (1985) who suggest that procurement system selection is important as it establishes the overall organisational frameworks within which project delivery takes place. The authors go on to suggest that different procurement systems offer different costs and benefits to the client.

Criticism has been levied at the array of procurement systems available to UK clients due to their failure to meet clients generic satisfaction criteria of Cost, Time and Design/Quality.

The range of available procurement systems has developed in an endeavour to elicit the most suitable procurement system for projects. This proliferation has been accelerated by the increased complexity of building designs, increased demands of clients, the magnitude of projects and escalating costs. This is however not merely a problem being faced in the UK, but an international phenomenon.

The report produced by Sir Michael Latham (1994) concerning the problems facing the UK construction industry, has highlighted the importance of procurement systems with particular attention to the choice of system. The report suggests that selection of a system should be determined by the nature of the project, the clients requirements and the clients decision on how much risk to take.

Procurement Classification

Current literature including the works of Masterman (1992) and Morledge (1991) have confirmed that the use of any existing procurement system classification criteria is unsuitable in the context of an international investigation. Essentially this is because they have been formulated and evolved using Anglo-American terminology and interpretations.

Most conventional classifications of procurement systems such as the 'Lump Sum/Traditional' method have originated from the UK, whilst, other approaches to procurement including 'Construction Management' and 'Management Contracting' have been cultivated in the USA and the UK.

The general deficiencies of the existing classification approaches is that they do not take account of the differences which exist in terms of language, meaning, culture and context. As they have been developed predominantly in the UK or USA, they have been constructed using Anglo-American meanings, and in association with the legal, political, and socio-economic conditions which prevail in these countries. Thus, for example, descriptors of roles are misleading and there is no common language or structure in terms of the roles performed or titles held by

individuals. In the context of the international construction arena, it is essential that there is no misunderstanding in the nature, characteristics and theoretical foundation to a particular procurement system. This has led to the development of a model which will provide a framework to enable the identification, comparison and appraisal of procurement systems in a particular country.
Research on the French procurement systems, (Meikle & Jeffery (1989) and RICS (1993))have highlighted the importance of cultural differences in the construction industry of France and the UK. The French government's economic and social policy towards building has major ramifications on the operation of her construction industry. The DATAR, the French regional development agency, provides substantial public funds to assist industrial development throughout France, particularly in the south and west of the country. Additionally the Chambers of Commerce are major participants in the promotion and implementation of development, and can subsidise building work or provide low cost finance.

A study of the American construction Industry has indicated that both the nature of the culture of the American people has major influences on the operation of the nations construction industry (Bennett (1991)).

Investigations into the Japanese construction industry have also indicated that the culture of the country heavily influences the business practices of the industry (Bennett, Flanagan & Norman (1987)). Levy (1990) in his study has also concluded that there are several basic differences between Eastern and Western culture, and these have influences Japans approach to construction.

Literature on building procurement produced by Franks (1990) and Masterman has emphasised that problems are often encountered when considering the meaning of procurement. They advocate that a 'systems' approach should be taken towards procurement. In an attempt to reduce this problem Masterman (1992) has devised the following categories for procurement systems;

- Separated and co-operative procurement systems. (responsibility for design and construction are separated)
- Integrated procurement systems. (design and construction become the responsibility of one organisation)
- Management-orientated procurement systems. (emphasis is placed on overall design and construction , usually involving an independent manager)

The Functional Approach

A functional approach to building contracts was discussed by Mathurin (1990) and Greenhalgh (1990), who both considered the concept of the 'functions' implicit in building contracts. These studies were based on the definition and classification of the main functions and the responsibilities of those involved in the act of construction. Both authors concluded that a single generic form of contract may be possible, based on project functions and responsibilities. This functional approach has been translated for use in the context of procurement rather than just contract.

It became evident that to facilitate an international investigation of procurement systems, it was necessary to devise an objective model which would identify what procurement systems exist internationally, taking into account cultural, language and meaning variations.

The functional approach to the identification of procurement systems has been established by isolating and separating all of the key operations in the procurement process into the generic functions involved in those operations. Five generic functions have been identified and are be discussed below.

During the development of the functional model of procurement systems the first obstacle to overcome was one of universally understood terminology. This was achieved by breaking down the primary functional roles and activities of the industry into their generic functions referred to above. An example includes the term 'Architect' which may not be a universally recognised term, but the role of design is understood internationally. The generic function is therefore, design, so the expression 'Designer' is used. By carrying out this process for all of the members and activities in the construction process, the key functions of procurement have been devised.

It is thus contested that building procurement systems are composed of five generic functions (processes), which include;

i) Initiate/Promote,

ii) Fund,

iii) Design;(which is subdivided into schematic, detailed and specialist design),

iv) Construct;(which includes the management process and the physical construction process), and

v) Risk Allocation amongst the aforementioned functions.

Once the functional processes had been identified, it became necessary to identify the primary functional roles involved in those processes. They include;

i) the Initiator/Promoter,

ii) the Funder,

iii) the Designer, (separated into schematic, detailed and specialist)

iv) the Constructor; (which may be separated into the Manager of construction, and the individual, group, or organisation responsible for the process of construction).

The five generic function of any procurement system include;

Generic Function	Definition
1. Initiate/promote	The process of recognising that a new building is required for owner occupation, as an investment, or as a speculative development.
2. Fund	The provision of the finance required in order for the project to be undertaken.
3. Design	The translation of the verbal or written requirements of the initiator/promoter into drawings and specifications, prepared to facilitate construction. The role of the estimator or cost manager is an integral procedure carried out during the design function. *The design process is sub-divided into concept/schematic design, detailed design and specialist design.*
Concept/ schematic design	The process of translating the requirements of the initiator/promoter into a basic design form, indicating the general design in terms of shape, size and function of the building.
Detailed design	The production of detailed drawings and specifications, from the concept/schematic designs, detailing and describing each element of the building so that it may be constructed.
Specialist design	The development of detailed drawings and specifications for a specific component or element within the structure, which requires specialist technical knowledge to design and construct.

4. Construct	The process of physically fitting the various components of a building together, to form a final structure. This process may be sub-divided into the management and physical action of the process.
Construction management	The management of the building process for the initiator/promoter
Construction process	The physical construction of all or part of the structure for the initiator/promoter, in accordance with the detailed designs (may also include the general management of construction).
5. Risk Allocation amongst Functions	The susceptibility of each of the above generic functions to varying degrees of risk. The degree of risk is dependent upon the type of procurement system implemented and the individual functional roles.

All procurement systems carry an inherent diversity of dominant risks. The generic characteristics of each system will present a distinct combination of dominant risks to either the initiator/promoter, the funder, the designer, or the constructor. By the nature of the procurement system, these risks will place a responsibility on the respective party which has been referred to in terms of Low, Medium or High Risk levels.

In an attempt to identify procurement systems internationally, it has become apparent that not only will the generic functions of the system need to be isolated, but the inherent risks of each system must also be identified.

Research carried out on UK procurement systems by Turner (1990), Morledge (1991), Masterman (1992) et al, have indicated that all procurement systems in the UK are susceptible to three generic categories of risk; Time, Cost/Price and Design/Quality.

For the purpose of this investigation the following categories of risk are to be considered;

Definition of Risks	
Time	Risk for the achievement of the completion date for the project. Timing of the project is considered in terms of the building being completed before the completion date, or on the stipulated completion date, or after the completion date. One of the generic roles identified will bear the risk of the project being completed on or before the completion date. (The overall programme time of the project will often have a premium on the price/cost and quality of the product).
Product Price	Risk in terms of total building price and price escalation. (The use and certainty of cost estimates is significant in the allocation of this risk).
Design Apportionment liability	The responsibility for design and design standards in the project. (Issues such as the reliability and durability of the designs will be considered).
Project Finance	The risk involved in providing the funding for the proposed project and the potentiality for loss.
Effectiveness of Building in operation (building Functionality)	Risks associated with the completed project not fulfilling the requirements stated in the brief. These risks are considered in terms of whether the project meets the stated requirements, can perform its proposed function, and is suitable for its intended purpose.
Quality of Product	Risk of the project being of unsuitable construction quality. Quality is a very subjective issue, and for the purpose of this study the risk has been assigned to the party who is responsible for the quality of workmanship and materials in the construction process.

Three basic working frameworks have been devised, showing the relationships which exist between;

- Functional Role and each Procurement Function (Framework 1),
- Functional Role and Risk inherent in any particular procurement systems (Framework 2), and
- Functional Role and the Formal Relationship which exists between the parties.(Framework 3).

These frameworks illustrate the generic functions of a procurement system, facilitating its identification and comparison.

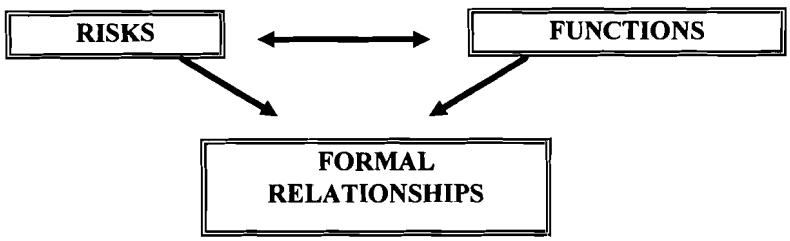

Diagram to Indicate the Relationship between Functions, Risk and Formal Relationships

As indicated above the primary functions and the risks associated with the procurement system are interdependent and influence the formal relationships which established within a particular procurement system.

Framework 1. (Fig.1)

This framework has been devised to show 'who does what' in the procurement process. The use of this framework will facilitate the objective establishment of which primary role carries out each generic process. (The benefits of this framework will become apparent when used in countries with less technologically sophisticated construction industries.)

Framework 2. (Fig2)

The dominant risks inherent to each primary function is established by this framework. It is contended that each of the four generic primary functions will have certain dominant risks associated with them. The pattern and profile of the dominant risks to each of the functions will be influenced by the processes, and the formal relationships which exist in a procurement system (Frameworks 1, and 3).The extent of each of the risk is measured in terms of being Low, Medium and High.

Framework 3. (Fig3)

At various stages throughout the procurement process, various formal relationships will be established. This framework will illustrate the existence of formal relationships with each of the generic primary functional roles. These formal relationships may exist as written or verbal agreements between the parties involved. Traditionally, they will be backed up by legal contractual documentation.

These frameworks will exemplify the pattern of Functional Responsibilities and Functional Risks inherent in the various dominant procurement systems. Each procurement system identified will have a particular arrangement in terms of the above frameworks. An amalgamation of the three will produce a 'Procurement System Model'(P.S.M.), illustrating the dominant procurement systems in a country. It is envisaged that an array of models will emerge and these may then be classified. To avoid the problems of misinterpretation, all of the procurement system models are to be enumerated. At this point it will be possible to conduct a comparison and appraisal of the procurement systems identified.

As the models have emerged, it has become clear that certain common types of dominant procurement systems exist internationally. Currently, the PSM have been created for the UK, France, and the USA, and Japan. The reliability of the models will be tested by academic and construction professionals in the countries under investigation.

Necessary Support Frameworks for Procurement Systems.

Investigations carried out of the dominant procurement systems in the UK, France, the USA and Japan indicate that similar procurement systems exist in these countries. The development of the Procurement Systems Model (PSM) has facilitated the objective comparison of procurement systems in each of the countries and has illustrated that similar procurement systems operate in countries with dissimilar structured construction industries.

The identification of this apparent paradox has led to the investigation of what is required to be in place in any country in order for a particular procurement system to operate. The development of the functional approach to procurement systems has highlighted that there are minimum competencies which are necessary for the operation of any procurement system in a country. These minimum competencies are defined in the table below;

Definition	Minimum Competencies
Initiation/ Promotion	The ability to understand need and to express that need. The ability to understand the procurement process or to understand how to initiate the process.
Funding	The ability to understand the nature of the process of funding and funding strategy.
Design	The ability to interpret the needs of the initiator/ promoter and to communicate those needs through a process resulting in a building which meets the functional, physical, and economic parameters established or presumed.
Construction	The ability to understand the requirements of any design and to adapt such designs through a process of construction to produce a building of acceptable quality, within acceptable tolerances and within an acceptable time frame for a specific client.
Risk	The ability to understand types of risk and the implications of risk, or the ability to obtain advice about risk, risk allocation, and risk management.

Indigenous Organisational Support Frameworks

Contiguous with these minimum competencies being in place, it is suggested that there are certain indigenous organisational frameworks which must exist in order for a specific procurement system to operate. The Indigenous organisational frameworks include;

Definition	Indigenous Organisational Frameworks
Initiation/ Promotion	Government, corporate, group, or individual promoters or promoting frameworks which own or have; authority or delegated authority, adequate funding or the ability to obtain adequate funding.
Funding	Banks, government funding agencies, or other financial agencies able to obtain indigenous or imported finance.
Design	Indigenous licensed, approved or accepted design individuals or corporate groups.
Construction	Indigenous individuals, bodies or corporate groups possessing the skilled labour, and having the ability to obtain the appropriate materials and/or appropriate machinery.
Risk	Adequate formal relationships to enable risk to be reliably allocated. Sufficiency of the ability to accept risk and to obtain security for that risk.

The research programme will seek to investigate;

1) the need for the existence of the minimum competencies required for a procurement system to operate.

2) the ability to produce a conceptual model of the indigenous organisational support criteria which must exist to enable the identified dominant procurement systems to operate.

Conclusion

The functional approach to modelling procurement systems has facilitated the objectivity which is unaffected by role descriptors, such as 'Architect', 'Engineer' and 'Quantity Surveyor', which are neither constant nor recognised in many construction industries internationally. Consequently, this approach may be implemented in any country in order to observe the dominant procurement systems.

This functional approach will also assist in the comparison of procurement systems which are adopted by major construction exporting and major construction importing countries. The importance of the ability to model such systems in this way will be highlighted with the continual globalisation of the construction industry and increased international trade.

Further development of this approach will allow the examination of the specific indigenous organisational support frameworks which are required to be in place in order to allow the effective application of a particular procurement system. It is anticipated that this will assist in the identification of what is required in a particular country before a procurement system can be used effectively.

The outcome from the Procurement Systems Model will additionally provide useful information to nations with growing construction industries in terms of the most appropriate procurement systems to use on their construction projects, given the context and project typology.

PRIMARY ROLE PROCESS		Initiator/ Promoter	Funder	Designer			Constructor	
				Sch.	Det.	Spe.	Management	Product
Initiate/ Promote		√						
Fund			√					
Design;	Schematic			√				
	Detailed				√			
	Specialist					√		
Construct;	Management						√	√
	Product							√

Framework 1.(Fig 1); Functional Role against Functional Process.

PRIMARY ROLE RISK		Initiator/ Promoter	Funder	Designer			Constructor	
				Sch.	Det.	Spe.	Management	Product
Time		LOW						HIGH
Product Price								HIGH
Design Liability	Schematic			HIGH				
	Detailed				HIGH			
	Specialist					HIGH		
Project Finance			HIGH					
Effectiveness of Building in operation (functionality)		HIGH						
Quality of Product								HIGH

Framework 2.(Fig 2); Functional Role against Risk

PRIMARY ROLE FORMAL RELATIONSHIPS		Initiator/ Promoter	Funder	Designer Sch.	Det.	Spe.	Constructor Management	Product
Initiate/ Promote			√	√	√	√		√
Fund		√						
Design;	**Schematic**	√						
	Detailed	√						
	Specialist	√						
Construct;	**Management**	√						
	Product	√						

Country; UK Model; A1 Assumptions; Use of JCT Standard Form of Contract

Framework 3.(Fig 3); Functional Roles against Formal Relationships.

References

Bennett. J, (1991), International Construction Project Management; General Theory and Practice. Butterworth Heinemann Ltd, Oxford.

Bennett. J, Flanagen.R., Norman.G, (1987), Capital & Counties Report; Japanese Construction Industry. CSSC, University of Reading.

C.I.B. (1991), Proceedings of International Symposium W65; Organisation and Management of Construction; Las Palmas, Gran Canaria.

Franks, J. (1990), Building Procurement Systems 2nd Edition. C.I.O.B.

Greenhalgh, B. (1990), A General Classification For The Procurement of Construction Using The Basis of Functions & Responsibilities & Investigating Whether This Can Form The Basis of a Single Form of Contract. Liverpool Polytechnic. C.I.B. Proceedings of Working Commission W92; Procurement Systems. Zagreb, Yugoslavia.

Latham. M, Sir, (1994), Constructing the Team; Joint Review of Procurement and Contract Arrangements in the UK Construction Industry. DOE, HMSO, London.

Levy. S. M, (1990), Japanese Construction; An American Perspective. Van Norstrand Reinhold, New York.

Masterman, J.W.E. (1992), An Introduction to Building Procurement Systems. E & F N Spons London.

Mathurin, C. (1990), Study of Responsibilities, Guarantees and Insurance in the Construction Industry with a view to Harmonisation at Community Level; Brussels, E.C.

Meikle, Jeffery. (1989), The French Construction Industry: a Guide for U.K. Professionals. C.I.R.I.A. London 1989.

Morledge, R. (1991), Building Procurement. Nottingham Polytechnic. Fac of Environmental Studies.

Nahapiet. H., Nahapiet. J, (1985), A Comparison of Contractual arrangements for Building Projects, Article, Construction Management and Economics 3 E & FN Spons, London, pp271-231.

RICS, (1993), The Business of Building in France. Chamber de Commerce Francaise de Grande-Bretagne and the R.I.C.S, London.

Turner, A. (1990), Building Procurement. Macmillan, London.