AN EXPLORATION OF STRUCTURAL MATERIAL CHOICE PROCESSES IN IRISH RESIDENTIAL CONSTRUCTION.

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SIGNED: Maurice O'Neill

DATE: 26/2/2000

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An Exploration of Structural Material Choice Processes in Irish Residential Construction

ABSTRACT

Researcher: Maurice W. O'Neill

This study is important in terms of applying organisational buying behaviour theory to structural material choice processes in the Irish residential construction sector, at a time when as the construction industry is awakening to the benefits and necessity of marketing.

Structural material choice processes are explored within a framework developed from the organisational buying behaviour literature including seminal such Robinson, Ferris and Wind (1967), Webster and Wind (1972) and Sheth (1973). The framework proposes three material choice process stages and three levels of participation. The three stages, which are not entirely sequential, are:- structural material selection, structural timber specification and structural timber supplier selection. Each of these stages is envisioned as comprising an unspecified number of related decisions. Participation in each of these stages is explored through the three participation levels:- decider, involvement, and influencer. Structural material choice criteria and structural material related changes are also explored. A study model is presented, which is firmly rooted in the study framework and emerged in its working format during the interview analysis.

The mixed-method approach adopted commenced with a dominant interview phase, which explored structural material choice processes on a development specific basis. A range of developments and development organisations were targeted and interviews were conducted with both developers and designers in each of the five subject developments. The less-dominant mail survey phase of the primary research aims to extend the investigation of structural material choice processes in the speculative residential development sector. This survey offered, amongst other things, the opportunity to provide participation level and criteria ranking in the three study generated stages of structural material choice processes.

The study provides insight into material choice processes at a time when organisational buying theory is experiencing a significant shift towards relationship based theory. The findings find little evidence of strong development organisation / material supplier relationships to date, however future scope for strategic relationships is highlighted in the move toward new development systems, such as timber frame construction.

INTRODUCTION

Introduction

The genesis of this research lies in a concern of Coillte – the Irish State Forestry Company – to more deeply understand the nature of demand for timber in Ireland. Initially it was thought that this would involve an econometric study of timber consumption in Ireland. Once the research was initiated it was realised that the changes in the nature of demand and the diversity of sectors in which timber is consumed would make it difficult to provide an accurate econometric based picture of timber consumption. The timber industry was in a period of significant change, due to rapid increases in both planting levels and roundwood supply, in parallel with massive restructuring of the sawmill and boardmill sectors. It was further recognised that there was very limited research to date on any of the markets for Irish timber, be it construction, packaging, fencing, agriculture, or joinery. This led to the decision to focus on the provision of an insight into specific aspects of the timber market, rather than an overview of the entire industry. From this basis it was decided to narrow the scope to one sub-sector.

The construction industry emerged as the most appropriate sector upon which to focus in this study, as it is by far the largest user of timber, as discussed in detail in Chapter 2. It should also be noted that this is an industry of which the researcher had a reasonable foreknowledge. Having established the importance of the construction industry in terms of timber use, Chapter 2 recognised that the majority of structural timber is used in residential construction; many non-residential buildings using little or no timber for structural purposes. Structural timber in residential construction is therefore of great concern to the Irish timber industry.

As it is argued in Chapters 2 and 3 there was not only a lack of information on the quantities of timber used in construction, but more importantly there was no information on the processes and parties involved in the choice of structural materials in the Irish market. In order to meaningfully research the structural timber market knowledge of the buying processes within which structural timber is selected and purchased in residential construction was needed. This led the research towards organisational and industrial buying behaviour literature for:- *"In order to succeed in business-to-business markets*

selling firms must possess an understanding of customer firms' buying behaviour. However, such an understanding may be difficult to achieve because organisational buying behaviour is often a mutiphase, multiperson, multidepartmental, and multiobjective process" (Johnston & Lewin, 1996:1). Indeed the construction industry presents a particularly interesting setting for a study of organisational buying behaviour as it can be viewed as an early form of network type organisational structure. Thompson (1996) for example discusses the construction industry in the context of the developing field of client-contractor relationships and network theory and describes the organisational structure commonly found in the industry as temporary project based networks. The organisational buying behaviour section of the review is largely framed around the three seminal studies by Robinson Faris and Wind (1967), Webster and Wind (1972) and Sheth (1973) and Kauffmann's (1996) six main influences in organisational buying behaviour literature. They are based on Webster and Wind's (1972) four influences of individual, group, organisational, and environmental, to which Kauffmann (1996) adds choice process, and products/markets.

The literature review of Chapter 3 concludes with the development of a study framework, which recognises Johnston and Lewin's (1996) above contention and incorporates a number Kauffmann's (1996) insights *"There are too few studies such as Wilson et al. (1991) which integrate several factors of influence"* (Kauffmann, 1996:103). The study framework recognises the diversity and uniqueness of buying situations (choice process influence) and as such focuses on structural material choice in terms of processes rather than a singular buying process. Secondly, in common with numerous authors since Robinson, Farris and Wind (1967) introduced the 'buyphase' concept, the framework incorporates stages in the exploration of organisational buying processes (choice process/stages influences). The three stages adopted in this study are – structural material selection (e.g. selection of steel, timber, concrete or masonry in each structural element), structural material specification (specification of structural material characteristics), and structural material supplier selection (selection of structural material suppliers). These stages are an important part of the framework as they provide a structure within which to initiate the exploration. Yet the decision to restrict the preset stages to three reflects the concerns expressed by various commentators, such as Spekman and Gronhaug (1986)

regarding the adoption of a large set of sequential preset stages in the examination of buying processes. Thirdly, the three stages adopted are not envisioned as discrete decisions, but rather as largely (but not completely) sequential stages which in themselves encompass an unidentified group of related decisions that may or may not explicitly arise in a given buying process.

The multiperson and multidepartmental aspects of Johnston and Lewin's (1996) description are recognised in the framework through the development of participation levels in material choice processes (individual and group influences). The three levels of participation adopted are influencers, those involved, and decision makers. Rather than concentrating on the departmental distinction this study concentrates on a multifunctional or multiparty participation in material choice processes. This is in recognition of the non-conventional organisational structure of the construction industry, where various functions are outsourced to external consultants and contractors, rather than departmentalised as is the case in many other industries.

The multiobjective aspect of Johnston and Lewin's (1996) description is recognised in the framework through the inclusion of material choice criteria (product/market/seller influences). The criteria considered by different participants in buying processes has been recognised as a fundamental aspect of organisational buying behaviour, where both Sheth (1973) and Robinson Faris and Wind (1967) recognised purchase/product characteristics and seller characteristics as important constructs in their seminal models of organisational buying behaviour. Indeed, Kauffman (1994) refers to the shortage of research relating to the effect of general product related factors on the choice of products by buyers.

Organisational buying behaviour studies frequently include models of the overall buying process or the specific elements of the process which are being examined in the particular study. The use of models to present a study framework and/or results has been undertaken by a range of researchers, as is noted by Roche (1997). *"Not infrequently researchers will themselves develop models by linking the ideas and findings emanating from literature reviews, and perhaps organising their own ideas on a research topic."* (Roche; in Brannick and Roche, 1997:105).

From the literature review and the construction and timber industry reviews the following aim was developed:

"To explore structural material choice processes in the Irish residential construction sector and to integrate the findings and study framework in a model."

The four primary objectives of the study arise out of this aim and the study framework. They are presented and discussed at the start of Chapter 4. Objective One is to explore participation in structural material choice processes while Objective Two aims to explore material choice criteria in the Irish residential construction sector. The third core objective is to present a model which integrates the research findings and the study framework in order provide a clearer picture of structural material choice processes in Irish residential construction. The fourth and final primary objective relates to the exploration of changes in structural materials in residential construction. It arises primarily out of the realisation that there is a deficit in market information on changes in structural materials within residential construction. Whilst work on this objective provided a lot of data regarding industry views on timber related changes, it also yielded information on certain dimensions of product changes as they relate to buying processes.

Chapter 4 argues that the method selected would need to be sensitive to the organisational structure of the construction industry. This led the researcher to the belief that a development-specific approach would yield some insightful findings. The diversity of residential development situations was recognised as an interesting feature of the industry and organisational influence on the buying process. Informal interviews with industry contacts pointed to likely differences in material choice processes across different types of developers. In view of the broadly exploratory nature of the research objectives it was decided to use a data collection method which would incorporate the flexibility to develop an understanding of material choice processes. Five developments were selected in order to reflect the diversity of developer type, scale of development, and type of residential units. These comprise:- a speculative housing development, a speculative apartment development, a social housing development, a single owner-developed dormer house, and

a single owner-developed timber frame house. Semi-structured interviews were conducted with designers and developers on a development specific basis. The procedures and instruments used to generate this data and gauge the reliability of the informants are presented in Chapter 4.

The analysis of the data generated from the interviews is initially detailed in Chapter 5 – the interview findings chapter. Inter-alia it was found that significant differences can arise in the participatory patterns regarding material choice processes in different developments. However, an interesting point of common ground was suggested by the results, in so far as the development initiators in each case appear to dominate the decisions in the material selection stage, where such decisions *explicitly* arise. This latter point is an important qualifier as many of the decisions involved in the various stages of material choice processes are implicitly made in the choice of development system. Differences in material choice criteria importance were highlighted both between developers and designers and between the different types of developer. The two single house owner-developers and the local authority showed greater concern about material quality and building life, however the local authority were far less concerned about aesthetics than the single house developers or indeed the speculative developers. A model of material choice processes is presented, based on the framework developed from the literature review and interview analysis in Chapter 5, which displays in skeletal form the results of the interview findings on a development specific basis.

In order to further extend the investigation of material choice processes it was decided to undertake a survey of speculative residential developers in the Dublin area. This mail survey represented the introduction of a less-dominant phase to the primary research. The rationale and procedures underlying this phase of the primary research are outlined in Chapter 6, while consideration of the use of mixed methods is provided in Chapter 4. Separate, but related, objectives were developed for this phase of the mixed-method study. Primarily the aim of the survey is to extend the investigation of participation and criteria in material choice processes within the speculative residential construction sector, and to further measure the views of speculative developers on structural timber related material changes. A relative importance ranking of material choice criteria and an average rating of

party participation in each of the three stages of material choice processes is provided in Chapter 7, which presents the home-builder survey findings. The interviews highlighted a diverse range of views on the use of Irish timber, but pointed to a widespread perception of inferior quality in Irish timber, which was supported by the survey findings. The survey findings facilitated the adaptation of the study model to reflect the accumulated views of the survey respondents. It illustrates some of the potential that the study framework affords for further research into organisational buying behaviour, particularly in the construction industry.

The final chapter ties together the various strands of the research, in particular the analysis of the dominant interview phase and the less-dominant mail survey phase. This led to some additional insights such as the support for the finding that development firm senior management appear to dominate decision making in material choice processes, with the exception of more technical specification related decision, which are left to the discretion of designers to a large degree. While it had been suggested in the interview findings that standardised development systems largely determined material selection, this criteria did not achieve a very high average importance rating in the survey findings. Similarly, the interview findings highlighted the importance of the cost/return relationship to speculative developers, while the survey findings underlined the dominance of both the cost/return and pure cost based criteria. However the interview findings also drew attention to certain factors which may over-ride the pure cost based criteria, such as service quality. These instances support the research approach taken in the dominant phase of the research, as they highlight two of a number of instances where information emerged from the interviews that would not have emerged from a highly structured survey approach. Lessons from the experiences of these mixed methods are briefly discussed in Chapter 8 together with a review of the limitations of this research.

Chapter 8 also makes some recommendations of relevance to future researchers in organisational buying behaviour, material suppliers, policy makers and those in both the construction and timber industries. The primary research opportunities to emerge from the study relate to longitudinal case studies into the changing structures of the construction industry. In particular the effects increased use of labour and materials contracting systems

could be observed to assess it impact on material choice processes. While the relationships between developers and suppliers were generally felt to be of a functional nature at strongest, there is particular scope for development of partnership style relationships as changes in development systems occur. Suppliers, such as timber frame manufacturers, will require a greater degree of integration with the entire development team if their system is to succeed in the speculative home-building sector. A study of a development team and the timber frame manufacturing organisation over the course of the initiation and development of such a relationship would be very interesting, and could contribute significantly to the emerging literature on relationship based organisational buying processes. The longitudinal case study methodology has been suggested by various sources as a method of bridging the gap between the existing body of organisational buying behaviour theory and the emerging relationship theory (e.g. Tanner, 1999). Chapter 8 concludes with further recommendations are aimed at policy makers and industry interests.

CHAPTER 1

CONSTRUCTION INDUSTRY REVIEW

Chapter 1: Construction Industry Review

1.0 Introduction

As outlined in the introduction to this study, this chapter and Chapter 2 provide the contextual foundations of the research topic, examining relevant aspects of the construction and timber industries. The construction industry is the largest timber using sector, accounting for over half the sawn softwood consumed in 1994 (Coillte, 1995). Residential construction is estimated to account for the majority of the timber consumed in construction (See 2.4.1). This chapter initially relates to the overall construction industry in Ireland. A brief sectoral review of the industry, is followed by a discussion of the parties involved in the industry and the primary structures or procurement systems used to tie them together. Residential construction then becomes the primary focus for the remainder of the chapter.

1.1 Construction Industry Overview

While this study focuses on timber choice in residential construction, it is difficult to separate residential from the general construction industry in a number of important areas, such as employment levels and the number of both construction and service firms involved. The forecast output for the construction industry in 1997 is just over £7 billion, including repair and maintenance (DOE, 1997a). One in every eleven people in work in Ireland is employed in construction related activities and over a third of the industrial jobs created between 1993 and 1995 were created in this sector (CSO, 1996). In order to put the construction industry's economic role in context, it is useful to point out that in 1996 new construction output was around £5.7 billion, whereas agriculture, once our dominant industry, accounted for £3.7 billion and the tourism sector accounted for £2.3 billion (CIC, 1997). The industry is currently operating at a very high level of activity, with increasing volumes of construction underway in all sectors of the industry. (DOE, 1997a & Webb, 1997). This is an unusual position for the Irish construction industry, as a review of sectoral activity over the last number of decades reveals a certain level of disparity between the growth and decline of activity in the different sectors at most previous points in time (DOE ,1997a).

1.1.1 Sectoral Breakdown

The construction industry can be subdivided in a number of ways into various different sectors and subsectors. The categorisation adopted here is the one used by the Department of the Environment (DOE) in its annual Construction Industry Review, as this is the core source of statistical data on the Irish construction industry. It divides construction into four main sections; residential, private non-residential, productive infrastructure and social infrastructure. A number of subdivisions are also used in the DOE categorisation, as can be seen in Table 1.1. Figure 1.1 incorporates some slight alterations to the DOE categories, in order to account for a couple of subsectors which the researcher feels should be included explicitly in the model. Apartments are added as a category in the residential sector and tourism and recreational development is added to the commercial non-residential sector.

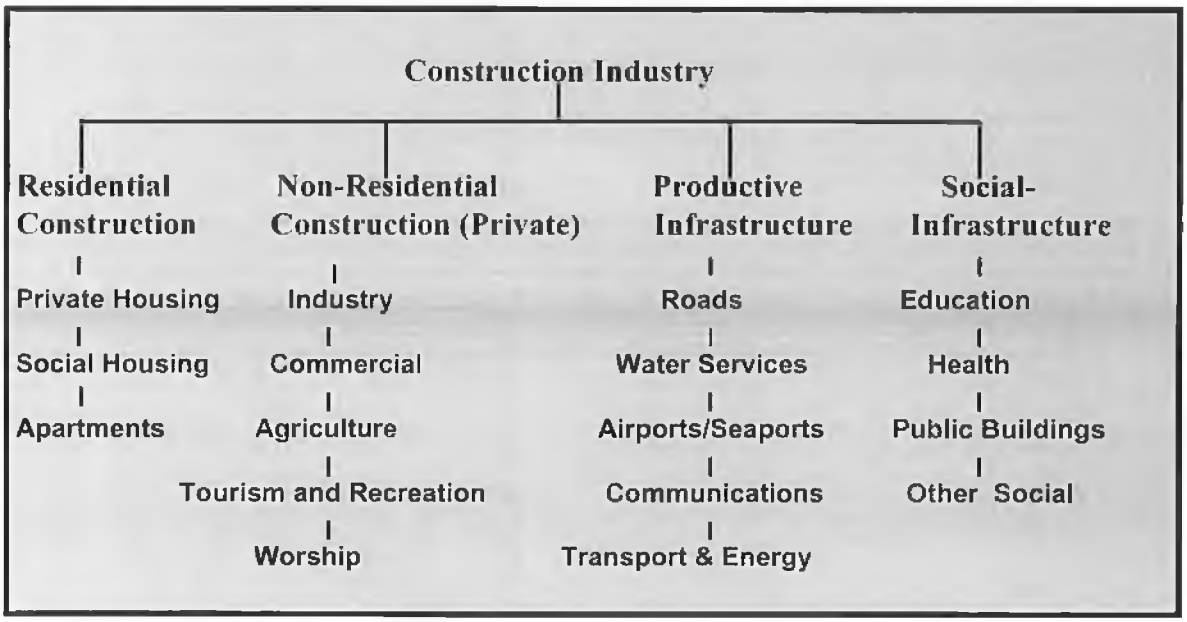


Figure 1.1 Construction Industry Breakdown (Developed from DOE Categories)

All sectors showed an increase in output in 1995 (+17.7% average) and 1996 (+22.7% average). This trend was forecast to continue into 1997 with around 14% average growth (DOE, 1997a). In 1996 the value of output in constant prices increased by 27.5% in residential construction, 30.1% in private non-residential construction, 9.6% in the case of productive infrastructure and 6% in social infrastructure. This can be contrasted with 1993, when residential construction fell by 6% and private non-residential construction

fell by 12%, while productive infrastructure increased by 12.7% and social infrastructure grew by 7.3%. (derived from DOE, 1997a). The year 1993 was an exception to the general trend of the 1990's, yet it is indicative of historical trends in Irish construction activity, where by a cross-sectoral slump or boom is unusual. Construction output increased in cumulative terms by around 40% between 1994 and 1996 (DOE ,1997a & CIC, 1997).

1.1.2 Non-Residential Private Construction

Private non-residential construction is second only to residential construction in output terms. It accounted for an average of 24% of total construction output, in constant prices, for the eight years from 1990 to 1997 (from DOE, 1997a -1997 projected). Industrial construction accounted for an average 6.7% of total construction output from 1990-97. Foreign investment in the establishment and expansion of large scale assembly and manufacturing units, have been particularly important in this area. The move towards high specification industrial/office parks such as the City West Business Park is another significant feature of industrial construction in recent years. Vast improvements in the country's motorway network has resulted in a considerable swing in the locational patterns of industry in Ireland.

Commercial construction refers to both office and retail developments. One of the main trends in both office and retail development has been the move towards retail and office centres of a scale unprecedented in Ireland. The financial services centre (IFSC) represents a massive departure for the Irish office sector. It is the largest scale, most high-tech and ambitious development of its kind in the history of Irish office development. Large scale suburban shopping centres, such as the Blanchardstown Centre and The Square in Tallaght and rejuvenated town centre developments, such as Jervis Street Shopping Centre and The Square in Waterford, have been the main feature of retail development in the 1990s. The scale of these developments has resulted in the increasing use of precast concrete units and steel frames as the primary structural materials, thus largely displacing structural timber.

Agricultural development is becoming a less important sector for the construction industry, in common with its reducing importance to the economy as a whole. It accounted for 7.8% of total construction output in 1990. However, it is projected to

account for only 3.7% in 1997 (from DOE, 1997a). Tourism continues to grow in Ireland and for this reason the development of hotels and other tourist related facilities has been very vibrant for the last decade or so. It is felt that recreation related development has also been quite vibrant in recent years, with the development of various multi screen cinemas, fitness centres and sports related facilities. Worship related buildings have represented a small share of construction related activity during the 1990s, averaging around £10.7 million per annum or 0.3% of total output (DOE, 1997a).

	1990	1993	1997 forecast	Ave% 1990-97
RESIDENTIAL CONSTRUCTION				
private housing	1,347.1	1,311.6	2,434.7	
social housing	91.7	136..3	213.0	
subtotal	**1,438.8**	**1,447.9**	**2,647.7**	**47.6%**
NON-RESIDENTIAL CONSTRUCTION				
Private Non-Residential Construction				
industrial	227.7	205.7	373.2	
commercial	462.5	207.2	358.6	
agriculture	269.4	148.0	193.1	
tourism	95.8	166.1	162.6	
worship	11.2	10.1	14.7	
subtotal	**1,066.6**	**737.2**	**1,102.1**	**24.0%**
Productive Infrastructure				
roads	285.4	362.3	409.0	
water services	135.4	135.0	178.9	
airports/seaports	42.9	52.8	111.1	
energy	84.8	120.0	240.6	
transport	66.0	40.4	70.1	
telecommunications	82.8	63.6	58.9	
subtotal	**697.3**	**774.1**	**1,068.6**	**20.5%**
Social Infrastructure				
education	78.4	109.3	145.3	
health	69.5	80.6	88.1	
public buildings	99.1	79.3	108.2	
other social	9.6	12.8	26.7	
subtotal	**256.5**	**282.0**	**368.4**	**7.9%**
Total All Construction	**3,459.2**	**3,241.1**	**5,186**	**100%**

Table 1.1: Construction Output in Constant Prices (£,000s) 1990 to 1997 (DOE, 1997a:9)

1.1.3 Productive Infrastructure

Productive infrastructure can be considered as the accumulation of all public sector civil engineering projects. It has experienced steady and sustained growth throughout the 1990's, rising from £697 million in 1990 to an estimated £1,068 million in 1997, in constant prices (DOE, 1997a). This represents an average of 20.5% of total construction output for these 8 years, making it the third most important sector over the period. One of the primary drivers in this sector has been the availability of European Structural Funds to aid the improvement of our national infrastructure. In fact, construction projects to the value of £5 billion are being undertaken between 1994 and 1999 with the aid of EU grants. The effect of EU funds in the development of our roads, airports, seaports and general infrastructure has been immense over the last couple of decades (Building Industry Bulletin, 1995). Most of the developments are large scale and specialised in nature, which leads to a situation where a small number of contracting firms dominate this sector. These projects are generally initiated by either State or Semi-State bodies, with an increasing emphasis on private sector partnerships. Again there is a limited amount of structural timber used in this type of development, however, a reasonable amount of fencing grade timber products are consumed.

1.1.4 Social Infrastructure

Social infrastructure includes education, health and public building projects, the vast majority of which are firmly rooted in the State sector and are covered by the Public Capital Programme. It accounted for an average 7.9% of construction output over the period 1990 to 1997 (from DOE, 1997a). These projects vary in size, from the construction of the Tallaght Hospital, to smaller projects like the addition of a room to a rural national school. Construction work in this sector and in productive infrastructure is normally awarded to eligible contractors on a tender basis.

Many types of non-residential construction systems use very little timber in a structural context. For example most modern industrial buildings are constructed using either concrete or steel frames, as timber is structurally or economically unsuitable for use in large spans. Major office and retail development have tended to avoid the use of structural timber in recent years also. So the primary use sector for structural timber is

residential construction, which is discussed in greater detail later in this chapter, after a brief look at the industry chain and procurement systems.

1.2 Construction Industry Chain

The construction industry is comprised of numerous participants, the most readily identifiable include contractors and subcontractors, design and management professionals and development firms. Some less obvious participants may include the clients who become involved through their need for a particular building, the numerous advisors and consultants and material suppliers and manufactures. Other parties who are indirectly involved in the industry include local authority planners, estate agents, owners of land suitable for development and development purchasers or end users. Figure 1.2 is a representation of the construction industry chain, as envisioned by the researcher.

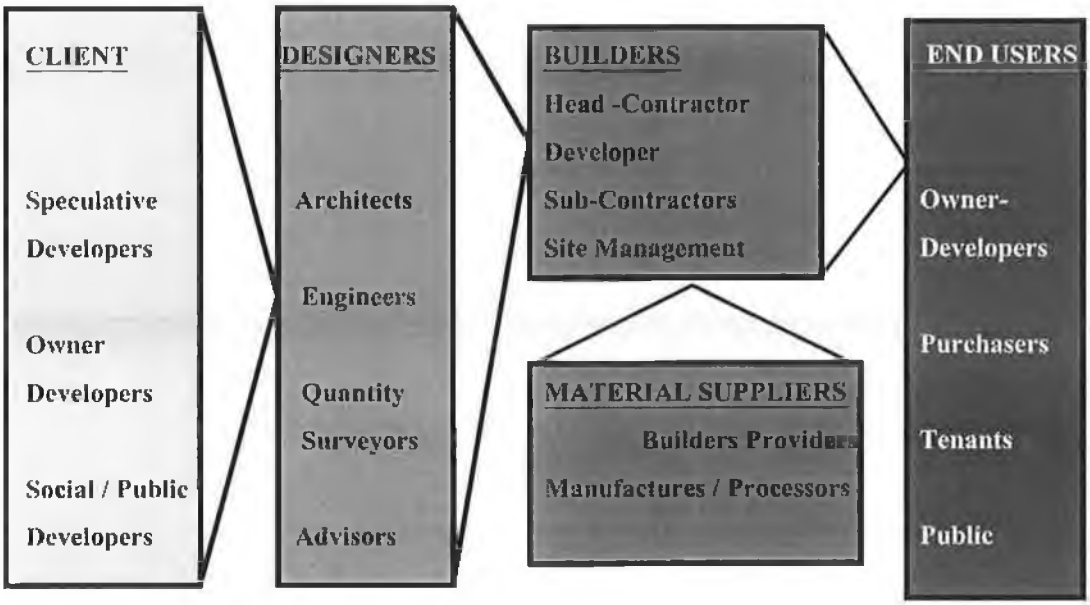


Figure 1.2 Model of Construction Industry Chain.

1.2.1 Clients

"The needs of clients are the basis on which the industry exists. The image and standing of the industry is dependent upon the degree to which it satisfies these needs." (Construction Industry Council, 1997:22). Yisa et al. (1996 & 1995) also discuss the importance of clients being viewed as the driving force for improvements in the construction industry. The client normally initiates developments and the designers and the contractors ultimately answer to the clients. Developments vary widely in their form

and function, as do the primary aims of the clients who initiate them (Cherns and Byrant, 1984). The three primary types of clients in the construction industry are: speculative or 'operative' developers (Eccles 1981:338), owner developers and social or public sector developers.

- Speculative developers are normally motivated by profit and are particularly prevalent in private multi-unit residential and commercial construction. Developments are normally disposed of during construction, or directly afterwards. The speculative developer normally carries the potential financial risks associated with the development.
- Owner-developers normally develop for their own occupation, where the client is likely to be concerned with meeting their own occupational/operational needs. Alternatively, if investment is the client's purpose, a development must meet the needs of potential tenants while maximising the developer's return.
- Social and public service developers are concerned with the provision of social and normally non-profit orientated developments. This category particularly applies to state, local authority and voluntary organisations, who are providing public service type developments, such as social housing, hospitals, schools, jails and infrastructure (DOE, 1991).

A large proportion of individuals, groups and organisations are clients or potential clients at some stage, particularly when repair, maintenance and extension works are included in our definition of construction. Even if these elements are excluded, it is difficult to account for all construction clients. For example, there are those who get their own houses built, the firms who have their premises purpose built, the investors who commission new construction, the speculative residential and non-residential developers and the social (public) developers.

1.2.2 Designers

The exact structure of the design team is liable to vary considerably across developments. The traditional and still predominant system, involves an architect(s), a quantity surveyor(s) and in most larger and complicated projects various engineers (e.g. structural, civil and services). Other parties may be involved in an advisory role, such as planning and development surveyors and general practice surveyors. The design team's job is to provide a blueprint for the transformation of a site or existing structure into a

development that meets the client's needs, within the resource constraints set by the client. This will normally involve, at a minimum, the drawing of plans and specifications for the development, which will form the instructions for the builders involved in construction. In more complex developments there are likely to be detailed initial plans, bills of quantities (itemised account of materials needed for the development), structural drawings and calculations, services drawings and on-going working drawings. All of which can be used to form part of the tender documents if the building work is being contracted out.

There are very few statistics on the number of individuals and firms involved in the design and professional elements of construction. The Labour Force Survey measures direct employment in the construction industry, however, it does not provide figures for the related industries or professions. The DOE (1997a) estimate that around 6,000 people are employed in construction related services.

In order to test this estimate, the researcher phoned the main professional bodies representing construction industry professions, such as, engineers, quantity surveyors and architects, to find out their membership levels. However, certain professional bodies represent individuals and firms who operate in other industries, for example both the main engineering bodies represent different types of engineers; structural, civil, mechanical and manufacturing / processing. Yet both fail to divide their membership into what are vastly different disciplines. Many designers are either ineligible or unwilling to join the various professional bodies. The Institute of Engineers of Ireland has around 15,000 members, a large proportion of these are civil engineers (according to the membership officer) and a further group are structural engineers. The Association of Consulting Engineers of Ireland estimate that 70% of their 180 members are involved in either civil or structural engineering. The Society of Chartered Surveyors has in excess of 600 registered quantity surveyors, 400 general practice surveyors - a minority of whom are likely to be directly involved in development - and 30 planning and development surveyors. The Royal Institute of the Architects of Ireland, which represents both architects and technicians, has approximately 1,600 individual members, in 350 member firms.

Due to the difficulty in establishing the number of designers who are not affiliated to professional bodies and the number of engineers involved in construction related

practice, it is not possible to effectively test the DOE's estimate of 6,000 individuals. Designers (architects, quantity surveyors and engineers) can either be in-house in individual development companies and state bodies, or they can be retained from external practices or firms. The DOE estimated that in 1986 there were approximately 3,000 professionals directly employed in the industry and a further 2,300 in private consultancy, which represented a 19% drop in the estimated levels engaged in 1981 (DOE, 1993).

Generally the design team incur a relatively small share of development risk, particularly in a financial sense. However, they are 'only as good as their last job', because reputation and past performance can be considered as key attributes in designer selection. Many designers are represented by professional bodies, who set and enforce standards within their area of the industry. However, anyone can call themselves an architect or surveyor, as there is no statutory definition of either of these terms. The Strategic Review of the Construction Industry (CIC, 1997) has recommended that the terms "Architect" and "Quantity Surveyor" be protected by legislation and all those entitled to use the titles be registered by the RIAI and the SCS respectively, in order to set and enforce certain standards of entry and professional behaviour within these professions.

1.2.3 Builders

'Builders' describes those involved in the actual physical construction stage of the development process. Many commentators refer to all the non-client and design team members involved in the building process as 'contractors' or 'subcontractors'. However, this is not necessarily an accurate description, because many developers directly employ a certain proportion of the parties involved in the construction process. Many development companies and head-contractors have reduced to skeleton organisations, primarily concerned with managerial and administrative functions. Most of the trades are sourced through specialist contractors and subcontractors. The researcher feels that the term 'builders' manages to include all the contractors and subcontractors, while still including the developers who are not strictly contractors and yet directly undertake a proportion of the works on an in-house basis.

The vast majority of construction industry employment is accounted for by the firms operating in the building process, whether directly employed by the client firm or by contractors and subcontractors. It is difficult to accurately account for all the individuals and firms involved, because there are a lot small firms in the industry with under 5 employees in the industry (estimated by the DOE as 60% of the circa 6,000 firms). These firms are particularly prone to rapid and widespread entry and exit from the industry. Estimated total direct employment in the construction industry has grown from 70,600 in 1993 to 86,000 in 1996 (92,900 forecast for 1997) (DOE, 1997 & CSO, 1997). The average level of output per person directly employed in construction is estimated to have grown from £38,500 in 1988 to £55,900 in 1996, representing a 45% increase in output (in constant prices based at 1990).

The out-sourcing or contracting-out of construction works has led to the establishment of numerous specialist (sub-)contractors, who are brought into the building process to perform specific pieces of work. This has alleviated the need for head contractors, or development firms, to maintain large numbers of employees on their books, which has in the past proved very difficult in times of prolonged recession. Some of the more common functions which are out-sourced include; block/brick laying, carpentry, ground workers, plastering, electrical, plumbing and roofing. The level of knowledge, expertise and investment in capital equipment required by building contractors is increasing, due to changing construction techniques. These factors are increasingly acting as a barrier to new entrants to the industry. Increasingly the ability to prepare and interpret detailed tenders and deal with financial institutions, clients, designers, planners and other interested parties involved, is becoming paramount to success (FitzGerald, 1996). The Construction Industry Federation (CIF) represents the interests of many building firms in Ireland, it has 2,000 member firms between its 33 associations, which represent the various trades involved in the industry.

1.2.4 Material Suppliers

Material suppliers constitute a crucial element of the construction industry chain. They feed into the building process. While there are no accurate figures for employment in the sector, it was estimated that there were approximately 30,000 people employed in the sector in April 1996 (DOE, 1997 & ESRI, 1997). The distribution chain for different types of construction materials is quite diverse. Many materials are distributed through

builders providers, which are more or less the equivalent of wholesalers. Timber is normally distributed through this channel, rather than directly form the processor or manufacturer as is the case with most concrete products. Readymix concrete, for example, must come directly from a manufacturer, as there are restrictions on the radius of potential suppliers, due to the timescale involved in hydration (setting) of concrete. Large precast and prestressed concrete units are also generally supplied directly by the manufacturers, due to the specialised nature of production, transportation and handling. Builders Providers are particularly important in the supply of imported materials and in supplying smaller developments with a central source of a variety of materials. The providers can offer developers a range of products and expert advice on the relative merits of different products. The supply of equipment such as cranes and concrete pumps is a specialist trade. There are a limited number of machines available to the industry at any given time, as suppliers can not afford to have too much under-utilised equipment during slumps. The providers of services such as electricity supply, gas supply and mains water and sewage services, are also important to the industry. All of these services are currently provided by either State /Semi-State Bodies, or Local Authorities, without competition.

1.2.5 End Users

The end users of construction industry products can be purchasers, tenants, the general public, or the developer (client). End users may or may not have direct contact with the builders and designers. When the building is purpose built for the client's own use, the input levels are likely to be relatively high throughout the development. Whereas purchasers, tenants and the public often have little or no input into the development. Post construction purchasers often only have direct contact with the estate agent. If there is contact with the builders it will normally only be at the finishing stages of construction, when only minor input is feasible.

1.3 Construction Procurement Paths

The industry chain section above outlined the main parties who are involved both directly and indirectly in the construction industry. This section aims to develop an overall picture of the main structures which tie clients, designers and builders, together in the construction process. The process by which construction projects are executed is termed the procurement path or method. The three broad categories are traditional,

package deal and management, each of which is examined briefly below. Most of the data available on these paths relates to the UK and primarily to commercial rather than residential construction.

1.3.1 Traditional Procurement Path

The traditional path normally involves the client appointing an architect, who based upon the client's construction needs and cost restraints (design brief), develops alternative plans/drawings, from which the quantity surveyor prepares estimates of costs in each alternative. The client then chooses his preferred design, the architect prepares detailed design plans and the quantity surveyor a bill of quantities. The construction work is then put up to tender, either to a selected number of builders or on a totally open tender basis. The builders estimate the costs involved in the project, add their required profit margin and estimate the time scale involved in order to formulate a tender. The client and their advisors consider the tenders and choose the builder to undertake the development. Once nominated the builder sets up his site management system, organises the works, orders the materials and arranges the sub-contractors. The builder and sub-contractors then carry out and complete the works (Franks, 1990).

Latham (1994) suggested that the traditional path is most suitable for well used and normal techniques of construction (traditional construction) and that its main strengths lie in the cost control and quality achievable (See Figure 1.4). Its degree of usage in the UK appears to be declining, as its share of construction volume has decreased from 72% in 1984 to 52% in 1993 (Yisa et al., 1996 & Bond and Morrison, 1994). Most residential construction follows the traditional path to a great degree, however many speculative developers fulfil the role of head contractor themselves and are reasonably involved during the entire process. A famous comment made by Sir Harold Emmerson in his 1962 report on the British construction industry is sometimes still cited as a problem with the traditional procurement path "*...in no other important industry is the responsibility for design so far removed from the responsibility for production*" (Emmerson, 1962). The subsequent Banville Report (1964) led to the realisation that the industry needed to streamline the development process and create more integrated systems, where the design and construction fields would become more co-ordinated. Shorter project periods became of the essence. A number of new procurement paths evolved in order to meet this need for greater integration and efficiency.

1.3.2 Management Procurement Path

The two main types of management procurement are management contracting and construction management. Management contractors directly employ the services of individual sub-contracting firms and enter into contracts with these firms themselves (Dodd and Langford, 1990). Construction management firms, on the other hand, do not enter into contracts with the contractors, instead the client and the sub-contractors are directly contracted to each other. These systems involve the out-sourcing of the traditional project managers role. The role of the project manager is one of co-ordinating client requirements, such that clear instructions from a single source can be provided to the other parties involved in the development (Franks, 1990). Management based paths are decreasing in usage in the UK, from around 12% in 1984 to 6.2% in 1993, according to Bond and Morrison (1994). Construction management and management contracting paths are most appropriate for 'innovative' and complex projects, which may explain why Franks (1990) states that they are most prevalent in the Southeast of England. The main advantages and disadvantages of each path is illustrated in Figure 1.3.

1.3.3 Package Deal Procurement Paths

There are numerous variations in package deal procurement paths, including 'turnkey', 'contractor's design', 'design and manage' and 'design and build'. These terms or path names describe the range of services which the contractors offer to the client. A package deal may involve the contractor in every aspect of the development process, from site finding (turnkey) and arrangement of finance to design and construction (Franks, 1990). These systems evolved primarily in response to the growing awareness of the need to develop more integrated and quicker development systems. The most commonly used of the package deals is design and build, where the contractor is responsible for the design and construction of the development, on a site chosen by the client. Design and build is particularly strong in standardised developments, such as industrial and office buildings in new development areas (Latham, 1994). The main advantages are the time savings which can be achieved, which in turn usually lead to cost savings, allied to the fact that the client has a single point of management contact with the contractor (Smyth, 1996 Franks, 1990 CIC, 1997 & Latham, 1994). Bond and Morrison (1994) found that design and build has been the major beneficiary of the traditional paths decline, having increased from 5% of UK construction volume in 1984 to 35.7% in 1993.

Figure 1.3 Summary of Advantages and Disadvantages of Contract Strategies (Latham, 1994:16)

Parameter	Objective	Traditional	Construction Management	Management Contracting	Design and Manage	Design and Build
Timing	Early completion	✖	✓	✓	✓	✓
Cost	Price certainty before start	✓	✖	✖	✖	✓
Quality	Prestige level in design and construction	✓	✓	✓	✖	✖
Variations	Avoid prohibitive costs of change	✓	✓	✓	✓	✖
Complexity	Technically advanced or complex building	✖	✓	✓	✖	✖
Responsibility	Single contractual link for project execution	✖	✖	✖	✓	✓
Profession Responsibility	Need for design team to report to sponsor	✓	✓	✓	✖	✖
Risk Avoidance	Desire to transfer complete risk	✖	✖	✖	✖	✓
Damage Recovery	Ability to recover costs direct from contractor	✓	✖	✓	✓	✓
Buildability	Contractor input to economic construction	✖	✓	✓	✓	✖

✓ **Appropriate** ✖ **Not Appropriate**

1.4 Residential Construction Sector

Residential construction is projected to account for over £3.7 billion of construction output in 1997, or 54% of total forecast construction output (DOE, 1997a). The researcher estimates that residential construction accounted for up to 80% of the structural timber consumed in Ireland in 1995, based upon a bill of quantities for a 'standard Irish house' (Dunne, 1991) and Coillte's unpublished internal estimate of structural timber consumption for 1995 (see section 2.4.1). In this study residential construction is segmented and examined in various ways. Firstly, private and social housing are examined in the context of general trends in dwelling construction. Secondly, dwelling type is examined and thirdly dwelling construction in the main urban areas is compared to that of the rest of the country.

YEAR	PRIVATE	SOCIAL	TOTAL DWELLINGS	HOUSES APPROX	APARTMENTS APPROX
1985	17,425	6,523	23,948		
1986	17,164	5,516	22,680		
1987	15,376	3,074	18,450		
1988	14,402	1,450	15,852		
1989	17,300	768	18,068	17,743	325
1990	18,536	1,003	19,539	18,718	821
1991	18,472	1,180	19,652	18,866	786
1992	20,982	1,482	22,464	18,645	3,819
1993	19,301	2,090	21,391	17,348	4,043
1994	23,588	3,275	26,863	21,678	5,185
1995	26,604	3,971	30,575	24,491	6,084
1996	30,132	3,593	33,725	27,055	6,670

Table 1.2: Residential Construction Breakdown into Social / Private and Houses / Apartments (CSO, 1997a & DOE, 1997b, 1997c, 1996b, 1995, etc.)

1.4.1 Private and Social Residential

Residential construction in Ireland is dominated by private sector building, which is currently operating at the highest level on record, producing 33,725 dwellings in 1996 (DOE, 1997b). Between 1985 and 1996 the proportion of dwellings constructed by the

private sector increased from 73% (17,425) to 89% (30,132) of total new dwelling construction. Private residential construction has experienced a period of relatively sustained growth since 1988 when 14,402 dwellings were constructed. Significant increases were recorded every year since, except 1991 and 1993. Social housing, which comprises public (local authority) housing and voluntary housing, has also experienced a period of sustained growth, from a record low of 768 dwellings in 1989, to 3,971 dwellings in 1995. 1996 witnessed a slight decline, when 3,593 units were constructed, however, it is forecast that 1997 will result in a return to growth in public housing provision, as an additional 14% expenditure was forecast by the DOE (1997a). Voluntary Housing Bodies are becoming increasingly important in the provision of social housing. In 1995 they accounted for just over a quarter of the social housing constructed. Local Authority completions exceeded 5,000 dwellings in 1986 and declined to 2,960 in 1995 (plus 1,011 voluntary). The major determinant of activity levels in public housing provision is rooted in Government policy and the availability of funds under the Public Capital Programme. Recent Government policies have focused on the facilitation of social housing provision by voluntary housing groups and the private sector, through various initiatives outlined in the "Plan for Social Housing" (DOE, 1991).

1.4.2 Dwelling Type

Dwelling type is a relatively straight forward method of segmentation, as each dwelling can normally be categorised by means of observation. The categories (segments) used by the DOE in their annual and quarterly 'Housing Statistics Bulletins' are - bungalows, detached houses, semi-detached houses, terraced house and flats/apartments. Table 1.3 illustrates the breakdown of dwelling completions for 1996 into these five categories. The researcher has added percentages to the DOE's figures and a new category for combined house types. Table 1.4 shows the percentages of each dwelling type constructed each year from 1992 to 1996.

Bungalow construction has been steadily declining in recent years, from 25.8% in 1992 to 20% in 1996. It is interesting to note however that detached houses have increased in share over the same period from 16% to 25.8%. While there is no statistical breakdown of the proportion of these categories which are single houses as opposed to estate houses, it is probable that a large proportion of the bungalows and detached houses are single-one-off

houses located in rural areas. It has been suggested by various industry sources, that one-off-houses are the most diverse in terms of design and material usage.

Semi-detached houses have remained relatively stable in terms of market share at around a third of new residential construction. They are the core of the lower and middle ends of the estate housing market and are particularly prevalent in suburban type developments. Terraced housing has been largely replaced by apartment development in its traditional environment of the inner city, where housing density levels have always been high. It is interesting to compare the decline of terraced housing to the growth of apartments, over the period from 1992 to 1996, as illustrated in Table 1.4. There is a close correlation between the rate at which apartments grew from 17% to 20%, while terraced housing declined from 7% to 4.2%. The dramatic increase in apartment construction since 1989 when only around 325 units were constructed (1.8% of new construction) can be compared to the 1996 situation where 6,670 units (or 20% of new dwellings) were constructed. This swing towards apartment development has been driven by the availability of tax incentives for development in various neglected inner city areas, which require high density developments due to the high cost and restrictive size of sites in these areas.

Area	Bungalow	D. House	SD House	Terraced	All House	Flat/Apt.	Total
Dublin City	3 1%	397 9%	421 10%	402 10%	1,223 30%	2,902 70%	4,125 100%
Total * Dublin	87 1%	765 8%	4,400 47%	613 6%	5,865 62%	3,581 38%	9,446 100%
Cork City	33 4%	146 17%	282 33%	71 8%	532 62%	327 38%	859 100%
Cork County	868 35%	824 33%	465 20%	150 6%	2,307 94%	154 6%	2,461 100%
Total** Boroughs	59 1%	766 12%	1,290 21%	480 8%	2,595 42%	3,549 58%	6,144 100%
Total *** Counties	6,586 24%	7,817 29%	8,733 32%	920 3%	24,056 89%	3,121 11%	27,177 100%
Total Ireland	6,645 20%	8,583 26%	10,023 30%	1,400 4%	26,651 80%	6,670 20%	33,321 100%

* Total Dublin = Dublin City/Borough, Dun Laoghaire-Rathdown, Fingal and South County Dublin (whereas Dublin and Cork cities are the Borough areas only)

** Total Boroughs = The totals for Dublin, Cork, Galway, Limerick and Waterford Boroughs

*** Total Counties = All dwellings in the county council and urban district council areas, but excluding the Borough areas.

Table 1.3: New Dwelling Completions From 1st January to 31st December 1996 (Adapted from DOE, 1997b & DOE, 1997c)

Year	Bungalow	Detached House	Semi-Det House	Terraced House	Flat/Apart-ment
1992	25.8%	16.0%	34.2%	7.0%	17.0%
1993	25.3%	17.1%	33.6%	5.1%	18.9%
1994	23.0%	16.8%	35.4%	5.5%	19.3%
1995	22.4%	18.1%	34.4%	5.2%	19.9%
1996	20.0%	25.8%	30.0%	4.2%	20.0%

Table 1.4: Type of New Dwellings Nation-wide 1992-1996 (DOE, 1997b, 1996b, 1995 etc.)

1.4.3 Location of Housing

Locational factors appear to have a distinct influence on the number and type of dwellings constructed. The most obvious example of this can be extrapolated from the DOE statistics, which show that around 29% of the dwellings constructed in 1996 were build in Dublin City and County, whereas County Laois for example accounted for a mere 1.2% (DOE, 1997b). The Borough areas of Dublin, Cork, Galway, Limerick and Waterford had an average of 58% apartment development, compared to just 11% for the rest of the country. Dublin City Borough alone accounted for 43.5% of the apartments developed nation-wide in 1996 and in the rest of Dublin accounted for a further 10%. Not surprisingly the opposite trend is obvious in relation to bungalow construction, which is primarily a feature of rural areas. In Dublin City and County for example, only 1% of new dwellings constructed were bungalows, or 1.3% of the national total. Cork County (excluding Cork City) on the other-hand had more bungalows than any other type of dwelling constructed in 1996, accounting for just over 35% of their total new homes. The average proportion of bungalows and detached houses combined in the Boroughs was 13%, whereas for the rest of the county it was over half. This is indicative of the earlier point that a lot of these house types are likely to be one-off rural houses, where there is less pressure on land availability. The final point on locational patterns relates to the level of semi detached housing development taking place in the suburbs of Dublin. The national average for 1996 was 30%, however in County Dublin semi-detached houses accounted

for 47% of total residential construction, while in the City Borough they only accounted for 10%.

1.5 PEST Analysis of Residential Construction

PEST is an acronym for political, economic, social/cultural and technological analysis of environmental forces (Tiernan et al., 1996), each of which is briefly examined below in relation to residential construction.

Economic conditions in Ireland have been very favourable for the residential construction industry over the last couple of years, with the ease of loan finance availability at the lowest sustained interest rates in 30 years, and very low inflation with rising real incomes (O'Donoghue, 1997 & ESRI, 1997). These factors have helped to build both the confidence and capacity of the industry to increase output and to lift demand for new housing within the general economy. The level of unemployment is dropping and this allied to changes in demography, is resulting in a rapidly decreasing rate of economic dependency. In the mid 1980's there were around 230 dependants for every 100 workers, however it is projected that this will have reduced to 125 dependants per 100 workers by 2010 (ESRI, 1997). Smaller households and higher levels of headership are fuelling demand for residential accommodation.

Social factors such as changing demography are also having a profound effect on demand for housing. Ireland is currently experiencing a period of net immigration (approximately 6,000 in 1996). This is due to three main forces: - the return of previous emigrants, - the entry of thousands of political and economic immigrants - and the dramatically reduced levels of long term emigration. Household size has dropped from 2.45 adults (over 20 years of age) per household in 1971 to 2.17 in 1996 and it is projected to continue dropping to around 1.98 by 2011 (ESRI, 1997). The number of children per household is also dropping, from around 1.7 in 1971 to around 0.7 in 2011 (ESRI, 1997). Headership rates, which measure the proportion of each age group who are heads of households, are increasing. This may be explained by the decline of the nuclear family and that household formation is no longer determined by the traditional family formation patterns. The rate of marriage is declining and fertility levels are decreasing, both marriage and parenthood are being deferred. The generation of the baby boom of the 1970s and early 1980s are now

aged between about 15 and 24 and are beginning to enter the housing market, at a time when educational and employment prospects are at an all time high in Ireland. The birth rate has declined from its century peak of over 74,000 in 1980 to around 48,000 in 1995 (CSO, 1996 & ESRI, 1997). Life expectancy, while still below the European average has increased from 57 years for men and 58 for women in the 1920s to 73 for men and 78 for women in 1996 (ESRI, 1997). Marriage break-ups are on the increase, which is also having an effect on household formation levels, as is the increasing economic independence of the female population. All of these factors are leading to decreasing household size and increasing demand for both existing and new housing stocks. In the larger urban areas this has resulted in a proliferation of apartment developments in order to cater for the demand for smaller dwellings in central areas (Society of Chartered Surveyors, 1995 & Williams, 1995). Increased demand is not only manifested in the owner occupier sector, but also in the rental market, which is experiencing chronic shortages particularly for the growing third level student population. Rents are rising at a rate of around 15-20% per annum (O'Donoghue, 1997).

Political influences which affect residential construction include both national and local policies on various factors such as designation, mortgage interest relief, stamp duty, VAT on building materials, local taxation, provision of serviced development land, zoning and general economic policies. National and local governments can adopt policies in any, or all, of these areas in order to create or inhibit a development friendly environment. In the 1980s the introduction of various tax reliefs for specific types of development in specified areas, acted as a catalyst to the construction industry and resulted in the rejuvenation of various dilapidated areas of our cities and towns, most notably Temple Bar and the Financial Services area in Dublin. (SCS, 1995 Williams, 1996 & MacLaren, 1995).

Technologically the construction industry is advancing relatively quickly, with the increasing mechanisation of building sites and the growing use of pre-assembled building components, such as precast concrete floors and factory made (prefabricated) roof trusses. This is speeding up construction considerably and reducing the on-site labour requirements. However it is increasing the need for skilled personnel to operate large scale machinery on site such as cranes and loaders. These changes have been particularly evident in apartment construction (CIC, 1997).

1.6 Potential Resource Constraints for Residential Construction

The residential construction industry is potentially constrained by three main factors. Firstly, the demand for new dwellings, which is currently very strong as discussed above. Secondly, governmental and economic influences. Thirdly, the availability of resources such as land, materials, industry capacity and labour.

Construction materials production is estimated to have declined by 23% in volume terms, between 1981 and 1988, with a decline of 41% in the volume of materials produced for the home market and an increase of 68% in production of building materials for the export market (ERU, 1992). The full impact of the decline in construction demand on the building materials sector in Ireland during the 1980's was softened through this increase in exports. The availability of building materials is unlikely to act as a restraint to the expansion of the construction industry for the following reasons:

- Various sectors of the materials production industry have under-utilised capacity, which could be brought into operation, whenever demand requires;
- The increased export volume can be rediverted to the home market;
- The materials market is open to import penetration/substitution, particularly from the UK.

Capacity in the construction industry can be a problem when responding to changes in market demand, particularly for less versatile firms with large full-time staffs. The recession in the construction sector during the 1980's had a major impact on the contracting sector, which can be illustrated by a brief examination of the data available relating to larger firms. The number of large firms (with 20 or more persons engaged) declined from 468 in 1981 to 244 in 1987. The number of direct employees of larger construction firms declined by 69% between 1981 and 1987 and the average number of direct employees per firm fell 41% (DOE, 1993). These sort of changes in industry scale and structure can not be reversed over night and some can have long term effects on the industry's capability to respond to increasing demand.

Labour and tradesmen availability is tied to the industry capacity, in so far as the first effects of a downturn in the industry will be a reduction in the levels of casual and non-

permanent employment. The industry has restructured in recent years, where developers and contractors have minimised their employment requirements by subcontracting individual elements of the building process to specialists. The lack of employment security which is a characteristic of the industry, has led many skilled workers to emigrate during periods of recession, such as the 1980s. This has resulted in severe shortages of various trades in recent years, causing builders to look at alternative, less labour intensive methods of construction, such as precast and framed structures. It has also resulted in the Construction Industry Federation advertising in the UK to encourage Irish skilled migrants to return home and the initiation of a register of same which can be matched to vacancies which arise in Ireland (Oliver, 1997 & DOE, 1997a)

Land availability suitable for development can become a significant constraint on the industry during periods of sustained development activity. It becomes difficult to locate suitable serviced and zoned land for development sites. This shortage leads to rapid inflation in building land prices, as occurred in the late 1970s and early 80s and is being repeated as we approach the millennium. A significant feature of recent development trends is the amount of high density infill development which has taken place, as opposed to the more traditional residential greenfield site developments, which has helped to relieve the demands on new services (e.g. water, sewage, electricity and gas). However, the majority of suitable development land in the inner city areas has now been developed and as such the lack of available land is becoming a major restraint to further residential and commercial development, despite the continuing strong demand for new dweillings. The price of development land has grown to such a level that certain developers are unable to purchase sites and as such are going out of business, or diversifying into other sectors of the construction industry, such as industrial, according to Joe Moran of Manor Park Homes and Michael Bailey of Bovale Developments (FitzGerald, 1996). This is leading to the emergence of a number of large and powerful development firms such as Manor Park Homes, Bovale Developments and Zoe Developments, who can through economies of scale, strong financial backing and an aggressive market approach, afford to purchase a large proportion of the scarce serviced land as it becomes available. Some of the stronger development firms managed to build up land banks, or reserves, during the late 1980s and early 1990s. Abbey for example have approximately 650 plots in their Irish land bank (Murdock, 1997), while Bovale have around 500 acres in their land bank (FitzGerald, 1996).

1.7 Conclusions

This chapter established the importance of construction in the overall economy and particularly focused on the dominant residential construction sector. The trends in residential construction were discussed in terms of structure and participation. House building has more than doubled since 1988, to reach historically unparalleled levels as we approach the millennium. The growing importance of apartments, at the expense of terraced housing was also highlighted. A PEST analysis of the sector, was followed by a discussion of the main potential resource constraints. Land and labour availability emerged as important factors which may constrain new housing supply if demand continues to expand at recent levels. Chapter 2 provides an overview of the timber industry and includes an analysis of structural timber use in residential construction. In order to examine structural material choice processes in residential construction, the third chapter reviews the literature in relation to organisational buying behaviour and develops a study framework.

CHAPTER 2

TIMBER INDUSTRY REVIEW

Chapter 2: Timber Industry Review

2.0 Introduction

This chapter follows on from the construction industry review in the context-building phase of the study, providing an overview of the timber industry in Ireland. It starts with a brief review of the forestry sector and progresses to a more detailed review of the timber processing sector. An analysis of timber consumption in residential construction forms the final section of the chapter, which ties the construction and timber industries together and provides the most comprehensive analysis of this subject in Ireland to date.

The Irish timber industry has undergone major development in the last number of decades and is currently in a period of extensive restructuring. Information on the industry is very fragmented and much of what is available is either incomplete or contradictory. The Coillte Allocation Scheme (CAS), which was the system used for log disposal to sawmills up to the start of 1997, required sawmills to submit operational information to Coillte in order to assess their roundwood allocation. This information is no longer available to Coillte and there is little or no data derived from end use available on the timber industry in Ireland. The import/export figures are considered to be relatively poor (Murphy, 1995) and there is little data available on stock holding levels.

This chapter aims to mesh the available information to provide an overview on the Irish timber industry. The researcher's understanding of the timber industry path from forestry plantation establishment to processing and through to end use is illustrated in Figure 2.1. The timber processing sector is examined, using Porter's Competitive Forces as a framework (Figure 2.2).

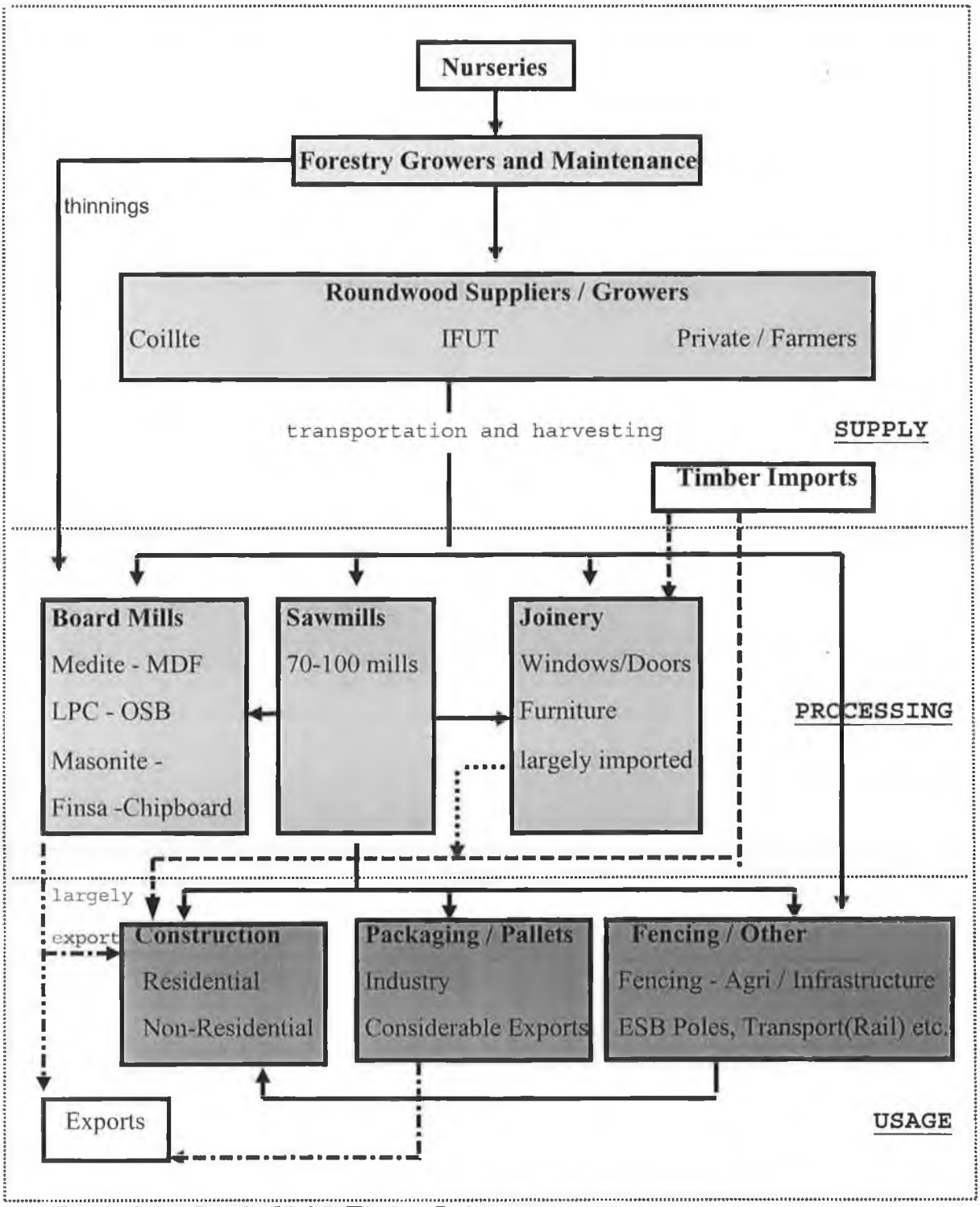


Figure 2.1: Model of Irish Timber Industry

2.1 Forestry Sector

The life blood and primary driver of activity in the timber industry is the roundwood producing forestry sector, which was the subject of a recent strategic review by the Department of Agriculture. *"Forestry is a complex activity - a renewable resource with a minimum 40 year cycle, an alternative agricultural land-use, an agent of landscape*

change, a wildlife habitat, an environment for recreation and, not least, the source of raw material for a range of timber based industries" (DOA, 1996:1). This study is solely concerned with the latter timber based uses, however, it should be noted that the other factors mentioned are becoming increasingly important considerations in the establishment and management of forestry. In 1993 Coillte, the State owned company charged with the ownership and management of around 5% of the land area of Ireland, owned 334,000 Hectares (ha) of forested land, while the private sector estate totalled around 87,000ha (DOA, 1996). The proportion and number of private forestry owners has been increasing dramatically over the last decade or so, primarily driven by the EU funded afforestation grant schemes (DOA, 1994a&b and O'Neill, 1995). Private sector planting has exceeded planting by Coillte since the early to mid 1990s. Sitka Spruce is the predominant tree species in Ireland, accounting for 62% of Coillte's forestry estate in 1995 (Coillte, 1995) and their planting in 1996 was 79% Sitka (Coillte, 1997).

Coillte supply 95% of the roundwood to the Irish sawmills and pulpwood (forestry thinnings) processors (DOA, 1996). However, Coillte's share of forest ownership dropped to 72% by 1994 and is being increasingly eroded as private planting has exceeded Coillte planting since 1994. The Irish Forestry Unit Trust (IFUT) was established in 1994 by Coillte, AIB and Irish Life, as a vehicle for investment funds to get involved in Irish forestry investment. By the end of 1996 in excess of 80 pension funds investing in it (Coillte, 1997 & IFUT, 1995).

It has been estimated that 1.5 to 2 million hectares of Irish land is ideally suited to forestry development (Business and Finance, 1992). The Strategic Plan (DOA, 1996) has targeted the expansion of the forestry estate to 17% of the country, or 1.2 million hectares by 2030. However, the price of this land has dramatically increased in recent years due to greater interest in forestry and the onset of the Rural Environmental Protection Scheme (REPS), which 'competes' for the same type of marginal land.

2.2 Timber Processors

The timber processing industry has developed from primarily producing low value timber products for local markets, to a more value-added export orientated industry. In 1978 Irish sawmills held only 15% of the national market for sawnwood, there were around 140 sawmills in the country, three board mills and one paper mill (Simons, 1991). Two of the

board mills have closed, as has the Clondalkin paper mill. However, in recent years new board mills are establishing in response to the increasing supply of raw materials. In 1970, 700,000 cubic metres (m^3) of timber was supplied by Coillte, by 1996 this had increased to over 2.2 million m^3 (Coillte, 1997). Coillte sold 1.38 million m^3 of medium and large roundwood primarily to sawmills and 0.845 million m^3 of pulpwood primarily to board mills in 1996 (Coillte, 1997). The data on the number of sawmills and the proportion of timber that the largest sawmills process, vary across 3 different industry reports. COFORD (1994) state that there are around 70 mills and that the 12 largest consume 79% of the roundwood. Coillte (1995) state that there are around 80 mills, the 12 largest of which consume 85% of roundwood. The DOA (1996) state that there are around 100 mills, the 10 largest of which consume 80% of the roundwood. Given the general consensus that the number of sawmills is contracting rather than growing, these figures give an indication of the questionable accuracy of the available industry reports.

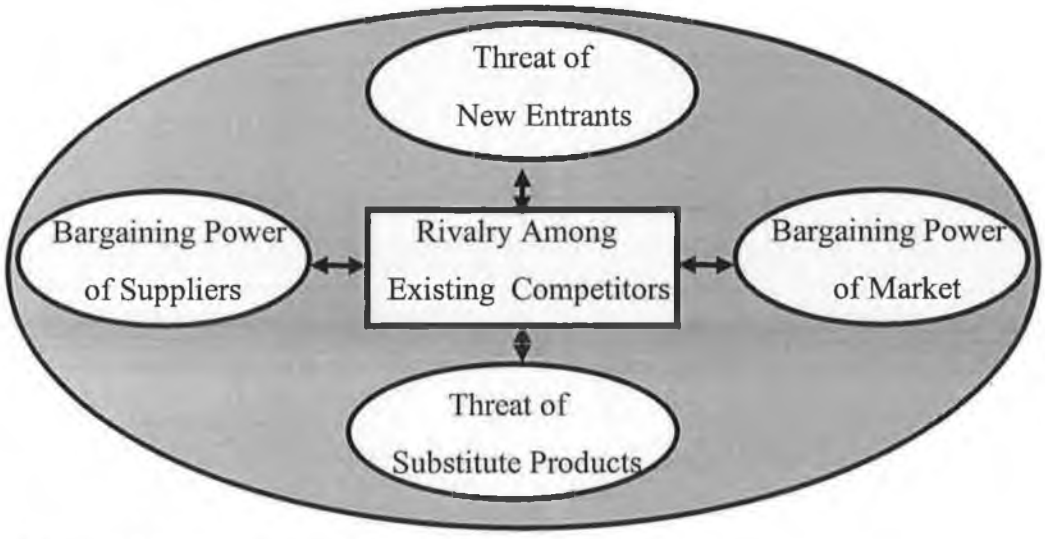


Figure 2.2 Competitive Forces (Porter, 1980)

2.2.1 Competitive Forces (Figure 2.2) - Timber Processors

Rivalry is high within the sawmill sector, as there is considerable over-capacity in the existing facilities, which has resulted in intense competition for the acquisition of roundwood and is leading to major restructuring of the sector. There were estimated to be around 140 mills in 1978 (Simons 1991) and by 1995 COFORD estimated that the number was around 80. It is likely that a number of these mills will disappear or undergo significant restructuring in the coming years, either through mergers, take-overs or closures (Sunday Business Post, 1995 & Irish Indo., 1995 & 1996c). Up to the mid 1990's all the sawmills, with the exception of Woodfab (Smurfit Group), were family based

businesses. On an international scale all Irish mills are considered small to medium sized. Coillte have now moved into the sawmilling industry by acquiring equity stakes in 2 sawmills, much to the dismay of the Irish Timber Council (Coillte, 1997& SBP, 1996a&b). *"Our aim is to become an integrated forest products group"*, according to the Patrick Cooney the Chairman of Coillte (SBP, 1996a). The increasing use of technologies such as kiln drying and pressure preservation treatment has meant that the more progressive mills have been able to supply an increasing proportion of the structural timber market, thus displacing imported timber. Inter-mill competition in the lower grade uses such as pallets and fencing is very strong.

A number of factors are considered as disincentives more so than ***barriers to new entrants*** into the sawmilling sector. Timber sawmilling is becoming increasingly capital and knowledge intensive. Forbairt are no longer encouraging the establishment of new mills. The proliferation of existing mills which are either trading at a loss or already closed (Murphy, D., 1996 SBP, 1995 & Irish Indo, 1996c) leaves ample opportunity for expanding Irish mills or foreign mills to acquire existing facilities rather than establishing new mills. The establishment of new and expansion of existing boardmill capacity in recent years is projected to meet the increases in pulpwood and sawmill residue supplies for at least the next ten years. *"The demand for pulpwood and sawmill residues from the panel board plants means that there is now no room for any further consumers of the raw material to establish themselves here this side of the year 2005"* (Kenna, 1996). All the board mills are foreign owned, Finsa the chipboard manufacturer in Scarriff Co. Clare is Spanish owned, the other three are primarily American owned. Medite, the Clonmel based Medium Density Fibreboard (MDF) manufacturer, was recently acquired by Williamette, the largest MDF manufacturer in the US. Louisiana Pacific / Coillte (LPC) the Oriented Strand Board (OSB) manufacturer recently established in Waterford, is a partnership between Coillte (35%) and the US timber processor Louisiana Pacific (65%). Masonite in Co. Leitrim which opened earlier this year, is the third US company manufacturing timber based products in Ireland and using their location as a gateway to the European market. (Kenna, 1996 Yeates, 1996 & Young, 1995).

The ***bargaining power of suppliers*** is currently high. As discussed already Coillte is the primary supplier to the sawmill sector, however, their dominance will be challenged when the recent upsurge in private planting reaches harvesting stage in around 2020. It has been suggested that the sawmillers spent more time and energy trying to get the Coillte

Allocation Scheme changed than they did on developing their own operations and markets (Simons, 1991 & SBP, 1995). However, since early 1997 a new electronic log auctioning system for the disposal of Coillte's logs has been established, with the full co-operation of sawmillers and their representative body the Irish Timber Council (ITC). The private growers will need to develop a co-ordinated approach to negotiating the disposal of early thinnings to the board mills. Coillte, the various forestry management companies, the Irish Timber Council and the Irish Timber Growers Association may all have a role in the creation of a centralised market for pulpwood and roundwood. The pulp processing board mills have all entered into long term supply contracts with Coillte, while the residue processors primarily operate on shorter term supply contracts with the sawmills. Suppliers' bargaining power is likely to increase due to the massive growth in demand for these low value materials. The total processing capacity of the board mill sector has increased from around 200,000 m^3 in 1990 (Murphy, 1991) to 1.77 million m^3 in 1995 and processing is currently running at around 1.4 million m^3 (Kenna, 1996).

The level of ***bargaining power of the market*** for the timber processing sector's products in Ireland is generally quite high, because in most cases the purchasers have the option of substituting imported timber for Irish timber. Most of the construction related timber products are distributed through builders providers, importers and exporters, who are in a reasonably strong bargaining position due to the large number of sawmills and the well established international trade in timber products (Murphy, 1991 & Simons, 1991). There appears to be a perception amongst many members of the construction industry that imported timber is superior in quality to Irish. However, the implementation of an Irish quality standard for structural timber (SR11) in advance of the common European standards (CEN), has to some degree helped to deal with this problem. The main point of differentiation for Irish timber appears to have been price due to its historical image as being of inferior quality, which tends to increase the bargaining power of buyers considerably. The lower value packaging products are particularly prone to price based competition. A large proportion of timber packaging / pallet products are exported to the UK market, which has been the source of considerable problems for the industry in recent years due to the unfavourable exchange rates which prevailed for a large portion of the mid 1990s. The industry was advised to target this market during the late 80s and early 90s due to the abundance of suitable low value, small size timber. Many sawmills entered into long term fixed price Sterling based supply contracts, which ended up making

considerable losses for them, due to the rising price of timber and unfavourable exchange rates.

Irish timber is now substituting much of the traditional import products. Increasing log production in Ireland means that the industry has to become more export orientated whilst continuing to increase their share of the domestic market. The increasing emphasis on adding value through services, is an area which should be closely examined by Irish mills. This includes linkages in just-in-time production systems, particularly in the pallet and construction materials markets.

Substitute products constitute a considerable threat to Irish timber products in all sectors. This threat arises from two fronts, firstly from imported timber products and secondly from non-timber based materials such as plastic, metal and concrete.

2.3 End Usage

As already stated, there are no end user based studies of timber consumption in Ireland (Murphy, 1991&1995). All the studies to date have attempted to estimate apparent consumption from a production perspective rather than working from first principles. The most comprehensive estimate of apparent timber consumption was carried out in 1991 by Simons Strategic Services, a Canadian Consultancy Firm, in relation to 1990 timber consumption. *"Simons estimated the breakdown of total softwood consumption levels into the various end use sectors. Estimating apparent consumption by these methods is relatively crude since it ignores issues such as time lags, stocks position, etc."* (Murphy, 1995).

Simons's estimated consumption of both domestic and imported timber is shown in Tables 2.1 and 2.2. It can be seen that the construction sector is estimated to have consumed 55% of total estimated timber consumption in Ireland in 1990. It is interesting to note that in 1995 Coillte's Marketing Department devised the most recent estimate of total derived timber consumption in Ireland. This was unpublished and for Coillte's internal use only. It was estimated that in 1994 around 660,000 m^3 of timber was consumed, of which 360,000 m^3 (54.5%) was estimated to have been consumed by the construction industry, 140,000 m^3 by the packaging sector, 100,000 m^3 by joinery and 60,000 m^3 by fencing and other uses.

The area of particular interest in this study is the use of structural timber in residential construction and the remainder of this chapter focuses on this aspect.

End Use	Domestic Production		Domestic Consumption		Export Shipments	
Pallet	205,000	(50%)	130,000	(40%)	75,000	(83%)
Construction	180,400	(44%)	175,400	(55%)	5,000	(6%)
Fencing/Other	26,600	(6%)	14,600	(5%)	10,000	(11%)
Total	410,000	(100%)	320,000	(100%)	90,000	(100%)

Table 2.1: Approximate End Use of Domestic and Imported Timber 1990 (m^3) (Simons, 1991:6-8)

End Use	Domestic Supply	Import Supply	Total Supply	% Domestic
Pallet	130,000 (40%)	10,000 (4%)	140,000 (24%)	93%
Construction	175,400 (55%)	155,000 (59%)	330,400 (56%)	53%
Fencing/Other	14,600 (5%)	0 (0%)	14,600 (3%)	100%
Joinery	0 (0%)	99,000 (37%)	99,000 (17%)	0%
Total	320,000-100%	264,000-100%	584,000-100%	55%

Table 2.2: Domestic Consumption by Irish/Import Supply 1990 (m^3) (Simons, 1991:6-8)

2.4 Timber in Residential Construction

This study revolves around the choice of structural materials in residential construction, with particular emphasis on structural timber. For this reason it is considered important to provide an analysis of the available data on structural timber use in this sector. Initially an estimate of total structural timber use in the residential sector is provided and then a brief outline of recent trends in timber use is provided for the main structural elements of residential construction. The predominant system of housing construction in Ireland involves the use of insitu concrete foundations and ground floors, tongued and grooved floor boards or chipboard on timber joists at upper floors, concrete block / brickwork

external walls, timber and plasterboard stud partition non-load bearing internal walls, concrete block load bearing internal walls and tiles or slates on timber framed or trussed roof.

There have been relatively minimal changes in this system over recent years. Some recent developments in the industry may in the future have a profound effect on material usage. For example, the increasing use of timber frame construction will effect the concrete industry's share of the materials market. Equally timber could be affected by the concrete industry's attempts to launch various energy efficient or lightweight concrete products, the most dramatic of which is the eco-house by Breton and CRH, which is constructed almost exclusively using concrete structural components. Energy efficiency is becoming a key consideration in new residential construction (Dunne, 1991 and Smyth et al., 1997) and is being used as the main selling point behind various new composite concrete products and both timber and concrete frame housing systems. Steel frame construction is emerging in the US as an alternative to the traditional timber frame systems, this is primarily due to increasing timber prices according industry sources (Pieters, 1996).

2.4.1 Estimate of Structural Timber Use in Residential Construction

The Simons (1991) estimate of derived timber consumption was based upon trade and production figures for 1990 supplied by Coillte (CAS returns) and the CSO trade statistics. These estimates are approximate and outdated. The three categories used are very broad, they are; pallet, construction, and fencing/other; and are based on processors estimates as opposed to end use estimates. For this reason the researcher has endeavoured to provide an estimate of timber consumption in the residential construction sector, which is based upon estimated timber consumption per dwelling (end use) rather than simply on industry production estimates.

From Brendan Dunne's (1991) bill of quantities for a 'Standard Irish House', the researcher calculated the total volume of timber used in each structural element and found that a total of 10.5 cubic meters (m^3) of timber was used. This was then multiplied by the total number of houses built in 1995 (24,491). It is known that considerably less timber is used per apartment than per house, in fact in Japan the average volume of structural timber per multi-storey residential unit is approximately $3m^3$ (Pesonen and Cohen, 1996). The researcher acknowledges that there are likely to be significant differences between

Japanese and Irish construction. It is felt that this statistic still gives reasonable grounding to the assumption that approximately 5 m^3, or less than half the volume of structural timber used in housing, is used per apartment in Ireland. Apartment development here is relatively low rise in comparison to Japan and as such is likely to incorporate somewhat more timber. There were a total of 6,084 apartments built in Ireland in 1995. This brings the total structural timber consumption in residential construction for 1995 to approximately 290,000 m^3.

According to the Marketing Manager of Coillte approximately 330-360,000 m^3 of structural timber was used in Ireland in 1995, which means that according to the researcher's estimates, residential construction accounted for around 80% of the structural timber used in 1995, or around 44% of total sawn timber consumed (660,000 m^3 - estimated by Coillte). However, the study estimate of residential construction timber consumption has caused Coillte to question their own production and trade based estimates. This highlights the need for a complete end user based analysis of timber consumption to be undertaken.

2.4.2 Timber Use in Structural Elements

The data from the 'Private Housebuilding in Ireland' reports (ERU, 1976-1993) is used in this section to develop a picture of recent trends in structural material use within the various structural elements of residential construction. This survey was been carried out and reported annually from 1976 to 1993, by the Environmental Research Unit and was compiled in an overall report by Ryan and Leahy (1995). Around 90% of the estate houses constructed each year were covered and a random sample of single houses in seven counties were also included in the survey. These counties were Carlow, Kilkenny, Mayo, Westmeath, Cork, Donegal and Monaghan. The information provided on estate houses was collected through a survey of house-builders, while the single house information was gathered through planning office searches in the selected counties.

The data in relation to ground floor construction, upper floor construction, external wall construction and roof construction, are all examined. The survey does not cover internal walls. It is felt that the majority of load bearing internal walls and party walls (dividing two dwellings in apartments and semi detached or terraced housing) are constructed of concrete blocks, while partition walls are primarily constructed using timber stud and

plasterboard. Tables 2.3 and 2.4 illustrate the results of this survey for six different years over the life of the survey, for estate houses (Table 2.3) and single houses (Table 2.4).

	Ground Floor			Upper Floors					Roof		External Walls		
year	con-crete	T&G	chip-board	con-crete	T&G	chip-board	ply-wood	none	timber trussed	timber framed	hollow block	cavity block	timber frame
1976	69%	24%	7%	0%	50%	41%	5%	4%	84%	16%	86%	14%	0%
1980	76%	24%	0%	0%	66%	30%	0%	4%	90%	10%	58%	42%	0%
1986	97%	3%	0%	2%	49%	37%	2%	10%	71%	29%	60%	39%	1%
1990	99%	1%	0%	1%	71%	20%	1%	7%	76%	14%	48%	51%	2%
1992	99%	1%	0%	1%	71%	18%	5%	5%	80%	20%	56%	41%	3%
1993	99%	1%	0%	1%	72%	18%	6%	3%	84%	16%	61%	35%	3%

Table 2.3 Percentages of Materials Used in Estate House Development 1976-1993 (Ryan and Leahy, 1995)

	Ground Floor			Upper Floors					Roof		External Walls			
year	con-crete	timber	timber & con	con-crete	T&G	chip-board	ply-wood	none	timber truss	timber framed	hollow block	cavity block	timber frame	PC concrt
1976	76%	12%	12%	1%	11%	0%	0%	88%	29%	71%	2%	95%	0%	3%
1980	76%	3%	21%	2%	11%	1%	0%	86%	29%	71%	1%	97%	1%	1%
1986	98%	1%	1%	1%	20%	3%	0%	76%	27%	73%	1%	99%	0%	0%
1990	99%	0%	1%	2%	37%	3%	1%	57%	30%	70%	1%	99%	0%	0%
1992	100%	0%	0%	1%	39%	3%	0%	57%	22%	78%	0%	99%	0%	0%
1993	100%	0%	0%	2%	43%	1%	1%	54%	23%	77%	0%	99%	0%	1%

Table 2.4 Percentages of Materials Used in Sample of Single Houses 1976-1993 (Ryan and Leahy, 1995)

2.4.3 Ground Floors

Concrete is now more or less exclusively the material used in ground floor construction, both in estate and single house development countrywide. However, in 1976 concrete ground floors only accounted for 69% of estate houses and 76% of single houses. Considerable differences existed on a regional basis, in the East (excluding Dublin) 87% of estate houses used concrete floors, whereas in the West only 56% were concrete. In

1980 (figures not available for 1976) the single house survey indicated that both Cork and Mayo used 89% concrete floors, while Monaghan used a mere 45%. Tongued and grooved (T&G) timber flooring on suspended timber joists has more or less disappeared in the vast majority of new construction, accounting for a mere 1% of estate houses in 1993 and 0% single houses. Concrete floors are easier to construct and are perceived as having a longer life, they also eliminate the need to incorporate separate fire proof and water resistant protection zones around kitchens and fireplaces, as is required with timber floors.

2.4.4 Upper Floors

By 1993 the main material used in upper floor construction was tongued and grooved (T&G) boards on timber joists, constituting 72% of estate house upper floors and 93% of the single houses with over one storey. In 1976 only 50% of estate houses used T&G floors, while 41% used chipboard. Chipboard has become far less common in construction in recent years, only 18% of estate house upper floors used chipboard in 1993. Concrete upper floors fluctuated between 0% and 2%, in both estate and single houses over the duration, which indicates the difficulty which the concrete industry has experienced in its various attempts to launch precast concrete upper floors in the housing industry. However, these statistics exclude apartment development, which now represents 20% of Irish residential construction and is dominated by precast concrete upper floors. The recent introduction of oriented strand board (OSB) into the European market may make in-roads into the structural board market, at the expense of plywood and chip board, however early indications show little impact, thusfar.

2.4.5 Roofs

There is a marked contrast between the extent of use of prefabricated timber roof trusses and site built timber framed roofs in estate houses and single houses. The predominance of trusses in estate houses has remained relatively constant over the survey period at 84% nationally. However, regional differences are evident with 68% trussed in the South and 90% in Dublin estates in 1993. The use of framed roofs in single house construction increased from 71% in 1976 to 77% in 1993, the most dramatic increase was in the Carlow/Kilkenny area where framed roofs constituted 45% in 1976 and 92% in 1993. There also appears to be a mix of framed and trussed roofs used in apartment developments, as quite often the roof structures can be relatively complex and non-standard, which favours the use of site constructed framed roofs. Flat asphalt on concrete

decking roof covers are also relatively common in apartment developments, as it facilitates the provision of roof gardens, which increases the site coverage ratio allowable within the planning system.

2.4.6 External Walls

Hollow block single leaf remains the dominant form of external wall construction in estate houses, accounting for 61% nationally in 1993, however this is a reduction from 91% in 1976. Dublin estate houses still predominantly use hollow block single leaf walls, accounting for 93% in 1993, however, double leaf cavity walls increased in use nationally from 14% in 1976 to 35% in 1993. Cavity walls have been predominant in single house construction since the start of the survey, accounting for 95% in 1976 and 99% in 1993.

Timber frame construction has been increasing over the last few years particularly in the single house sector. Even though this is not represented in the survey findings, it does indicate that 3% of estate houses built in 1992 and 1993 used timber frame. Industry sources indicate that timber frame is steadily gaining market share. While there are no current official statistics available, estimates of its share vary between 5% and 15% of the new housing market according to industry sources. The researcher feels that a reasonable estimate would be around 8-10%, however its adoption at the moment is occurring on a sporadic regional basis, in areas such as Kildare, Laois and Monaghan.

2.5 Material Selection Criteria in Construction

In examining the use of structural timber in residential construction, it is important to identify the criteria which industry participants consider in the selection and specification of structural materials. The Construction Marketing Network (CMN, 1997) carried out a survey of American contractors, specifiers, readymix concrete producers and precast concrete producers, in order to assess the relative importance of 11 different building product selection criteria. These were: product quality, price/value relationship, product availability, experience with brand, manufacturer's reputation, technical support, manufacturer's warranty, ease of application, design flexibility, product appearance and energy efficiency. Product quality was rated as the most important criteria by all four groups and value for money was rated within their top five. Contractors and producers are also concerned with product availability, while specifiers showed a greater interest in product appearance and manufacturer's reputation (CMN, 1997).

A survey of North American (Canadian and US) specifiers (architects and structural engineers) of structural materials in non-residential construction, found that the most important design considerations in structural material selection are as follows: architectural considerations (light, space, sound, function, etc.), the cost of installing the materials, whether or not the product has a proven track record, material strength, material longevity; fire performance of the material and preference of the architect or the structural engineer. The least important design considerations were found to be product guarantees, proximity to other buildings, environmental considerations, availability of tradespeople, building resale value and preference of the contractor (Kozak and Cohen, 1996).

Both of these surveys raise a number of questions in relation to the selection and specification criteria of the Irish construction industry when choosing structural materials and particularly as to how these criteria effect structural timber use in residential construction.

2.6 Conclusions

The Irish timber industry is in a period of dramatic change and is likely to remain so for the foreseeable future as sawmills scramble to survive, boardmills compete for supplies, foreign timber industry giants strive to continue their globalisation drive and Coillte attempt to increase involvement in processing (Mather, 1995 Irland, 1995 & Cohen and Smith, 1992). There are concerns over the lack of management and silvicultural expertise and backup available to the thousands of private forestry owners. The Government must ensure that the current levels of planting (20-30,000 ha per annum) are sustained once the current round of European funds cease in 1999. If it is not maintained on a continuous basis, there is little point in developing a processing industry to deal with what could be a 5-10 year glut of roundwood. The interdependence between the timber industry and the construction industry is emphasised by Gregory (1987) and can be seen from the timber use estimates, which suggest that around 40-45% of timber consumed in Ireland is used in residential construction. The brief examination of two material choice criteria studies at the end of this chapter leads into the next section of the study, which examines organisational buying behaviour inn the context of material choice processes.

CHAPTER 3

MATERIAL CHOICE PROCESSES AND ORGANISATIONAL BUYING BEHAVIOUR

Chapter 3: Material Choice Processes and Organisational Buying Behaviour

3.0 Introduction

The initial two chapters of this study examined the construction and timber industries leading to an analysis of structural timber usage in Irish residential construction sector. We now progress to a discussion of the theoretical base within which structural material choices are to be researched. Initially organisational theory relating to the construction industry is examined The primary concentration of this body of research is focused on client-contractor relationships in the large-scale commercial construction sector. There is little exploration of the smaller-scale organisations involved in the home-building sector or of development organisation-supplier relationships. It is argued that in Ireland such relationships may be more of a functional than a strategic partnership nature. A natural progression from the discussion of organisational theory is the examination of organisational behavioural theory, including a brief discussion of individual and group behaviour, as it can be argued that these form the foundations of organisational behaviour. Organisational behaviour is important as it forms the basis for understanding the dynamics involved in organisation buying behaviour, which in turn underlies our understanding of construction industry material choice. As decision making constitutes an important element of organisational buying behaviour a brief look at the types of decisions made by organisations, some decision-making models and the decision-making unit are considered useful in developing an understanding of organisational buying behaviour.

The organisational buying behaviour section of the chapter begins with a brief examination of consumer behaviour as it relates to organisational buying behaviour, and then outlines the three seminal models of organisational buying behaviour. These models form the basis for a vast proportion of the subsequent 25 years of research in this area, which, is subsequently examined by means of influence and research streams. The study framework draws upon many of these influences in organisational buying behaviour research to aid its development at the end of this chapter.

3.1 Organisations

Organisations have been and continue to be, approached from the perspective of many

different disciplines within social science. Robbins (1988) suggests the following definition of the term organisation: *"...a formal structure of planned co-ordination, involving two or more people in order to achieve a common goal"* (Robbins, 1988:2).

Traditionally organisations were classified into industrial sectors. This industrial classification of business organisations differentiates the primary industries (agriculture, mining, forestry and fishing), secondary industries (manufacturing sectors relating to industrial manufacturing and construction) and tertiary industries (services and distributive activities) (Chisnall, 1985). An important element which is omitted from the traditional sectoral classification is the differentiation between public and private sector organisations. Parkinson and Baker's (1986) adjustment to the basic industrial classification addresses this: they propose six categories of organisations: manufacturing industry, retail sectors, government procurement, non-profit agencies, extractive industries and service industries.

Another problem arises due to the fact that many organisations can not be neatly classified into a single category within industrial classification systems, because their activities may span a number of the sectors. In particular as Martin and Horne (1992) point out the delineation between goods and services is becoming harder to define as products are increasingly viewed as a combination of both. A pertinent example is that of the construction industry, which is classified as a secondary / manufacturing industry under the traditional economic system. However, this fails to recognise the very high service element involved in construction. The importance of this service element in the construction sector was signalled in 1997 when an Irish Government services employment policy document recognised construction as part of the services sector (CIC, 1997).

A recent collection of organisation theory readings (Williamson, 1995) illustrates the interdisciplinary nature of organisational research with political scientists, sociologists, economists and business academics among its contributors. These disciplinary approaches provide an interesting contrast of organisational theories. Some maintain that the study of organisations may help repair the rift between the *"economistic disciplines and 'soft' behaviourally orientated"* approaches to the study of business (Foss and Koch, 1996:191).

One aspect of the interdisciplinary debate on organisations relevant to this work is the efforts in describing and defining the nature of organisational structures. The relevance to

this thesis of the economistic approach to the discussion of organisational nature and definition is signalled by Williamson's interest in the construction industry which was evident as far back as his seminal "Markets and Hierarchies" and continues in later work (Williamson, 1975&1979). Eccles (1981) coined the term 'quasi-firm' to describe the relationship which may build-up over a reasonably long period between the general contractor and his subcontractors, particularly in the absence of competitive bidding. Caldwell and Cresswell (1996) suggest that the economic grounding of Eccles's quasi-firm concept is not entirely appropriate when an industry is attempting to implement the 'lean production' system. This is because lean production systems which concentrate on the development of partnering and collaboration in order to maximise competitive advantage (Laming, 1993 & Womack et al., 1990). From the 'softer' network side of the debate has come a challenge in favour of a more relational based approach. For organisations and marketing in general this approach has stressed the importance of relationship building and management. Gronroos, (1994), Dodd (1996) and Thompson (1996a & 1996b) suggest that understanding relationships can provide useful insights in the construction context.

Drawing again on the network and relationship view the concepts of temporary project networks and a project's milieu are of particular relevance to the current enquiry. Cova (1996) suggests that the milieu surrounding a construction project is the most important concept in understanding constructional organisation, rather than the transaction itself. His theory attempts to link the ideas forwarded in network theory, which sees a group of collective actors linked through long-term relationships and regional economics or spatial theory.

The temporary or project based network classification has also been applied to the film industry (Jones, 1996 & Faulkner, 1987). Indeed Jones describes a remarkably similar organisational picture in the film industry as can exist within the construction industry. *"The film industry's network organisation is constantly being created and re-created.... work is organised around the project rather the firm; the 'employees' are subcontractors who move from project to project or across firms, over time. Thus, the new networks are an interfirm phenomenon."* (Jones, 1996:58). Two defining characteristics of project networks are task and environment related. The task involved in project networks is complex and non-routine with a high level of team interdependence, while the environment is dynamic and uncertain. These conditions are extremely evident in the film, music (Peterson and Berger, 1971) and fashion industries (Piore and Sable, 1984).

Kadefors (1995) challenges the application of the temporary project based networks approach to the construction industry and argues that the construction industry is prone to institutionalisation due to the lack of diversity in the buildings produced and the organisation of projects. On the other-hand it has been suggested that construction work is usually executed by what some call temporary multi-organisations *"...with the appointment of consultants, contractors and subcontractors we are in the less well charted waters of multi-organisational dynamics. A new, though temporary, organisation is formed, a temporary multi-organisation"* (Cherns and Bryant, 1984:180). Thompson (1996a & 1996b) suggests that the construction industry is an early example of project based temporary networks which he describes as organisations drawing together the people and resources of a network of firms, in order to meet the needs of a specific project.

It can be seen from the above discussion that there are a number of different conceptualisations of the nature and structure of organisations which are relevant to the present enquiry concerning residential construction organisations. The general emphasis appears to be moving towards a view of commercial construction organisations as temporary or project based networks. Despite Kadefors (1995) objections the broad thrust of these conceptualisations continues to be developed in a convincing manner.

However, much of the theory being developed relates to the relationships between clients and contractors in large-scale commercial construction. As the vast majority of residential construction in the Irish context is undertaken by relatively small-scale speculative developers, who are in effect the client and head-contractor, this dimension of relationship theory is of limited application to the present study. Similarly, with one-off owner-developers the relationship between the client and the contractors is likely to a one off transaction based relationship. The third primary segment of Irish residential construction - local authority development - also allows for limited application of the client contractor relationship theory due to the impediments to continuous relationships posed by the tendering process (Pratt, 1996).

While it is considered important to remain constantly aware of the current developments in organisational relationship theory within the construction industry buying processes remain a important and legitimate aspect of organisational theory. Indeed Tanner (1999) stresses the importance of remaining aware of the impact of individuals and the factors

that influence their behaviour in buying processes, even where strong relationships are formed. Demkes (1997) in a similar vein suggests that existing decision making theory can be applied to decision making practice in multiple organisations. Most existing models of organisational buying behaviour stress the need to recognise influencers and factors external to the core buying centre (Johnston and Lewin, 1996). The refocusing of concentration towards project based organisations rather than individual firm-based organisations does not undermine the fundamental premise of organisational buying behaviour theory that multiple individuals and groups are involved in buying processes (Tanner, 1999). Nonetheless, it is important to recognise that as relationships become stronger between various members of the developments team and suppliers, undoubtedly the buying process becomes more integrated. So from this perspective it is important to concentrate not alone on the development firm as the primary medium for examining buying processes in the construction industry, but rather the project team.

In order to progress the study of material choice processes, which are seen in the context of organisational buying behaviour theory it is considered useful to initially provide a brief insight into organisational behaviour theory.

3.2 Organisational Behaviour (OB)

Organisational behaviour (OB) has been variously defined. For example the dominance of the softer approach to the study of OB can be seen in Luthan's (1989) definition as the study and application of the human side of management. An early definition was *"the study of the structure, functioning and performance of organisations and the behaviour of groups and individuals within them"* (Pugh, 1971:9). More recent definitions have stressed the constitutive elements of organisations rather than the whole organisation as actor. Robbins (1996) defines OB as a field of study that investigates the impact that individuals, groups and structures have on behaviour within organisations and the application of that information to make the organisation work more efficiently (Robbins, 1996:6). This is an expansion of his 1988 definition:*"...the strategic study of the actions and attitudes that people exhibit within organisations"* (Robbins, 1988:2). Organisational behaviour theory has evolved from a number of different disciplines including psychology, sociology, social psychology, anthropology and political science. Psychology primarily focuses on the individual within organisations, sociology and social psychology concentrate on groups, while anthropology concentrates on groups it also recognises organisation systems as a unit of analysis along with political science. We will briefly discuss individual and group

factors in organisational behaviour and then progress to an examination of organisational buying behaviour as the core concern of organisational systems theory.

3.2.1 Individual Behaviour

The argument proposed by the psychology stream of organisational behaviour theory claims that it is individuals within organisations who behave rather than organisations themselves. It is proposed that individual behaviour can be viewed as a foundation stone of organisational behaviour, as organisations are composed of individuals who interact with each other and the external world as a part of the organisation. Considerable elements of individuals' personalities, traits and characteristics can be reflected in their day to day operations. Numerous factors combine in order to determine the manner in which individuals act and Figure 3.1 below illustrates the linkages between these various factors and how they feed into individual behaviour.

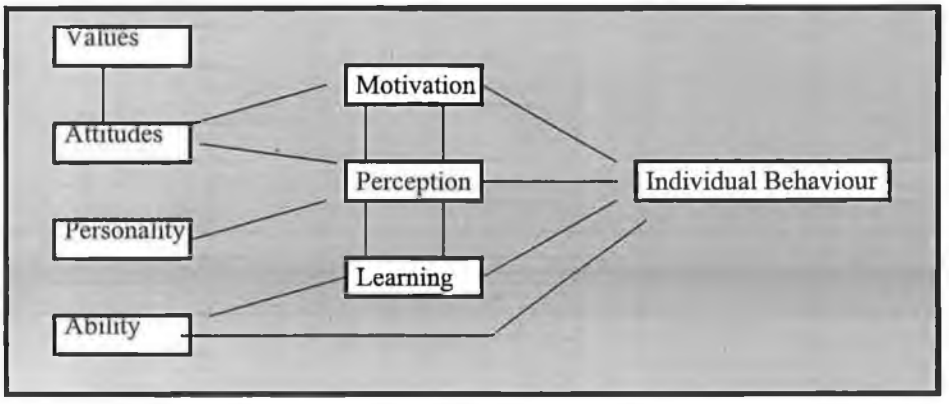


Figure 3.1: Linkages Between Key Variables Affecting Individual Behaviour (from Robbins, 1988)

Most mainstream organisational and consumer behaviour texts deal with these factors in some detail (e.g. Robbins, 1996). While it is pertinent to point out the importance of individual behaviour within the context of a study involving organisational behaviour, a detailed discussion of these factors is not warranted here. Instead a small number of the abundant potential references are suggested for each of these factors. ***Values*** (Robbins, 1988 & Solomon, 1994), ***Attitudes*** (Robbins, 1996), ***Personality*** (Solomon, 1994 & Robbins, 1988 & 1996), ***Perception*** (Schiffman and Kanuk, 1997 & Solomon, 1994), ***Learning*** (Robbin, 1988:22), ***Motivation*** (Malhotra, 1993 & Callahan et al., 1986). Various motivational theories have been developed throughout this century, some of the most notable authors in this area have been: Mill (1949), Murray (1943), Maslow (1954 &

1968), Herzberg et al. (1959) and Bandura (1977).

3.2.2 Group Behaviour

From the sociological, social psychology and anthropology spheres group behaviour is considered an important element of behavioural science, as it examines how individuals interact in various settings. Solomon (1994) points out that humans are 'social animals' and that we all belong to some form of groups, be they formal or informal (Vecchio, 1995). Groups may be work related, social, special interest, religious, cultural, economic, racial, or family, etc. (Howard, 1989 & Solomon, 1994). The key factor is some common interest or link which connects two or more individuals and this common link may influence individuals to behave in a certain manner in order to conform with the other group members. Certain individuals can emerge as opinion leaders in group settings, others may be gatekeepers and others recipients (Solomon, 1994:387). Whilst various elements of group behaviour have been suggested as important constituents of organisational behaviour (Robbins, 1996:22) we are going to concentrate on three that are of great importance to organisational buying behaviour and therefore material choice processes.

3.2.3 Conflict, Power and Influence

Three key components of organisational behaviour identified from the literature are conflict, power and influence each of which is now briefly discussed in turn.

Conflict *"...is the process that results when one person (or a group of people) perceives that another person or group is frustrating, or about to frustrate, an important concern."* (Vecchio, 1995:468). It involves incompatible differences between parties that result in interference or obstruction (Thomas, 1979). Robbins (1974) suggests that conflict refers to all types of opposition or antagonistic interaction.

In recent years conflict has become accepted as inevitable and to a certain degree desirable (particularly from the political science discipline), particularly where organisations are attempting to generate new ideas, tactics and strategies in order to achieve certain goals. Various conflict management strategies have been developed which encourage a certain degree of conflict, whilst maintaining conflict reduction elements (Vecchio, 1995 & Chisnall, 1985). According to Callahan et al (1986:292) *"...conflict is not always undesirable. A certain level of conflict may be necessary for organisational efficiency"*. The levels of conflict within the construction industry can be high, due to the number of

organisations brought together in project networks. Ruble and Thomas (1976) categorised a number of managerial strategies that can be used in the handling of organisational conflict. These are: collaboration, compromise, accommodation, avoidance and competition. It is generally felt that managers are likely to utilise a combination of these strategies in the management of organisational conflict.

Power according to McClelland (1976) is *"...the ability to cause others to perform actions that they might not otherwise perform",* while Vecchio (1995) describes it as the ability to change the behaviour of others. Callaghan et al. (1986) defines power in a considerably broader sense "*power is the capacity to influence others to get things done"* (Callahan et al., 1986:618). While everyone in an organisation holds some degree of power, the higher up the organisation an individual goes the more power that is normally vested in them. Callaghan et al's. definition of power could be seen to be broad enough to encompass influence, which the researcher interprets as being weaker than power, as discussed below. Power in the organisational context is most commonly seen through the exercise of management and most specifically the decision making function. Callaghan et al. (1986) sees leadership as the key element in managerial power.

The five bases of power proposed by French and Raven (1959) which were re-affirmed by Hinkin and Schriesheim (1989) are: Reward Power (Vecchio 1995, & Callahan et al., 1986), Coercive Power (Vecchio, 1995 Callahan et al., 1986 & Sheley and Shaw, 1979), Legitimate Power (Vecchio, 1995), Referent Power (Vecchio, 1995) and Expert Power (Speckman, 1979). Buchanan et al. (1997) add Information Power as a sixth base of power to French and Raven's original 5 bases. Interestingly Bonoma (1982:115) proposed a slight variation of French and Ravens' five bases of power, they examine power in organisational buying on the basis of reward power, coercive power, attraction power, expert power and status power. Etzioni (1975) proposed three types of organisational power (coercive, utilitarian and normative) which he correlated to three types of involvement (alienative, calculative and moral). Power within organisational buying is often difficult to locate due to the various strata of management involved and it can be dispersed both locationally and across departments. Kohli (1989) found that the most effective form of individual power in organisational buying centre was expert power.

Influence has been described as *"...efforts by individuals to change the behaviour of others in situations in which they do not possess formal power or authority over their*

targets" (Vecchio, 1995:693). He goes on to state that influence is subtler, less reliable and weaker than power. On the other hand, Callahan et al. (1986:191) express the view that *"...power is the capability to influence, while influence is the application of power"* and Buchanan and Huczynski (1997) feel that power is the basis for influence. The link between power and influence in organisations appears to be quite strong and interdependent. Certain types of power, or power bases, are not very compatible with influence, such as coercion and formal authority. Buchanan and Huczynski (1997) state that the 6 bases of power underpin influence, however the influencee should not be aware that they are being influenced *"...if performed successfully the person being influenced, the influencee, will believe that they are acting in their own best interests"* (Buchanan and Huczynski, 1997:695).

Kipnis et al. (1984) in a study of how parties influenced their managers, co-workers and subordinates, identified seven influencing strategies; reason, friendliness, coalition, assertiveness, higher authority and sanctions. Figure 3.2 below illustrates the favoured methods of influencing: -upwards (management), -downwards (subordinates) and -across (co-workers). It can be seen that reason is the favoured strategy for those wishing to both influence up and influence down, while the use of sanctions where they are an option are a last resort. This is another example of where the line between power and influence appears to be blurred. The researcher's interpretation of power as a stronger force than influence in causing individuals to perform actions that they might not otherwise perform would suggest that power is primarily a tool available to those involved in 'influencing down'.

influencing up	**influencing down**	**influencing across**
(management)	**(subordinates)**	**(co-workers)**
reason	reason	friendliness
coalition	assertiveness	reason
friendliness	friendliness	bargaining
bargaining	coalition	assertiveness
assertiveness	bargaining	higher authority
higher authority	higher authority	sanctions
(no sanctions)	sanctions	coalition

Figure 3.2: Preferred Order of Use of Influencing Strategies from Kipnis et al. (1984)

3.3 Organisational Decision Making

A crucial element of organisational behaviour as from the organisational buying behaviour and thus material choice process perspective is organisational decision making.

Organisational decision making, like organisational buying behaviour is more complex than most individual or consumer decision making, because there may be a number of parties (individuals and groups) to the decision, each with their own motivations. Trying to identify the point at which a decision is made within an organisational context can be very difficult. Hill and Hillier (1986:44) describe an organisational decision as follows:- *"...a decision can be considered to have been taken, at that level in the managerial hierarchy where the criteria of choice are determined, in accordance with both individual and corporate goals and expectations, for the ultimate selection of one of several alternatives"*.

Shall et al. (1970:320) define decision making as *"a conscious and human process involving both individual and social phenomena, based upon tactical and value premises, which concludes with a choice of one behavioural activity from among one or more alternatives, with the intentions of moving towards some desired state of affairs"*. So a decision can be considered as the actual point where a choice is made, whereas decision making is the process leading to this choice. Hill and Hillier (1986) suggested that there are four types of decisions involved in industrial buying processes and that they form a 'Cycle of Industrial Buying Decisions', as illustrated below.

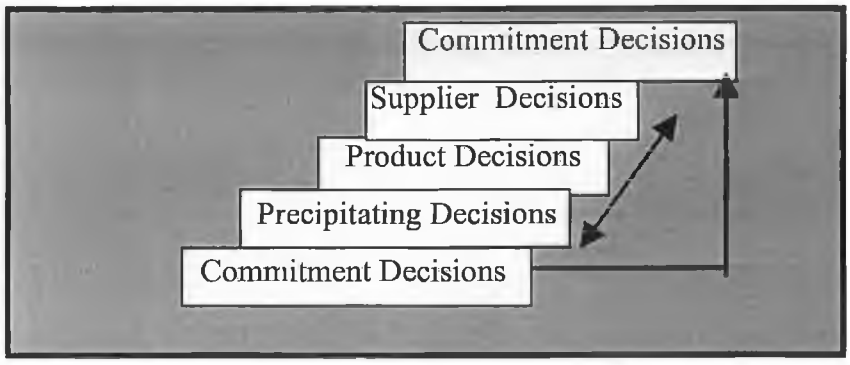


Figure 3.3: The Cycle of Industrial Buying Decisions - Incremental Nature of Industrial Decisions (Hill & Hillier, 1986:45)

3.3.1 Types of Decision Making

Understanding organisational decision making is made more complex by the variety of types of decisions made. As Cray et al. (1988:14) put it *"Trying to comprehend the decision making process analytically is frustrated by the convulsions and variety of the process"*. The strategic importance of such comprehension is illustrated by Mintzberg and Waters (1982:466) *"...organisational strategy can be seen as a pattern in a stream of decisions"*. Cray et al. (1988) developed three broad types of strategic decision making

from a study of 150 decisions in 30 British organisations. They used five elements to differentiate decision making:- scrutiny - the extent to which interest groups seek information relevant to the decision issue (Hage, 1980); interaction -both formal and informal discussions and negotiations; flow - degree of interruption and impedance in the process; duration - including both gestation time and process time; and centrality - level at which a decision is authorised. Their study resulted in the identification of sporadic, fluid and constricted decision processes.

- *Sporadic* decision processes are characterised by short bursts of activity with considerable delays, an extensive information gathering process and a wide scope of negotiations, many of which are informal. The decision normally takes a long time to reach and is taken at a high level in the organisation.
- *Fluid* decision processes are characterised by few interruptions, relatively short time spans, involving a small number of people on the basis of more homogeneous information. The decision proceeds smoothly through decision making framework and authorisation remains at a high level.
- *Constricted* decision processes involve relatively few individuals and little effort to collect new information, however, experts may play a major role. The process flows relatively well, as formal interaction is minimised.

This can be compared to a 1976 study by Mintzberg et al. of 25 decisions which resulted in the identification of 7 different types of decision or 'path configurations'. A common differentiation in decision making relates to programmed (well structured and relatively routine) and non-programmed decisions (novel and poorly structured) (Simon, 1977 and Vecchio, 1995). The main concerns in decision-making classifications are the degree of structure, the time taken, the level of involvement and novelty of the decision.

3.3.2 Decision Making Models

There have been numerous models and theories developed to describe the nature of both individual and organisational decision making. The main thrust of the traditional or classical theory is that decision making is a rational (Callahan et al., 1986) linear process, which has strong ties to classical economic behaviour theory (Vecchio, 1995). This can be contrasted to the descriptive theories which recognise that the linear staged models have weaknesses in accounting for the diversity of individual behaviour within organisations.

The *Optimising Model* (Robbins, 1996) is one of a number of rational models which suggests that there are a number of sequential steps involved in decision making. This

model suggests that decisions consist of six stages, which are followed in order, these are;

i) Ascertain need for a decision - disparity between desired state and the actual condition

ii) Identify the decision criteria

iii) Allocate weights to criteria in order to prioritise their importance.

iv) Develop the alternatives for the resolution of the problem.

v) Evaluate the alternatives using a scoring system and weightings

vi) Select the best alternative with the highest overall score, which best meets the criteria.

A second rational linear decision-making model is the eight stage *Rational Economic Model* (Vecchio, 1995). Kast and Rozenweig (1979) produced a more complex form of probability based modelling called the *Decision Process Model*, where decision-makers assign probabilities and weightings to various situational and personal variables. Other rational models of problem solving and decision making have been developed by Robertshaw et al. (1978) (5 stage), Simon (1960) (3 stage), Elbing (1970) (4 stage) and Ansoff (1971) (10 stage). Many of the buying decision making models emphasise the importance of post decision evaluation (e.g. Webster and Wind 1972 & Hill and Hillier, 1986). It may be noted that Hill and Hillier's model of the industrial decision process as illustrated in Figure 3.4, bears remarkable resemblance to the 'buyphases' in the Robinson Faris and Wind (RFW) organisational buying behaviour model (Robinson et al., 1967-see 3.4.6).

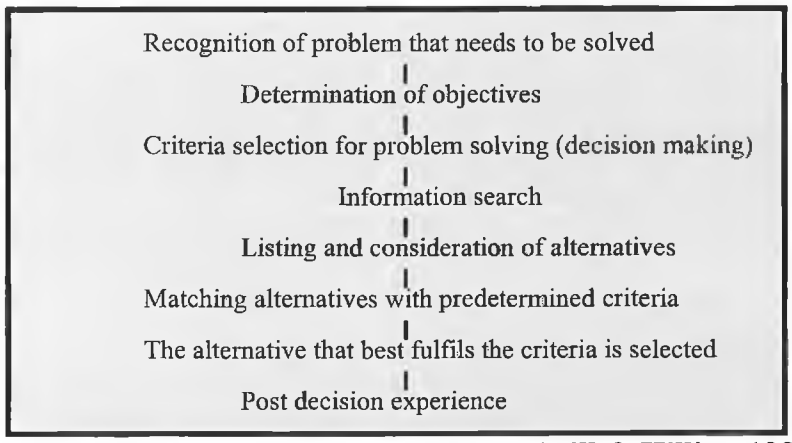


Figure 3.4: Industrial Decision Process & Stages (Hill & Hillier, 1986)

Some of the main draw backs or limitations of the rational models of decision making relate to assumptions that individuals and organisations undertake this process in a totally logical, objective and structured way, ignoring political, social and perceptual factors *"...one major set of deficiencies in the classical approach lies in its assumptions that all*

alternatives will be considered, that the consequences of each alternative will be considered, that accurate information is available at no cost and that decision makers are totally rational beings" (Vecchio, 1995:401). Owing to these reservations about rational models it is felt that they offer excellent guides as to how decisions should be made rather than how they are actually made.

Recognising the limitations of the rational linear models, a number of more descriptive theories have evolved to explain how decision making 'really' happens. The *Satisficing Model* (Robbins, 1988 and 1996) is based upon the supposition that we seek solutions that are satisfactory and sufficient, or 'good enough', as opposed to maximisation or optimisation. It is similar to the *Behavioural Theory* of decision making described by Vecchio (1995) and the *Administrative Model* described by Simon (1957). The Satisficing Model is characterised by bounded rationality and incrementalism. *Bounded rationality* is the tendency to settle for something short of an ideal or optimal solution, as people operate within the confines of limited problem solving. It is normally not possible to identify and consider all the possible solutions to a given problem, so quite often criteria are set and once a search yields an alternative that reasonably meets these criteria this alternative will be selected (Robbins, 1988 and Vecchio, 1995). *Incrementalism* is a truncated decision making process which assumes that the search for alternatives is limited to possible solutions that lie close to a solution which previously has worked. This search is narrow in scope and is normally undertaken when an improvement or adaptation is desired in some existing or similar solution (Robbins, 1996).

The *Garbage Can Approach* was developed by Cohen et al. (1972). It envisions; problems, decision participants, choice opportunities and solutions; to be swirling around in a 'decision space', combining in ways that regularly do not follow the sequences in the rational model(s). The *Subjective Expected Utility Model* as developed by Fischoff et al. (1981), states that decision making involves the maximisation of utility. Decision-makers assign probabilities and utility to various outcomes in a somewhat similar manner to the optimising model. This theory is closely linked to economic thought on utility maximisation (Callahan et al., 1986).

3.3.3 Decision-Making Unit (DMU)

The decision-making unit (DMU) in an organisational context refers to the group of individuals who actively participate in a given decision making process. The composition of the DMU often varies depending upon the nature and importance of the problem being

tackled in the particular buying decision. The motives of these individuals can vary greatly depending upon numerous factors, such as educational and work background, or internal political motives. Hawkins et al. (1995) feel that less familiar or more complex products are likely to involve a far more complex buying procedure, with higher ranked members of the organisation involved in the DMU, than would be case with routine purchasing decisions.

The importance, cost and risk involved in the particular purchase are crucial in determining the constitution of the DMU, according to Mattson and Esmail (1993). They also address the issue of attempting to differentiate between involvement and influence in determining the membership of the decision-making unit. The difficulty arises in arriving at an acceptable measure of involvement in order to define someone as a member of the DMU. Some researchers take the view that the individuals within an organisation are themselves the best determinants of their involvement or otherwise. Whereas, others feel that membership can best be defined through the fundamentals of - individual involvement, departmental involvement, influencing individuals and decision makers- which underlie Webter and Winds' (1972) five organisational buying roles. These roles are gatekeepers, influencers, users, deciders and buyers, as discussed later in this chapter. In Mattson and Esmail's study it was found that there was little difference in reported levels of involvement and influence between respondents. However, Silk and Kalwani (1982) found a lack of consensus about purchase influence between pairs of informants from the same organisations. Variations were also found in the ratings amongst roles but little difference was found in stages of the buying process.

Grønhaug (1975) and Patton et al. (1986) distinguish between decisions made by a single individual and joint decisions within an organisational context. Grønhaug discovered through a survey of 30 stores in Bergen, Norway, that joint decisions tended to be less programmed than autonomous buying decisions and normally involved more research. The factors identified as primary determinants of decision type (autonomous or joint) were: the degree of routinisation, the perceived importance of the product and the availability of resources for handling buying problems. Patton et al. (1986) found that the extent of joint decision making appeared to be strongly related to firm size and that individual decision making seems to predominate in modified rebuy situations.

3.4 Organisational Buying Behaviour (OBB) Overview

Organisational buying behaviour (OBB) theory - a vast and growing body of literature which has developed rapidly over the past 30 years - emerged as the primary theoretical area within which to explore material choice processes. The term 'organisational buying behaviour' (OBB) refers to the purchasing behaviour of organisations, for organisational as opposed to individual needs. These two aspects are well recognised in the literature where OBB *"...refers to the purchase behaviour of producers, resellers, government units and institutions"* (Dibb et al., 1997:147) and is *"...the purchase of a good or service to satisfy organisational rather than individual needs"* (Parkinson and Baker, 1986:6). Clearly this is the type of buying behaviour that is usually involved in the purchase of structural material in the construction industry. This section of the chapter builds upon the previous sections which examined the related areas of organisations; individual, group and organisational behaviour; and organisational decision making. Initially a brief discussion of consumer behaviour as it relates to organisational buying behaviour is provided, which is followed by a look at the three seminal models of organisational buying behaviour. An examination of influences in organisational buying behaviour precedes a brief categorisation of research streams. The final section of this chapter draws upon the foregoing sections to produce a study framework.

3.4.1 Consumer Buying Behaviour

It has been suggested that a strong relationship can be drawn between organisational buying behaviour theory and consumer behaviour theory (Deshpande and Zaltman, 1987). The organisation of many textbooks (e.g. Solomon, 1994) suggests such a grouping. Solomon (1994:619) even defines consumer behaviour as *"...the processes involved when individuals or groups select, purchase, use, or dispose of products, services, ideas, or experiences to satisfy needs or desires"* which is broad enough to embrace OBB. Furthermore, the actual actors in OBB - or indeed as was argued above in any organisational behaviour - will be individuals. It can be argued that OBB is clearly related to consumer behaviour and shares much of its essence. For this reason a brief account of the development of consumer behaviour should aid in understanding OBB.

Consumer behaviour theory, like organisation buying behaviour theory, has grown out of various disciplines including both marketing and psychology theory and since its development in America in the 1950's, has been the subject of intense research activity.

There are two main types of consumer buying behaviour models, monadic and multi-variable models (Chisnall, 1985). Monadic models have emerged from a single discipline such as economics, whereas multi-variable have emerged from a synthesis of various behavioural sciences (eclectic approach). The main monadic models include: Perceived Risk Model (Bauer, 1960 and Cox, 1967), Black Box models (Chisnall, 1985) and Decision Process or Logical Flow models (Kotler, 1967 and Engel et al., 1968). The decision process models are similar to the rational organisational decision making models already discussed in this chapter. Multi-variable models have been developed by Engel, Kollat and Blackwell (1978), Howard and Ostlund (1973), Nicosia (1968) and Andreasan (1965).

3.4.2 Three Seminal Studies of Organisational Buying Behaviour

Over the last thirty years numerous studies have been have been undertaken to explain organisational buying behaviour, many of which have included models to represent their theories. The studies and models which have formed the basis of the vast majority of organisational buying behaviour research in this period are the Robinson, Faris and Wind (1967) framework, the Webster and Wind (1972) model and the Sheth (1973) model. Numerous researchers have attempted to test different aspects of these models (Sheth, 1996), while others have amalgamated parts of them into their own frameworks (Mattson and Esmail, 1993; Johnston and Lewin, 1996 & Mattson, 1988). However, on the whole these models still remain the basis of most research into organisational buying behaviour. Each of the models is examined below.

3.4.2a) Buygrid Framework (Robinson, Faris and Wind, 1967)

Robinson, Faris and Wind (1967) (RFW) developed a framework termed the 'Buygrid' framework, which includes the three **'buyclasses'.** These are:- *straight rebuy* (routine products and purchasing procedure); *modified rebuy* (some alteration required to a familiar product purchasing procedure); and *new task buying* (first time product is purchased, where a lot of information is required as there is no past experience of the product). Robinson et al. (1967) suggested that the three buyclasses differ to the extent that decision-makers:- a) consider the purchase situation to be new or unfamiliar (newness of the problem), b) gather additional information (information requirements), and c) seriously consider new alternatives (consideration of new alternatives) (Robinson et al., 1967 & Wind, 1978). The model also proposed eight **'buyphases'** - need recognition, determination of solution characteristics, description of solution characteristics, search for sources, acquisition of proposals, evaluation of proposals (source selection), selection of

order routine and performance evaluation.

Robinson Faris and Wind's (1967) model has formed the basis for a considerable proportion of the organisational buying behaviour research since its publication. Many of its the critics feel that certain aspects of the model have limited empirical evidence to back them up (Bellizzi & McVey, 1983 & Ferguson, 1979). Ferguson (1979), using his survey of 1,000 US distribution executives claimed that the Buygrid Analytic Framework could not, be considered as a general-purpose model of industrial buying behaviour. Bellizzi and McVey (1983) examined the effects of product type and purchase experience in relation to industrial buyer behaviour and stated that *"...though the significance of the buyclass variable appeared to be high in the Robinson et al. study, it was not statistically tested with a relatively large data base"* (Bellizzi and McVey, 1983:57). They concluded that the buyclass variable is not significantly related to buyer behaviour, but that product type is a meaningful variable. Anderson et al. (1987) on the other hand, found in an empirical study of salesforce managers, that much of what sales people observe correlates closely to the buyclass framework. They also found that the 'seriousness of consideration of alternatives' does not appear to correspond to the theory presented in the buyclass framework. Nevertheless, the Robinson Faris and Wind (1967) model has gained some support from empirical investigations:- *"No one study has been able to test the entire buygrid, but the accumulated evidence from fragmented studies over the past two decades overwhelmingly supports the buygrid variables"* (Mattson, 1988:208).

Over the years modifications to the basic model have been suggested. Lemann and O'Shaughnessy (1974) suggest an alternative to the 'buyclasses' (new buy, modified rebuy and straight rebuy) in order to better explain purchase complexity. They breakdown industrial purchases into four categories - routine-order products, procedural problem products, performance problem products and political problem products. These categories are by no means mutually exclusive and the combination of various categories in a product purchase may lead to a lengthy and difficult purchasing process. However, in a study of the taxonomy of buying decision making Bunn (1993:51) concluded that *"the buy-class dimension is really a surrogate for many activities and therefore it is very robust"*. Both Anderson (1987) and Bunn (1993) have suggested that "purchase importance" should be added as an extra dimension to the Robinson Faris and Wind (1967) framework. While Johnston and Lewin (1994) in their review of 25 years of OBB journal articles concluded that the levels of risk associated with purchases is a crucial consideration in examining

organisational buying behaviour.

More fundamental limitations of the Robinson, Faris and Wind (1967) model can also be made. While the framework is particularly important in studies examining *"who makes decisions and in what manner"* (Gopalkrishnan, 1996:82), however, it has certain weaknesses in terms of examining the strategic importance of purchasing decisions. Additionally Robinson, Faris and Wind (1967) use of a staged linear sequential model of purchasing is very questionable in practice. However, the buyphases are only a representation of a 'typical' buying process and should not be viewed as definitive. Similarly the buyclasses attempt to capture the diversity of product familiarity and to demonstrate that certain types of products are likely to take more time and effort in terms of progressing through the organisational buying process. A further limitation of the Robinson Faris and Wind (1967) model is that it fails to account for the complex influences which may affect buying, such as social, cultural, economic and psychological factors.

The Robinson, Faris and Wind (1967) model appears from the literature to be the most debated and tested of the organisational buying behaviour models and it remains a dominant theory of organisational buying behaviour (Mattson, 1988 Anderson et al., 1987 and Bunn, 1993).

3.4.3b) Webster and Wind (1972)

A second seminal organisational buying behaviour model was developed by Webster and Wind (1972). It recognises the combination of individual and group decision-making and identifies four classes of organisational buying behaviour influencing variables:- individual, social, organisational and environmental. These four variables are subdivided into task dimensions (relating directly to the problem) and non-task dimensions (concerned primarily with personal goals). Kauffman (1996) suggests the addition of two further sources of organisational buying behaviour influence. These are; choice process related influences and; products and markets related influences. A important element of Webster and Wind's model is the introduction of five roles in organisational buying; influencers, users, gatekeepers, buyers and deciders, each of which is briefly discussed below.

Influencers informally have an input into the buying process (Bonoma, 1982). They are often very difficult to identify, yet they can have a considerable effect on buying decisions. According to Speckman and Stern (1979) two types of influencers can emerge in a given buying situation: active influencers who actively seek to influence a decision and passive

influencers who do not actively participate but influence the decision. Tanner and Castleberry (1993) state that. *"Passive influencers may influence but not participate"* (Tanner and Castleberry, 1993:36). An influencer does not have any formal involvement in the decision making process, however their views may help those involved to reach a particular decision.

Users are normally most influential when technical purchases are being considered, as they are the ones who will be 'consuming' the product (Chisnall, 1985 & Bonoma, 1982). Berkowitz (1988 & 1986), found that end user and technical staff influence in the purchase of general maintenance supplies was strongest in the early stages of buying initiation and information gathering. Purchasing staff and others with 'low stakes' were found to dominate the final decisions regarding supplier selection and securing the product.

Gatekeepers are the individuals through whom information on alternatives normally flow. There may be a number of different gatekeepers in a given purchase situation at various different levels within the organisation, each of whom has some control over the flow of information from suppliers to deciders. At each stage of this process the supplier's contact, be it by means of technical literature or personal contact may fall prey to the various gatekeepers who constitute a buffer zone between the decision makers and multitude of potential suppliers. (Chisnall, 1985).

Buyers is often a purely administrative role and it is typically carried out by purchasing departments in larger organisations.

Deciders are those within an organisation who say yes or no to a particular purchase. *"Decision makers, in terms of the buying centre roles defined by Webster and Wind (1972), are the people who actually make the purchase decision, irrespective of whether they formally have the authority to do so."* (Berkowitz, 1988:43). Berkowitz found that in larger firms purchasing departments dominated the final decision making role in the purchase of general maintenance supplies. He found that 77% of such purchasing decisions were made by purchasing departments in firms with between 250 and 499 employees, whilst in firms with between 1 and 19 employees only 47% of such decisions were made by the purchasing department. As the majority of residential construction firms in Ireland fall into this latter category, it is likely that purchasing departments play a relatively minor role in the buying process.

The continued importance of roles in organisational behaviour theory is emphasised by Tanner (1999). However, he suggests that the increasing emphasis on relationships between buyers and sellers demands a rethink of the traditional roles. In cases where

strategic partnerships are replacing functional and transaction based relationships new roles such as facilitator, advocate and relationship manager should be considered (Tanner, 1999 Moon and Forquer Gupta, 1997).

3.4.2c) Sheth (1973)

Sheth's (1973) study of organisational buying behaviour emphasised the behavioural aspects of organisational buying and the information sources used, whilst still accounting for the process factors as proposed by Robinson, Faris and Wind (1967), and environmental factors as focussed on by Webster and Wind (1972). The model postulates that the precise relationships of the multiple influences (the interplay of socio-cultural, economic and emotive influences) will be affected by the nature of specific products and individual's interpretation of their effects. Sheth (1973) recognised that information is constantly updated, at variable intensity, rather than at a discrete point in time as would be suggested in the buyphases and that this information is subject to individuals' own perceptual distortion. The theory also emphasises the different objectives which individuals may hold in the buying process. For example a user may be interested in prompt delivery and ease of use, while an engineer may be concerned with performance quality and reliability and the buyer may consider price as the primary concern. The four primary concerns of this model are: the expectations of participants and influencers, product and company specific factors relating to the buying process, the processes of conflict resolution, and situational factors. Ad hoc situational factors, such as temporary price controls or trade disputes, can intervene to restrict the effectiveness of theorising or model building in certain buying situations, according to Sheth (1973).

Sheth (1973) stressed the behavioural aspects of organisational buying behaviour in his seminal model, however Tanner (1990) and Tanner and Castleberry (1993) further this approach through their behaviour choice model and participation model. These models again stress the importance of individual behaviour in material choice processes. Individuals within the buying organisation perceive a wide range of behavioural choices, according to Tanner (1990). These may range from the individual's desire to avoid inclusion in the buying process, to wanting to single handedly make purchases. It is important for the industrial marketer to understand how individuals within an organisation arrive at their choice of behaviour. *"The BCM depicts the process by which an individual selects a behaviour or set of behaviours. The model applies to individuals who are professional purchasers, users and others who participate in organisational buying"*

(Tanner, 1990:58). The four stages which individuals go through in the formulation of an behaviour strategy are:

- *Identification of Situation* involves the individual determining the nature of the task at hand.
- *Evaluation of Personal Relevance* is an evaluation of the benefits or penalties that could accrue to the individual in the buying process.
- *Assessment of Action Alternative* is the individual's assessment of the requirements for action.
- *Behaviour Strategy* choice can be classified as defensive - which is used by individuals to minimise personal decision risk, or offensive - when the individual is more concerned with gaining recognition for a successful outcome to a buying process.

Tanner (1999) stresses the input which individuals who are not professional purchasing agents can have into organisational buying decisions and suggests that as cross-functional supplier teams are developed to manage relationships with suppliers it becomes even more important to understand the behaviour of individuals. He thus recommends that further individual level research be undertaken.

3.4.3 Integration and Development of the Seminal Models.

The importance of, and their dominance in the current literature of the three seminal models discussed above is evidenced by the Kauffman (1994 or 1996) Johnston and Lewin (1996) more recent reviews of the literature. Johnston and Lewin (1996) in their integrative study of organisational buying behaviour theory have identified nine characteristics between the three seminal models of organisational buying behaviour and add: *"Further, after 25 years of empirical testing, it appears that these models were correct in proposing that environmental, organisational, group, participant, purchase, seller, informational, and conflict/negotiation characteristics, as well as the stages in buying process significantly affect organisational buying behaviour"* (Johnston and Lewin, 1996:2). They add a further four characteristics to these nine to reflect additional organisational buying research streams to emerge in recent years. These are role stress and decision rules on the intrafirm dimension and buyer-seller relationships and communication networks on the interfirm dimension. From this research a table of the characteristics examined in each of the studies is presented below (Table 3.1).

Characteristic	RFW (1967)	W&W (1972)	Sheth (1973)	J&L (1996)
Stages	✓	✓	✓	✓
Environmental	✓	✓	✓	✓
Organisational	✓	✓	✓	✓
Individual/Participant	✓	✓	✓	✓
Purchase/Product	✓		✓	✓
Seller	✓		✓	✓
Group		✓		✓
Informational			✓	✓
Conflict/Negotiation			✓	✓
Role Stress				✓
Decision Rules				✓
Buyer/Seller Relationship				✓
Communication Networks				✓

Table 3.1 Organisational Buying Behaviour Characteristics.

Note:-

The following abbreviations are used in the above table: RFW (1967) for Robinson, Faris and Wind (1967); W&W (1972) for Webster and Wind (1972); and J&L (1996) for Johnston and Lewin (1996).

Kauffmann (1996) in his analysis of previous organisational buying behaviour studies provided a useful categorisation: his six main streams of influence. These are:- individual characteristics, group factors, organisational factors, environmental factors (all of which were proposed by Webster and Wind 1972), choice process factors, and product/markets factors. It is Kauffman (1996)'s six part categorisation that is used below to further investigate the development of the literature.

3.4.3a) Individual Characteristics

Kauffman, 1996:96) points out that: *"Although groups are involved in most organisational choice processes, individuals impact and can dominate the process".* Individual influences may include factors such as:- age, education, job status, personality, income, motivation, job satisfaction, etc.. All of these factors may impact upon an individual's performance and their level of participation and can create differences in attribute importance in buying processes (Crow and Lindquist, 1982). Whilst we are dealing with organisational buying behaviour individual factors of course remain important for it can be argued that it is through the roles played by individuals that organisational buying is achieved. Individual behaviour has been briefly dealt with earlier in this chapter. However we will not examine some of the literature dealing with individual participation in greater detail.

There can be numerous participants and influencers in organisational buying processes. From the point of view of sellers it is often insufficient to target marketing efforts to 'purchasers', as they may merely fulfil the role of order processors in many organisations. As Murray Harding put it *"...suppliers have significant misconceptions about who in their customers' companies initiate purchases, select a 'purchaser pool' and actually approves the final supplier"* (Harding 1966:11). From the buying organisations' perspective Evans (1981) found that 'passive' or uninvolved buyers can have an adverse effect on the firm's bottom line and stresses the benefits of increasing the involvement of members of the buying centre with the products being purchased. According to Mattson (1988), the purchasing agent personified the organisational buying function up to about the late 1960's. However, subsequently the research concentration expanded from 'myopic' to the entire buying process and all the organisational participants, particularly after the development of the organisational buying centre concept, by Webster and Wind (1972).

Much research has focused on the influences affecting participation. It has been suggested that participation in the buying centre depends on various factors such as:- product type (Kauffman, 1994 Evans, 1981 & Bellizzi, 1979), novelty of purchase (Doyle et al., 1979 & Berkowitz, 1988), cost of purchase (Mattson, 1988) and functional relevance of the product to the individual participants (Webster, 1993 & Berkowitz, 1988 and 1986).

Tanner and Castleberry (1993), in a study of potential participants in the purchase of photocopiers identified a number of factors which determine whether an individual is a participant or a non-participant. The primary factor associated with involvement was found to be the risk of not participating, while other factors included extrinsic and intrinsic reward expectancy, product involvement and self-efficacy (ability to perform). They proposed the following participation model (Figure 3.6). According to Webster (1993) buyer involvement (participation) is dependent upon the degree of perceived risk and the personal relevance of the buying outcome. She found that the industrial buyer normally exhibits high or medium process involvement and never seems to exhibit low involvement decision-making.

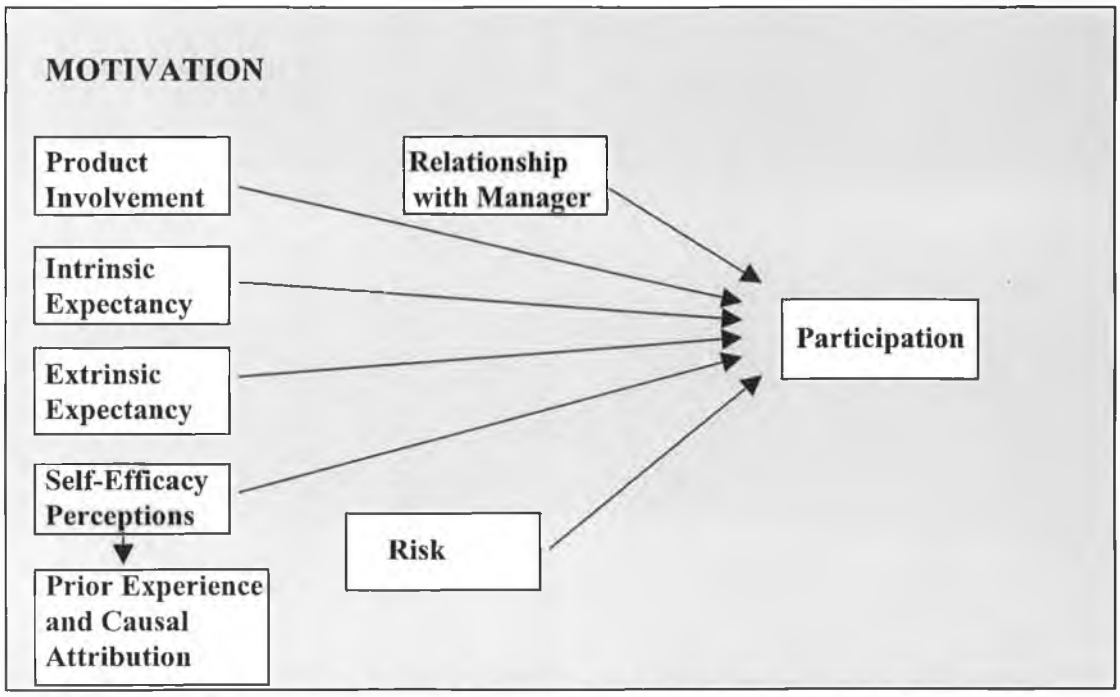


Figure 3.5: Tanner and Castleberry's Model of Participation (1993)

Product Involvement: Tanner and Castleberry found that product involvement - the importance or ego-involvement that an individual attaches to a product - could not discriminate between participants and non-participants, contrary to their initial presumption and conventional marketing wisdom.

Extrinsic Reward Expectancy: relates to the rewards distributed by the formal organisation. It was found that the expectation of extrinsic rewards was a meaningful discriminating factor in participation.

Intrinsic Reward Expectancy: refers to the non-formal rewards that may accrue to an individual through participation such as feeling good about oneself. Tanner and Castleberry (1993) found that this did not constitute a significant discriminator between participants and non-participants.

Self-Efficacy Perceptions: is the perceived ability to perform a given task and is normally framed by the perceived level of success or performance in a past experience. Tanner and Castleberry (1993) found self-efficacy perceptions to be a significant predictor of influence in four stages of the buying process.

Perceptions of Risk: refers specifically to the risk of participating versus the risk of not participating. It was found that perception of participation risk is a significant predicator of participation / non-participation.

Relationship With Manager: refers to the quality of the working relationship and exchanges between subordinates and their managers. Tanner and Castleberry (1993) found that this was not a significant factor in participation. However, it should be noted that their

study concentrated on the purchase of one specific type of product - photocopies - and as they point out this finding, as with the others, may not hold true for other types of products.

There are a variety of terms used throughout the literature to describe participation, including involvement, participation and influence. Bellizzi (1979) for example used relative influence as opposed to participation (Tanner and Castleberry, 1993) in his study of buying in commercial construction contracting firms. He found differential influence depending on the type of product (capital equipment, accessory equipment, operating supplies and major materials) across nine buying stages ranging from need recognition/anticipation to performance feedback and evaluation. He identified senior management and site superintendents as the influence and decision leaders in the purchase of capital equipment, accessory equipment and operating supplies. However, major material purchases, which are the primary concern of this study, were led by engineers, senior management and site superintendents. The Bellizzi (1979) study emphasises the diversity of groups and individuals who may either influence or be involved in the buying process, depending on the structure of the individual organisation and the type of product.

In certain studies roles have been adopted as a mechanism for exploring participation in organisational buying behaviour. Bonoma (1982:113) describes six roles that organisational buyers can assume as *"...a fixed set of behavioural pigeon-holes into which different managers from different functions can be placed to aid understanding"*. These roles are the same as those already discussed in Webster and Winds (1972) research, with the addition of 'initiators' - who recognise that a company problem can be solved or avoided through the acquisition of a product or service (Bonoma, 1982).

These six roles may be undertaken by one individual, but frequently a number of individuals and departments are involved (Patton et al., 1986), which can create a *"complex interplay of personal and organisational motivations and objectives"* (Chisnall, 1985:186). This is likely to particularly be the case in construction, where a number of firms are involved in the temporary organisations formed for each development, thus complicating the process of identifying those fulfilling the different roles.

3.4.3b) Group Influences

Early organisational buying behaviour literature introduced the buying centre in order to explore how buying decisions are taken and what groups are involved in such decisions

(Robinson et al., 1967 Woodside and Sherrell, 1980). The decision making unit, as already discussed earlier in this chapter, grew out of the buying centre concept (Chisnell, 1985). Group membership is likely to differ in each decision (Wind, 1978) and during the course of individual decisions (Kennedy, 1983). Interpersonal factors become important in a group context as they relate to the degree of co-operation and conflict (Barclay, 1991) amongst parties and the power relationships (Kohli, 1989) that exist within the organisation. Communication is also an important group related influence (Kauffmann, 1996). Many group related influences are internal to the organisation and are reasonably controllable from within. Conflict and power have been briefly dealt with in section 3.2.3 above. Risk is an element of individual and group participation in organisational buying behaviour, however it is discussed below in the context of organisational influences.

3.4.3c) Organisational Influences

Organisational influences include factors such as: organisation size, style, values, objectives, purchasing policies, resources and buying centre structure. All of these factors are internal to individual organisations and are much more subject to control from within than environmental influences. Some discussion of organisational theory and particularly the structure of construction industry organisations has already been undertaken earlier in this chapter. Organisational size has been found to affect the purchasing process in terms of the prevalence of joint versus autonomous decision making (Grønhaug, 1975). Crow and Lindquist (1985) found that larger organisations are more likely to set purchase criteria and guidelines for buyers. The objectives and buying procedures of public and private organisations have also been found to differ considerably (Speckman, 1985). Berkowitz found that: *"In public and nonprofit settings, formal buying procedures appeared to be more pervasive, probably for reasons of public accountability"* (Berkowitz, 1986:42). This dimension of organisational type is of particular interest in the structural materials market in view of the mix of private and public housing construction as outlined in Chapter 2.

Risk is intertwined with individual perceptions, group and organisational objectives and environmental factors. However we will now examine risk in the context of organisational influences. *"As Robinson Faris and Wind (1967) speculated in their concept of buy task, much of the variation in organisational buying behaviour appears to be related to the levels of risk associated with a given purchase situation."* (Johnston and Lewin, 1996:8). Risk or the perception of risk can been seen as an important element in shaping organisational decision making. *"A great part of the efforts of business executives is*

directed towards minimising uncertainties" (McClelland, 1961). According to Henthorne et al. (1993) the two primary variables which determine the level of perceived risk are the importance of the purchase and the amount of uncertainty surrounding its outcome. They suggests that risk can be divided into three *'separate but operationally related parts'* (Henthorne et al. 1993:42):- *Performance Risk* (associated with product failure); *Social Risk (*risk of a purchase not meeting with the approval of an important reference group); and *Economic Risk* (the greater the cost of a purchase the greater the degree of perceived risk).

Some of the characteristics of increased risk associated with purchases according to Johnston and Lewin (1996) include:- larger and more complex buying groups, higher level (managerial) involvement, more educated and experienced members of the organisation participate, greater effort and more careful deliberation, product and supplier with proven track records will be favoured, the search for information will be more rigorous, conflict within the buying group is likely to be high because there are more individuals and departments involved, purchasing 'rules' may not be easily applicable, role stress increases, and inter-firm relationships become increasingly important. Figure 3.6 illustrates a number of these factors on a risk continuum

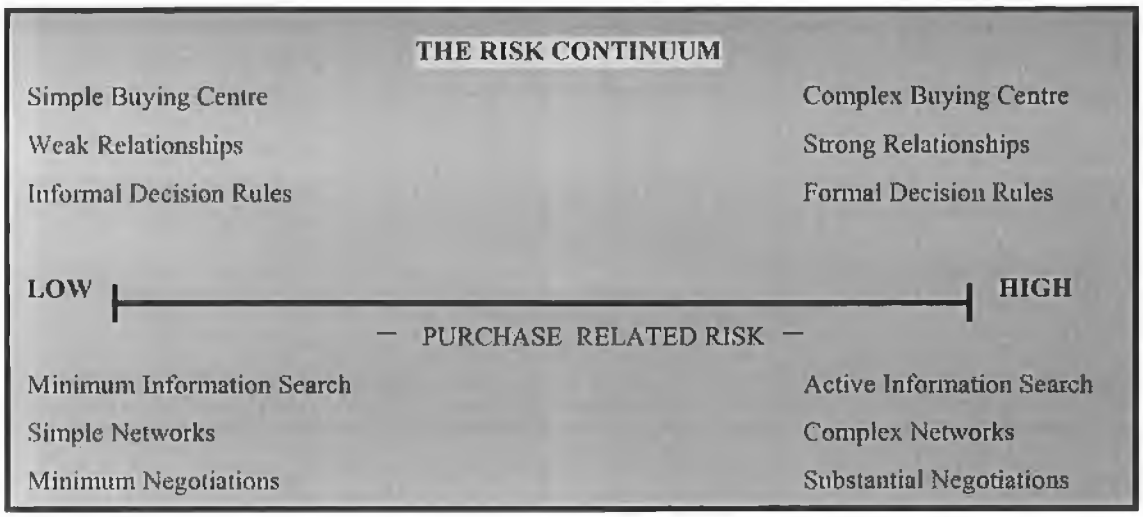


Figure 3.6: The Risk Continuum for Organisational Buying (Johnston & Lewin, 1996:9)

Risk can in many cases be minimised through increased interpersonal contacts and the facilitation of information exchange (Hakansson, 1982). One particular example of risk management would be where an organisation uses dual sourcing of essential materials in

order to offset the risk of production disruption caused by suppliers. Perceived risk may also be reduced in buying situations by building relationships with suppliers, getting quality guarantees and using suppliers with a proven intra-organisational track record (Johnston and Lewin, 1999:10)

3.4.3d) Environmental Influences

Environmental influences include factors such as: laws, regulations, economic conditions, competitive forces and technological changes. These factors are difficult for individual firms to control, however their effects must be dealt with in everyday operations. A number of environmental factors effecting residential construction were discussed in Chapter 2, through the PEST analysis. Again as discussed above risk management (Johnston and Lewin, 1996) is a significant part of organisational response to environmental uncertainty. Environmental uncertainty can effect buying processes with regard to buying centre influence/participation (Speckman, 1979), buying centre structure (McCabe, 1987) and buying centre conflict (Barclay, 1991).

3.4.3e) Choice Process Influences

Choice process is a constituent factor of all three of the seminal models of organisational buying behaviour (Robinson, Faris and Wind, 1967 Webster and Wind, 1972 and Sheth, 1973). All three identified steps and multiple participation in choice / buying processes (Johnston and Lewin, 1996). As will be discussed in the study framework section to follow a wide range of steps / stages / phases have been proposed by a variety of researchers. A further area of process related research has focused on the comparison of organisational buying processes to those of consumers. Moriarty (1983) points to the differences in consumer to organisational processes, while others such as Fern and Brown (1984) point to the similarities.

3.4.3f) Product and Market Influences

Product related factors have been recognised as an important influence in organisational buying behaviour, principally in terms of product attributes, type, use and market segmentation (Kauffmann, 1996). The buyclass dimension of Robinson, Faris and Wind's (1967) framework recognised familiarity with the product being purchased as an important dimension, which has been the subject of intensive research since, as already discussed. Bellizzi (1979) examined the effect of product type on buying processes. Product attributes have been examined by Kauffmann (1994) and Lehmann and O'Shaugnessy (1982) who identified five categories of product choice criteria (performance, economic, integrative,

adaptive, and legalistic). Mattson (1988) found that the use and importance of the product being purchased bare a direct relationship to the level of managerial participation and that the dollar value of purchases affected managerial involvement.

3.5 Study Framework

In order to proceed with this study it is important to encapsulate some of the pertinent aspects of the literature so as to develop a clear direction for the research to follow. The development of a framework allows for the illustration of the researcher's interpretation of a number of the key components of organisational buying behaviour theory, as they relate to material choice processes. The framework aims to incorporate a number of elements including process (material choice processes), participation (individual and group) and criteria (product and supplier choice criteria) to allow exploration across a range of material choice process settings (organisational). These elements cross a number of the influences mentioned by Kauffmann (1996).

3.5.1 Material Choice Processes

In consideration of structural material choice within the context of organisational buying behaviour literature it was decided to adopt processes as the overall umbrella term. The concept of organisational buying processes is relatively well established in the literature *"...organisational buying behaviour is best described as a process..."* (Johnson and Lewin, 1996:2). Webster and Wind (1972) and Kauffman (1996) highlight the idea that a single buying process does not exist and that it is not possible to identify one true decision making process. The use of the term structural material choice processes is an effort to acknowledge this diversity.

3.5.2 Stages in Material Choice Processes

Stages have long been used in the study of organisational buying processes, indeed Robinson et al. (1967) introduced the eight 'buyphases' as an integral element of their seminal work. Some authors have referred specifically to stages (e.g. Banting et al., 1991 and Johnston and Lewin, 1996) whilst others refer to steps (Mattson and Esmail, 1993) or phases (e.g. Robinson et al., 1967) as the building blocks to understanding organisational buying behaviour. Other researchers have argued that organisational buying should not be examined using preset stages, as they represent an attempt to fit an artificial structure to what are essentially unstructured and diverse processes. Instead some behavioural and time

process theories have been developed by researchers such as Tanner (1990) and Bunn (1990). The automatic assumption of step-by-step staged processes in organisational buying behaviour has also been criticised, rather it is suggested that buying processes are iterative and not sequential (Browne and Brucker, 1990 and Speckman and Gronhaug, 1986). In view of these perspectives this research has adopted a minimal number of stages in the exploration of structural material choice processes, compared to previous researchers who have used up to twelve stages, according to Kauffman (1996). The three stages adopted - structural material selection, structural timber specification, and structural timber supplier selection - are acknowledged as not being purely sequential. Some degree of iteration is likely between decisions associated with each of the stages in any given buying process. The three stages are aligned where possible to stages used in previous studies in Figure 3.7.

Present Study **3 Stages**	**Banting et al. (1991)** **6 Stages**	**Cooley et al (1978)** **2 Stages**	**Bellizzi (1979)** **9 Stages**	**Mattson & Esmail (1993)** **4 Steps**	**Johnston & Lewin (1996)** **8 Stages**
	Initiation of project.		Anticipation of problem.	Info gathering on new materials/ projects.	Need recognition
Material Selection	Survey alternatives & determine kind of material.	Product selection.	Determination of general characteristics.	Need recognition & determination of product needs.	Determine characteristics
Specification	Determination of specifications and characteristics to be met by material.		Setting specific description of characteristics.		Establish specification.
			Search for potential sources.		Identify potential sources.
	Survey available makes and invite bids from suppliers.		Info gathering and proposals.	Search for suppliers.	Request proposals.
	Evaluate submitted materials for fit with specifications.		Analysis of proposals.	Evaluation of suppliers.	Evaluate proposals.
Supplier Selection	Decide which supplier gets order.	Supplier selection.	Evaluation of proposals and supplier selection.		Select supplier.
			Select order routine.		
			Performance feed-back and evaluation		Post - purchase evaluation.

Figure 3.7: Organisational Buying Process Stages Used in Previous Studies.

Each stage is envisaged as comprising of a number of undefined, individual, but related decisions, rather than themselves constituting individual self contained decisions. This is

indicated in the third level of the framework, as illustrated in Figure 3.8. Decisions can be viewed as the smallest and most precise unit of analysis in a given buying process. However, it is considered impractical and excessively pre-emptive to identify a finite set of decisions, as each buying process is likely to differ in the number and sequence of individual decisions. It would be difficult to identify all the decisions that occur in an individual buying situation but it is near impossible to identify an exhaustive list of decisions that may occur across a range of buying situations.

The use of three stages minimises the degree of pre-emption, and possible bias, required before entering the primary research field and yet provides a framework for exploring a wide breath of buying processes across a range of buying situations. The researcher was conscious during the selection of the three stages of the need to use terminology that would be readily understandable within the construction industry. In support of the approached adopted in this framework, it is interesting to note that Cooley et al. (1978) adopted product selection and supplier selection as the two stages in their study of relative power (influence) in industrial buying decisions. They discuss the use of product specifications as a further possible stage. Banting et al. (1991) used six stages and a further four sub-stages in their investigation of industrial buying process involvement in Capitalist and Socialist Countries across material, component and equipment purchases. They range from the initiation of a project leading towards a purchase to deciding which supplier gets the order, and include a stage relating to the determination of specifications and characteristics to be met by the product.

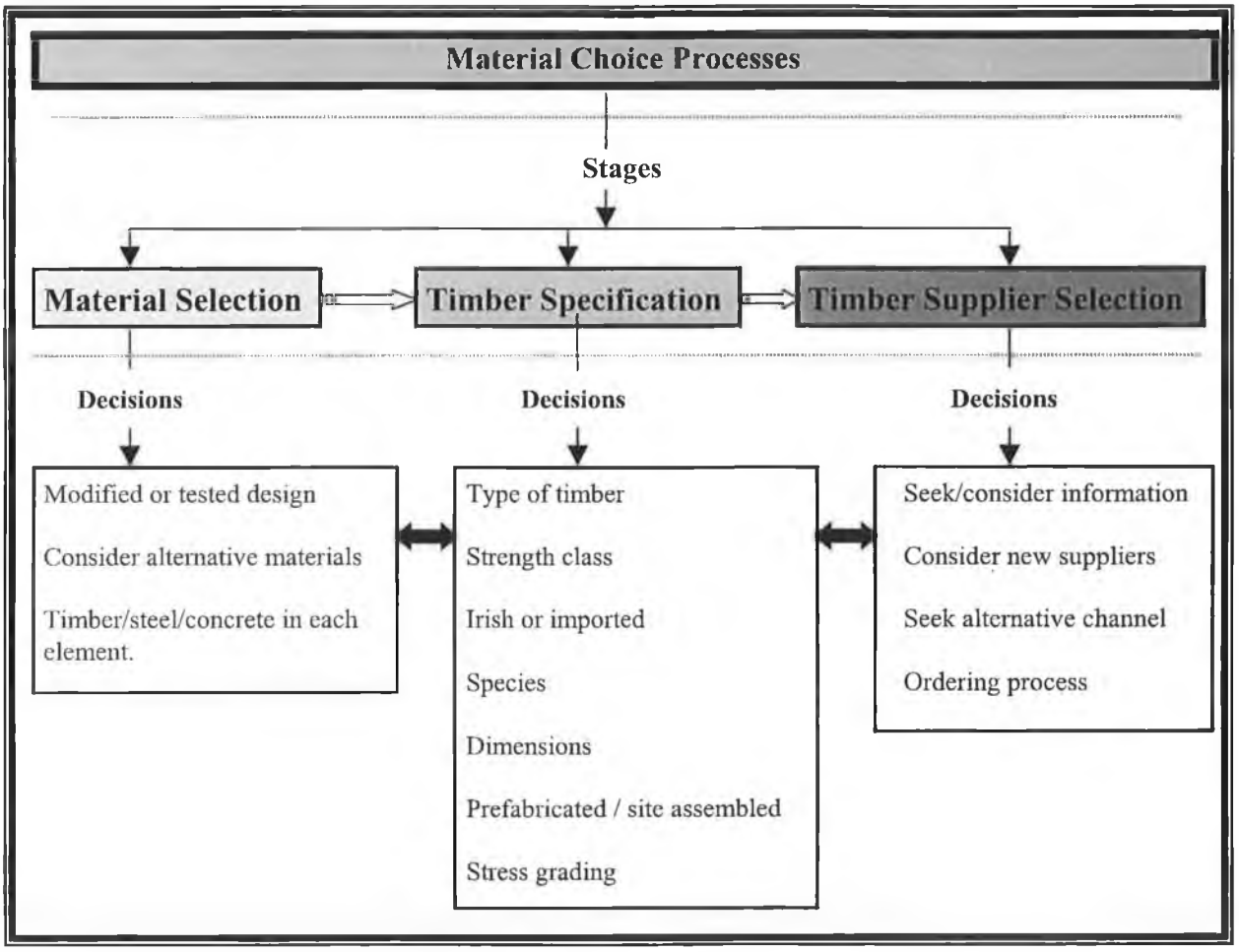


Figure 3.8: Representation of Organisational Buying Framework in Structural Material Choice.

3.5.3 Participation in Material Choice Processes

The second primary concept in the study framework is the definition of levels of participation in organisational buying as discussed earlier in this chapter. It was recognised that a clear delineation of terminology was needed in this regard, as the literature review uncovered a certain degree of ambiguity in some cases regarding the interchangeable use of the terms participation, influence and involvement. In common with Mattson and Esmail (1993) the delineation between influence and involvement is invoked – influence being an indirect and informal form of participation whilst involvement is seen as direct participation. Deciders (decision makers) is the third level of participation adopted in this study. It is also derived from previous literature dating back to Webster and Wind's (1972) classification of five buying centre roles and again appearing in Bonoma's (1982)

expanded version of same. The introduction of deciders into this study's classification of participation levels is an effort to reflect the different tiers of participation and power within material choice processes. Deciders are envisaged as the parties who have the final determining voice in decisions relating to material choice. The study framework aims to indicate the need to recognise the different levels of participation in the different stages of material choice processes as illustrated in Figure 3.9.

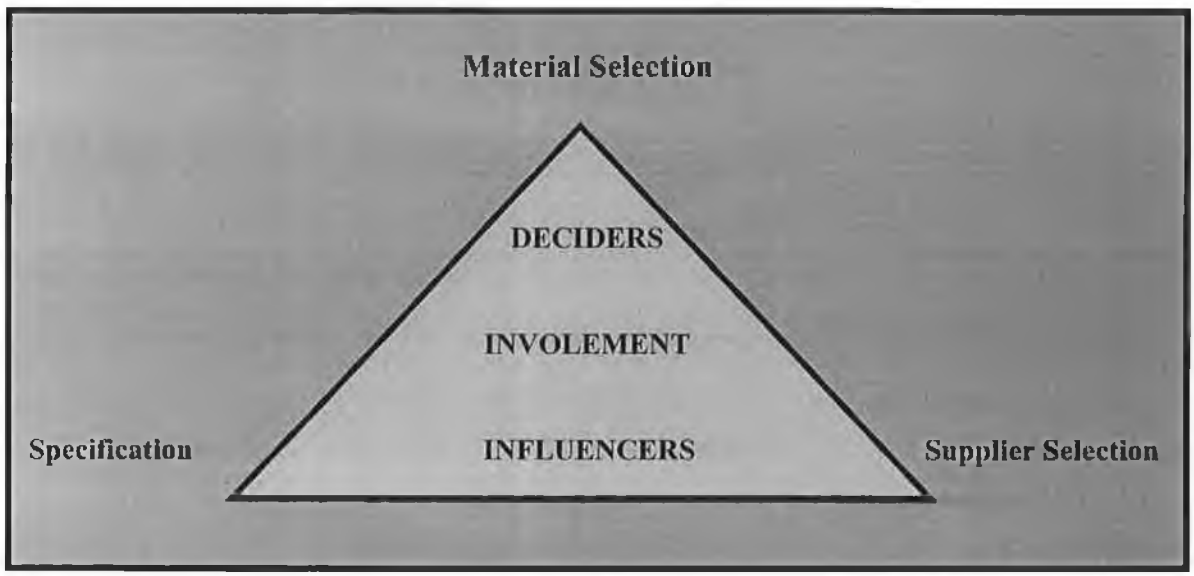


Figure 3.9: Participation Levels in Material Choice Framework.

3.5.4 Material Choice Criteria

The third primary constituent of the study framework suggests that material choice criteria differ across different purchasing situations. Kauffman (1994) highlights the importance of product attributes in organisational buying behaviour:- *"While there have been numerous attempts to over a number of years to describe and analyse various aspects of the industrial buying process, comparatively little has been done to determine the effects of general product related factors on the choice of products by buyers"* (Kauffman, 1994:29). He goes on to add process type and products / markets related factors to Webster and Wind's (1972) four sources of influence in organisational buying behaviour, in a later article (Kauffman, 1996). Choice criteria were examined by Lehmann and O'Shaughnessy (1982), who suggested five categories of criteria in product buying processes – performance, economic, integrative, adaptive, and legislative. In the context of material choice in the construction industry two previous studies have been located in the course of the literature searches. Firstly, Kozak and Cohen (1996) carried out a large scale survey of North American (US and Canadian) architects and engineers to discover their views on the

comparative merits of different structural materials, and provided a ranking of relative importance of various criteria in this regard. Secondly, The Construction Marketing Network (1997) also conducted a survey of US building contractors and specifiers, from which they produced a relative importance ranking of building product selection criteria. Product choice criteria is an important element of the study of organisational buying behaviour as it can provide an insight into the differing dynamics at play in the buying centre.

3.6 Conclusions

This chapter briefly examined issues of interest to structural material choice processes regarding organisational theory and organisational behaviour, which are important building blocks to organisational buying behaviour. The developing theory on construction industry organisational structure is examined, which highlights a shift towards relational and project based networks. However, most of this research focuses on client-contractor-subcontractor relationships concentrates on large-scale commercial sector contracting firms, rather than on the comparatively small-scale firms involved in the home-building sector. It is suggested that in the move towards relationship based organisational buying theory should remain focused on the importance of individual and group participation in buying processes (Tanner, 1999 and Demkes, 1997). Organisational behaviour literature highlighted conflict and power as important dimensions, which can impinge upon organisational buying behaviour. Much of the organisational buying behaviour literature is firmly rooted in three seminal models, which were published over 25 years ago. From the primary organisational buying behaviour influence based research streams a study framework for the exploration of structural material choice processes emerged. It incorporates elements of individual, group, organisational, process/stage, participation, and purchase/product/seller influences. The study framework initially assists in the development of study objectives (Chapter 4) and later in the primary research findings (Chapter 5) a model for integrating the presentation of the framework and research findings is produced. However, initially the methodology pursued in this study is outlined in Chapter 4.

CHAPTER 4

METHODOLOGY - DOMINANT INTERVIEW PHASE

Chapter 4: Methodology - Dominant Interview Phase

4.0 Introduction

This chapter forms a vital link between the secondary research contained mainly in the industry and literature review and the primary research that will follow. It describes and justifies the main stages of data collection, generation and management, as used in this study. This study incorporates two stages of primary data generation. The dominant first phase involved in-depth interviews with key individuals involved in residential developments. The less dominant second phase comprised of a mail survey of speculative home-builders in the Dublin area. This chapter concentrates on the rational and mechanism underlying these two phases, whereas Chapter 6 outlines the mechanisms underlying the mail survey.

The remainder of this chapter is structured as follows. Initially the topic and aim of the study are restated, followed by the description of the research objectives. Method selection is introduced in the next section after which the appropriateness of adopting mixed method research design is then considered. A diagrammatic representation of the methodology adopted is presented in Figure 4.1, which also illustrates the alternative research routes considered in the course of this study. The rationale for using 'qualitative' semi-structured development-specific interviews as the more dominant phase is examined in the following section. Next, the processes involved in the qualitative data collection are outlined and justified. The chapter closes with a conclusions section.

4.1 Research Topic

As a starting point for the discussion of methodology adopted in this study it is helpful to review the process involved in the development of the research. The lack of end user based research into the timber industry has been noted in the limited research literature on the Irish timber industry (Simons, 1990 and Murphy, 1990). The residential construction industry was selected as the focus for this study, as it was found to be the largest use sector for softwood timber products (See Chapter 2). The literature highlighted the importance of recognising the participation of various individuals and groups in organisational buying processes and the diversity of influencing factors involved in organisational buying processes:- *"Apart from the*

mixed motivations which influence buyers of industrial products, it is also important to study how buying decisions are taken. Who, in fact, is the key figure in deciding to buy a particular product and what is the contribution made by other members of the Firm" (Chisnall, 1992:266). The literature searches only yielded two studies on organisational buying behaviour within the construction industry, both of which date back to the 1970's. Firstly, a study of patronage motives of private residential builders in supplier selection (Banville and Dornoff, 1973), and secondly, a study focusing on buying behaviour in US commercial construction firms (Bellizzi, 1979). The research, as described in the title, is centred round structural material choice processes in Irish residential construction as the overall context within which structural timber is used.

4.2 Study Aim

The importance of developing a clear statement which summarises the central aim, question or problem being addressed in the study is generally accepted as a fundamental element of the research process (e.g. Brannick, 1997 & Creswell, 1994). This statement should capture the essence of the study in a single sentence or paragraph and thus establish the direction of the research. The aim of this study is as follows:

"To explore structural material choice processes in the Irish residential construction sector and to integrate the findings and study framework in a model."

Material choice processes are adopted as the key component of the study aim in order to reflect the diversity of buying situations, as discussed in the previous chapter.

4.3 Objectives

There are four core objectives in this study, each of which is discussed below:-

Objective 1:
To explore participation in structural material choice processes in the Irish residential construction sector.

The exploration of participation in material choice processes stems from one of the

cornerstones of organisational buying behaviour theory, which suggests that the multi-party constitution of organisational buying processes adds to the complexity of understanding organisational buying behaviour. Indeed organisational buying processes have been described as *"...mutiphase, multiperson, multidepartmental and multiobjective process(es)"* (Johnston and Lewin, 1996:1). Many researchers have concentrated on the identification of participants, influencers, those involved or decision makers in specific stages, phases, decisions or steps of organisational buying processes (e.g. Banting et. al, 1991; Mattson and Esmail, 1993; Grashof, 1979, Tanner, 1996; Berkowitz, 1988). This study borrows some of these terms to build a framework for exploring a broad spectrum of the buying process in the residential construction sector, as discussed in Chapter 3.

As explained in Chapter 3 three stages were adopted; structural material selection, structural timber specification, and structural timber supplier selection. Furthermore, three levels of participation were identified for exploration across the three stages of residential construction industry material choice processes. These levels of participation are influencers, those involved, and deciders. Previous studies have most commonly produced rankings of relative participation, influence, or involvement (e.g. Mattson and Esmail, 1993; Bellizzi and McVey, 1983; Bonoma, 1982; Silk and Kalwani, 1982). The essence of this objective is to explore three participation levels, as gathered from a variety of previous studies, within the context of the residential construction sector.

This objective and the second objective, which follows, identify specific aspects of the structural material choice processes, which emerged from the organisational buying behaviour literature as being of particular importance. This type of data is recognised to be of importance: *"...vendors should identify the functional areas' influence by decision phase, recognise the choice criteria of each area, and adjust the marketing mix to satisfy these criteria"* (Tanner and Castleberry, 1993:35).

Objective 2

To explore structural material selection criteria in the Irish residential construction industry.

The importance of exploring the criteria involved in product choice is recognised by many authors, however the research on choice criteria has been relatively limited as highlighted by Kauffman:- *"...comparatively little has been done to determine the effects of general product-related factors on the choice of products by buyers"* (Kauffman, 1994:29). Kozak and Cohen (1996) found regional differences in the quality rating of structural materials within the US and Canada and they also noted differences between structural engineers' and architects' views in this regard. This study also aims initially to discover and explore differences in criteria emphasis between participants in different types of residential development (one-off owner-developers, speculative developers and social developers). Secondly, the study aims to discover if differences in criteria exist between different participants involved in individual developments.

Criteria or product attribute importance has been examined by Evans (1981), in his study of involvement and product attribute importance across four different types of products. Banville and Dornoff (1973) investigated the relative importance to private residential builders of both economic and non-economic patronage motives in industrial source selection decision processes, however this study aims to investigate a range of criteria in each of three stages of material choice processes.

Objective 3:
To integrate the study findings and the study framework through the presentation of a study model.

The development of models of either specific elements or overall organisational buying behaviour processes is relatively widespread in the literature. Seminal organisational buying behaviour works incorporated the development of models (Robinson et. al, 1967; Webster and Wind 1972), which have been the subject of a considerable volume of the subsequent research over the past 30 years (Sheth, 1996 and Chisnall, 1985). While this research is not claiming to develop a new model of organisation buying behaviour, models are important vehicles for displaying the framework and findings of research. Models enable readers to scrutinise kernal concepts of research work . The use of such models can be illustrated by Roche's statement:- *"Not infrequently researchers will themselves develop models by linking*

the ideas and findings emanating from literature reviews and perhaps organising their own ideas on a research topic" (Roche, in Brannick and Roche, 1997: 105). The framework developed at the end of Chapter 3 is a crucial element in the presentation of the study model.

Objective 4:
To explore structural material changes in the Irish residential construction sector.

A number of previous studies have examined the effect of changes in the products purchased on organisational buying processes. There is contradictory evidence on the impact of new and modified products on the buying process. Berkowitz (1988) and Lewin and Johnston (1996) point to considerable differences in buying processes in the case of major changes in products purchased. On the other hand Bellizzi (1983 and 1979) found in his study of the commercial construction industry that the 'buyclass' variable (new task, modified rebuy and straight rebuy) is not a significant variable in organisational buying behaviour. This objective aims to discover some of the changes in structural material usage and to provide some insight into the organisational behaviour implications of these changes.

Sub-objective 4.1: To discover residential construction industry views on structural timber related material changes.

This objective seeks to provide an insight into the residential construction sector views on structural timber related material changes, in an effort to retain a strong orientation towards the origins of this topic, as a study grounded in the concerns of the timber industry to understand demand for their products. As stated in the industry reviews the residential construction sector is the most important user of timber products and as such warrants the concentration of this study. This study provides a unique opportunity to discover and develop a picture of residential industry participant views on structural timber products.

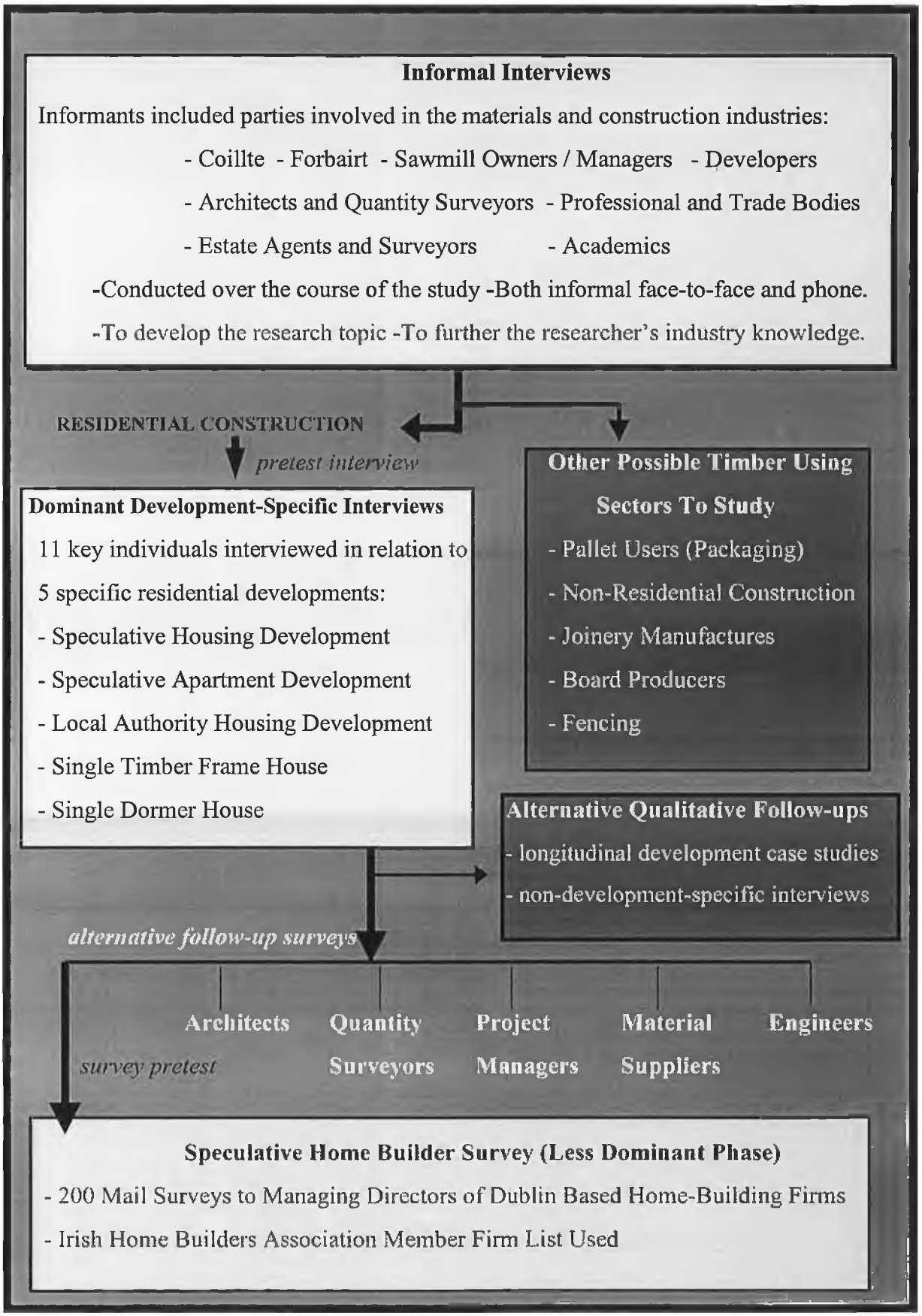


Figure 4.1 Outline of Study Methodology (showing selected strategies in light background and non-pursued strategies in darkened background).

4.4 Method Selection

The choice between qualitative and quantitative research methods has sometimes been viewed as part of a paradigmatic debate. For instance various authors describe qualitative and quantitative as separate paradigms (e.g. Malhotra, 1993; Creswell, 1994; Dibb et al., 1997; Hathaway, 1995). Donnellan (1995) expresses the view that qualitative research allows for a broader and more holistic perspective than is possible with quantitative research. Further qualitative methods have been associated with a degree of subjectivity and researcher integration in the subject, whereas quantitative methods have been considered as more objective with the researcher remaining distant from the subject.

However there are numerous objectors to making the distinction between quantative and qualitiative methods a paradigmatic one (e.g. Guba and Lincoln, 1994). Rather than discuss quantative and qualitative paradigms Brannick (1997) instead writes of two major traditions of research – the empiricalist / hypothetico-deductive and hermeneutic / understanding / inductive traditions. Briefly and crudely the empiricalist / hypothetico-deductive approach stresses the testing of generalisations, whereas the hermeneutic / understanding / inductive tradition tries to grasp the meanings of social groups and actors. Further Brannick (1997) identifies three primary methodological strategies as experiment, survey and case base research. Case based and survey strategies are acceptable both within the empiricalist / hypothetico-deductive and hermeneutic / understanding traditions - experiments on the other hand are held to be incompatible with the hermeneutic tradition.

In this study a distinction is drawn between qualitative and quantitative methods and data rather than elevating the distinction to an inter-paradigmatic one. The combined exploratory and descriptive nature of the research objectives rather than a predisposition of the researcher to a given method drove method selection. As regards the 'paradigm' or tradition into which this research might be placed it is clear that the explicit development of a study model in chapter 3 would seem to preclude classifying the research in Brannick's definition of the inductive / hermeneutic tradition for:- *"In the hermeneutic tradition (sometimes referred to as inductive theory) the researcher ideally enters the research site with few or no theoretical preconceptions."* (Brannick, 1997:6). Nevertheless the researcher attempted to gain from the lessons of such an 'inductive theory' approach by being open to, and

reporting on, themes emerging from the in-depth interviews.

4.5 Mixed Methods

The appropriateness of using mixed or combined methods in research projects has been the subject of considerable debate for many years. Creswell (1994) and Hathaway (1995) point to three schools of thought on the combination of research methods. *"The 'purists' said that paradigms and methods should not be mixed; the 'situationalists' asserted that certain methods are appropriate for specific situations; and 'pragmatists' attempted to integrate the methods in a single study"* (Creswell, 1994:176). Hathaway states that purists *"...focus on the incommensurability between the two approaches and argue that the two approaches are so divergent in terms of assumptions about the world, truth, and reality that one should not even consider combining quantitative and qualitative research"* (1995:539). The argument that the qualitative-quantitative distinction is a paradigmatic one has been rejected above. Such objections to mixing qualitative and quantitative 'paradigms' has been refuted by various authors on the grounds that epistemological differentiation is unrealistic as the two are inextricably intertwined at the level of specific data sets and at the levels of study design and analysis (Brannen, 1992).

At a more pragmatic level some point to the considerable expansion of study length and duration and skills required to conduct a mixed method study (Locke et. al, 1987). Yet numerous authors have recognised the benefits of mixed method research. *"Designing a study in which multiple cases, multiple informants, or more than one data gathering method are used can greatly strengthen the study's usefulness for other settings"* (Marshall and Rossman, 1995*). "The multi-technique approach to research underlies the desirability of using several different methods, which together make up a sound research strategy. It is not so much a question of which method is best as which set of methods is likely to result in an objective research programme"* (Chisnall, 1992).

Crewell (1994) and Hathway's (1995) - situationalists believe that certain methods are most appropriate for specific situations and they alternate between quantitative and qualitative methods as they engage the research process. *"In contrast to the situationalist who alters between the two approaches, the pragmatist views the two approaches capable of simulanteously bringing to bear both of their strengths to answer a research question"* (Hathaway, 1995:539). The researcher notes a certain

degree of convergence between Hathaway's description of pragmatists and the process of triangulation as described by Greene et al. (1989) (see below). Furthermore, there appears to be a link between situationalists and complementarity when related to the other three purposes for combining methods outlined by Greene et al. (1989). Mixing of methods is discussed comprehensively by Greene et al. (1989), who identify five purposes for mixed-method evaluation: triangulation, complementarity, development, initiation and expansion. The term triangulation is often used as an umbrella term to describe all mixed-method evaluations. However, according to Green et al. *triangulation* is the designed use of multiple methods, with offsetting or counteracting biases, in investigations of the same phenomenon in order to strengthen the validity of inquiry results. This may be contrasted with *complementarity* where qualitative and quantitative methods are mixed in order to examine overlapping but also different facets of a phenomenon, which yields an enriched, elaborated understanding of the phenomenon. *Developmental* mixed methods involve the sequential use of qualitative and quantitative methods, where the first method is used to help in the development of the second. *Initiation* seeks the discovery of paradox and contradiction, new perspectives of frameworks, the recasting of questions or results from one method with questions or results from the other method. *Expansion* seeks to extend breath and range of an enquiry by using different methods for different inquiry components.

The rationale behind using mixed methods in this study crosses three of these purposes - complementarity, development and expansion. The primary purpose is complementarity as the survey of Home Builders primarily examines the same phenomena of participation and material choice criteria, but it also widens the breath of the study by examining perceptions on structural timber and timber frame development.

The interview phase assisted in the development of the survey, but yet remains the dominant element of the primary research. Jick (1979) expresses the view that mixed method designs, particularly those mixing qualitative and quantitative methods, are desirable and that they should be considered as complementary rather than rival.

4.5.1 Mixed Method Research Design

There is limited guidance in the literature on appropriate designs for combining

qualitative and quantitative methods within a single study. However, Creswell (1994) suggests three models for mixed method designs these being; the two-phase design, the dominant-less dominant design and the mixed-methodology design.

The *two-phase design* involves the presentation of a qualitative phase and a separate quantitative phase to a study, where the two are presented in a thoroughly separate fashion. The difficulty with this approach is that the reader may fail to discern the connection between the two phases.

The *dominant less-dominant design* involves a clear dominance of either the qualitative or the quantitative phase in the presentation of the study. In fact Creswell suggests that the study be presented entirely in the dominant 'paradigm', with one small component of the overall study drawn from the alternative 'paradigm'. Whereas Creswell's (1994) use of the term paradigm is suspect (see discussion above) he does present design options for the mixing of methods.

The *mixed-methodology design* involves the integrated presentation of both qualitative and quantitative phases throughout all stages of the research. It is the highest form of mixed method design according to Creswell, however he expresses the view that the researcher requires a sophisticated knowledge of both 'paradigms' and that the linking of the two 'paradigms' may be unacceptable to some authors.

The present study broadly follows the dominant-less dominant design in the combination of a predominant qualitatively orientated semi-structured interview phase, which is followed by a less-dominant mail survey. The later phase examines a small component of the overall topic, by focusing on a number of very specific issues amongst a small, but significant, section of the overall population within which the study is set. Whilst the results of the two phases are presented separately, the interview analysis is dominant and the conclusions section aims to tie them together. The conclusions draw on the less-dominant mail survey results to a considerably lesser degree than the dominant interview results.

4.6 Qualitative Research

Qualitative research emanated from various disciplines and is constantly evolving. It is concerned with how the social world is interpreted, understood, experienced or

produced and based on methods of data generation that are flexible and sensitive to the social context in which the data are produced. The methods of data analysis and explanation involve understanding the detail and complexity of data and whilst it often involves some degree of quantification it is rarely incorporates statistical forms of analysis (Mason, 1996).

Creswell (1994:5) describes qualitative research study as *"...an enquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants and conducted in a natural setting".* Qualitative research methods allow a greater level of flexibility in design and execution of research than is generally the case with quantitative. The scope for uncovering and reporting industry opinions, attitudes and perceptions is one of its primary strengths in the context of this phase of this study. *"With qualitative research it is the concepts and categories, not their incidence and frequency, that is said to matter. 'In other words qualitative work does not survey terrain, it mines it' (McCracken, 1988:17)"* (Brannen, 1992:5/6). *"All qualitative researchers can cite occasions on which an off-the-cuff remark from one respondent illuminated the research problem and provided a framework for understanding all that was going on. That remark was invaluable in for the insight it gave and yet it was said once by one person"* (Robson and Hedges, 1993:30). This extract from an article on the analysis and interpretation of qualitative research reiterates one of the primary advantages of qualitative research over quantitative, which is its flexibility to discover the unusual and the unanticipated. Furthermore, Cherns and Bryant (1984) also point to the need to conduct in-depth qualitative exploratory research within the construction industry *"Construction industry researchers tend to oversimplify the role of the client in the construction management process. This partly results from the propensity of researchers to use 'broadcast' survey method approaches which typically achieve shallow penetration of the client's world."* (Cherns and Bryant 1984:177).

Various assumptions have been forwarded as underlying qualitative research methods, such as the researcher being the primary instrument for data collection and being interested in process and meaning rather than simply reporting outcomes. More comprehensive discussion of these assumptions may be found in Merriam (1988), Creswell (1994) and Marshall (1990).

As already mentioned, in qualitative research the researcher's presence in the

participants' lives, whether for prolonged periods as in long-term ethnographies, or for a short period as in the case of in-depth interviews, constitutes an integral part of using qualitative methods. For this reason it is necessary to state that the researcher comes from a valuation surveying and property economics educational background, and has previously conducted research on the Irish forestry sector (O'Neill, 1995). Though these facets may be seen as potential sources of bias, the research has endeavoured to recognise and challenge preconceptions held about the topic. It was necessary for the researcher to realise that certain perceptions about the construction industry were untrue or exaggerated. Nevertheless, it is felt that on balance the researchers fore-knowledge was beneficial in terms of building and maintaining a sense of rapport with the interviewees.

The main methods associated with qualitative research are in-depth interviews, participation, observation, case studies (Yin, 1993 and 1994), focus groups and projective techniques (Marshall and Rossman, 1994; Creswell, 1994; Malhotra 1993). It was decided to use in-depth semi-structured interviews in this study.

4.6.1 In-depth Semi-Structured Interviews

In-depth interviews have been described as a conversation with a purpose. They are far less formalised in terms of predetermined response categories than is the case with their quantitative counterparts. There are various types of interviews, including ethnographic interviewing (used to gather cultural data), phenomenological interviewing (involving the study of experiences and ways in which we put them together to develop a world view), elite interviewing (focuses on a particular type of interviewee, i.e. people with special expertise, or prominent, well informed, influential people) and focus group interviewing. There have been numerous arguments put forward questioning the external validity of qualitative research interviews or labelling them as 'non-scientific'. These objections to interviews have been rebutted by writers such as Kvale (1994).

Lang and Heiss (1994) and Bailey (1982) too discuss the main advantages and disadvantages of interviews as a research method and their work is drawn on to discuss the appropriateness of interviews to this study.

A number of advantages arise with interviews, which help to illustrate their appropriateness to this study.

Firstly, the flexibility to deviate from a set pattern of questions if the need arises,

allows the interview to be tailored to the individual situation and respondent. This is important as this research investigates the views of different participants in different types of residential development. Secondly, probing is possible in areas of particular interest or vagueness. As Marshal and Rossman (1994) put it there is flexibility for the researcher to follow up informational opportunities which may arise during participant interviews. Probing facilitates the expansion of the enquiry into areas of particular interest through the extension of existing topics or the introduction of new topics or perspectives through the course of individual interviews. Thirdly, interviews generally have a better response rate than other survey methods.

Fourthly, face to face interviewing facilitates a higher level of communication between the interviewer and respondent. Given the study aim to explore the complicated organisational buying behaviour issues surrounding material choice processes in the residential construction sector, it is important to facilitate a high level of communication in order to elicit the required information. Face to face interviewing enables rapport to be established between the interviewee and the interviewer, which assists in explaining and exploring specific aspects of the study framework. Fifthly, non-verbal behaviour such as facial expressions and hand gestures can be noted and can be as important as the actual verbal responses, silences and pauses can be noted, which can also be very enlightening. Finally, the overall atmosphere of the interview and demeanour of the interviewees can be recorded.

Sixthly, information can often be checked or verified during the actual interview, which was crucial for this phase of the research, as the potential for misunderstandings and incorrect information was minimised in the face to face setting. A system of cross checking some of the factual information given by interviewees was undertaken by way of examination of the plans for the subject developments lodged in the local planning offices. Additionally brief inspections of the completed developments were undertaken. These cross-checks enabled the researcher to gauge the accuracy of the interviewees' accounts of materials used in the subject developments. As it emerged, this helped to reassure the researcher on the validity of the interviewees' recall of the specific developments and thus bolster confidence in other information received.

Finally, the interviewer can control, or certainly record, the environment under which interviews are conducted and only the respondent can answer. All the interviews were

held in the interviewees' office or home. Each was recorded by Dictaphone.

There are also a number of limitations of interviews. Firstly, time and monetary costs are high. A problem arises in the level of dependence which the researcher has on receiving co-operation from the participants and their ability or willingness to participate. This has restricted the number of interviews conducted within this study, nevertheless a broad range of parties were covered. Secondly, there is a lack of anonymity, which can be a problem when investigating sensitive issues. The issues under investigation in this study would not be considered as excessively sensitive. Thirdly, the comparability of answers given by respondents can be restricted, as the wording and order of particular questions vary from interview to interview. Fourthly, it can be difficult to determine the worthwhileness and truthfulness of the information received. Fifthly, there is a need to create rapport between the interviewer and the respondent. Finally, there are potential problems of interviewer bias and subjectivity.

4.6.2 Development-Specific Interviews

It was decided that the interviews should be conducted on a development-specific basis for four main reasons. Firstly, in order to focus the interviewees' responses on a specific development or context. Secondly, to enable the researcher to compare and contrast the responses of the different interviewees on the basis of the same developments. Thirdly, the researcher could ensure that the targeted range of development types could be specifically covered. Finally, the emerging organisational perspective of the construction industry as a project based temporary network structure would suggest that the most appropriate unit for exploring organisational buying is within the context of specific projects or developments. Focusing on particular developments enables the interviewees to recall specific details in relation to the composition of the team involved in the development and more importantly the dynamics of the material choice process. It is considered crucial that this focus be facilitated, as interviews on an non-development-specific basis, in this situation, would be likely to yield very general answers, which would fail to uncover the depth of information necessary to provide a complete picture. This strategy also enabled the researcher to elicit general views on trends in material usage and the dynamics of the industry, in the same way as non-development-specific interviews would.

Due to the unique nature of each development and the precise make-up of the development or project team (network), an exploration of specific developments adds

depth to the research and helps to create an understanding of material choice processes in these cases. If a survey of architects, developers, or other construction industry players were carried out, on a non-development-specific basis, the responses would be general in nature, as the balance of responsibility in each development differs and the specifics of material choice processes would not be discovered. The data gathered would also be limited to the views of only one group within the industry, which results in a somewhat one-dimensional picture. A significant difficulty with development specific interviews arises due to the need to gain access to specified individuals involved in the selected developments. The next concern was the selection of suitable developments upon which to conduct the interviews, so next the theory of sampling in qualitative research is examined and then the subject-developments are outlined.

4.6.3 Sampling in Qualitative Research

Luborsky and Rubenstein (1995) discuss the importance of sampling within qualitative research. They argue that qualitative research involves sampling for meaning, as meaning and context are seen as the basic building blocks of qualitative research. Probability sampling which is the staple of much quantitative research, cannot normally be used in qualitative research as the members of the universe are not known a priori. However, Luborsky and Rubenstein (1995) identify five types of non probability sampling which have been used in qualitative research from the literature, these are as follows:-

- ***Convenience*** or opportunistic sampling is based upon a first come first served subject selection procedure, in order to reach a target number of subjects.
- ***Purposive*** sampling involves the intentional selection of subjects in order to represent some pre-defined traits or conditions, the goal of which is to explore and describe the conditions and meanings occurring within each of the study conditions. It does not attempt to determine prevalence, incidence or cause. Sykes (1991:5) describes purposive sampling as comprising of *"...non-probability samples selected in such a way as to increase the chances of covering the range of issues, phenomena, types of individuals and so on, that are of interest."* Purposive sampling is particularly applicable to this study, as the researcher has identified a number of different conditions which differentiate various sectors of the residential construction industry. The developments selected include a broad range of these conditions.
- ***Snowballing*** or word of mouth techniques use participants as sources of other

potential participants, whereby existing participants may refer the researcher to other suitable sources. Again a certain element of snowball sampling was used, both to get initial contacts in suitable developments and then to gain access to other parties involved in these developments.

- ***Quota*** sampling involves the selection of numbers of subjects to represent particular conditions, as opposed to using the universe of possible subjects as the starting point.
- ***Case Study*** samples select a single individual, institution, or event, as the total universe in itself.

4.7 Subject Development Selection and Access

Initially purposive sampling was used to identify suitable residential developments for this study. The main types of residential construction were identified as speculative housing, social housing (public and voluntary), speculative apartments and owner developed single houses. It was decided to examine one of each of the first three types of multi-dwelling developments and two one-off-houses. It was felt that generally the greatest diversity in terms of design and material usage can be found in single one-off housing developments, however the vast bulk of new residential units are constructed in multiple unit developments. So from this viewpoint the sampling requirements were set by the conditions or development types to be examined. This is similar to the approach adopted by Harris and Sutton (1986) who in order to build a model applicable across organisation types purposefully selected diverse organisations from a population of 'dying organisations'. They chose eight organisations across four categories: private-dependent, private independent, public dependent, and public independent. This study aims to include a range of developments types to include public, speculative and owner developments.

Each of the developments, which acted as the base for interviewee selection, is discussed in more detail later. Industry experts assisted the researcher in identifying and targeting individuals and development firms who were recently involved in appropriate developments. The individuals and organisations in question were then contacted either by letter or phone in order to seek their co-operation. If they then showed a willingness to participate and had been involved in a suitable development within the previous year, the researcher sought the names of the main designers / architects involved in the development. When the architects were contacted the name of the individual within the development firm who identified them was used in order

to 'break the ice'. This procedure was very time consuming, however it was found to be the most effective method of achieving the co-operation of the parties involved.

A number of earlier tactics for gaining access to suitable developments failed, for various reasons. For example the initial strategy to gain access to suitable developments involved contacts within the new home divisions of estate agencies. The developments were selected from newspaper property sections in order to represent the selected conditions or segments of the market. This approach succeeded in one case, however it failed in two other instances. The process of achieving agreement from the parties in each development was time consuming in all cases and refusals often took as long to confirm as agreements.

It was found that the developer was the vital link in terms of securing the agreement of the other parties involved in developments. When contact was then made with designers the researcher could reassure them that their client had agreed to participate and in so doing it overcame objections in regard to confidentiality and may have made them concerned about not participating as it might have reflected badly on them to their clients.

The interviewees were offered confidentiality in regard to their identities and the name of the subject development, where applicable. An assurance that only a general description of the location of the development would be provided in the study was also given (see sample letter in Appendix A). This was felt to be necessary after initial contact with a number of potential subjects uncovered a reluctance to be named in the study. Even with these assurances one developer still refused to co-operate, as he had a policy of not participating in research studies.

4.7.1 Subject Developments

Table 4.1 below displays information on the subject developments in terms of type of development, general location, approximate size and the parties interviewed in the research.

Development Type	Location	Size	Interviewees

Speculative Houses	**Co. Dublin**	**c. 70 houses**	**QS (development firm) & Architect**
Speculative Apartments	**Co. Dublin**	**c. 300 apartments and houses**	**QS & Partner (development firm) & Architect**
Public (Social) Houses	**Co. Dublin**	**c. 60 houses**	**Local Authority Architect & QS (contractor)**
Single Timber Frame House	**Co. Offaly**	**1 house**	**Owner-Developer & Architect**
Single Dormer House	**Co. Kildare**	**1 house**	**Owner-Developer & Draftsman**

Table 4.1: Outline of Subject Developments

4.7.1 a) Speculative Housing Development

The speculative housing development is located in County Dublin and comprises of approximately 70 semi-detached houses. The design and materials used are relatively standard in terms of estate housing. Initial identification of the development was through the new homes division of an estate agency firm. The first contact within the development company was with the in-house sales administrator, who identified the in-house quantity surveyor as the primary individual involved in this development within the development company. When the quantity surveyor agreed to co-operate, he identified the individual architect within the architecture practise used, who had the greatest input into the development. When contacted this individual also agreed to participate.

4.7.1 b) Speculative Apartment Development

The speculative apartment development is located in County Dublin and comprises around 200 apartments and 100 houses. It was developed in phases, the most recent phase was completed in July 1996 and consisted of around 70 apartments. The structural materials used are relatively standard in terms of apartment development. Initial access to this development was gained through an industry source. This developer has been involved in apartment development for many years in advance of the current upsurge in apartment development and as such has a vast amount of experience and knowledge in this area. The contact within the development company very quickly agreed to participate, as did the architect who designed the development.

4.7.1 c) Public Housing Development

Again the public (social) housing development is located in County Dublin and comprises of approximately 60 terraced houses. The materials are relatively standard.

Initial contact was made with the head contractor involved in this development, as industry contacts identified this company as being very active in social housing developments. The in-house quantity surveyor agreed to participate in the research and he identified the Architect within the Local Authority who was responsible for this project. He also agreed to co-operate, after slight hesitation.

4.7.1 d) Timber Frame House

The timber frame house is located in County Offaly and was developed by the owner-occupier. The main difference from traditional blocks and mortar construction is that the internal leaf of the external walls are timber, while the external leaf remains of conventional blockwork construction. This house was suggested as a possibility by an industry contact. The initial approach was made to the owner developer and then to the architect, both of whom agreed to co-operate.

4.7.1 e) Single Dormer House

The second single house is a dormer type house, located in County Kildare, within commuting distance of Dublin. The materials used are relatively standard. The owner developer was approached first and then the designer who is a draftsman / engineer. Both agreed to participate.

4.8 Interview Procedures

All the interviews were conducted in the offices or homes of the interviewees, in May and June 1997. They ranged in duration from 30 minutes in the case of the owner developer of the timber frame house to 90 minutes in the case of the owner developer of the single bungalow. Each interviewee was contacted by mail and by phone in order to firstly secure their co-operation and secondly to arrange a suitable appointment. This process took varying numbers of contacts in order to secure their involvement and in some cases it proved very time consuming.

The importance of developing and implementing a systematic approach to recording research data is emphasised by Marshall and Rossman (1995), to facilitate the future management and analysis of the data. A dictaphone was used to record the interviews, as it allowed the interviewer to fully concentrate on the answers given and to follow up interesting angles which arose during the interviews. It has also been found that note taking by the interviewer can inhibit and distract the respondent (Lang and Heiss 1994). Most of the interviewees were initially somewhat concerned about the use of

the dictaphone. However, they were reassured that the purpose of the Dictaphone was solely to allow the interviewer fully concentrate on the dialogue. As the interviews progressed, they seemed to more or less ignore it and engage in relatively free discourse. One of the respondents was very wary about the whole idea of the interview and the idea of it being taped. However, this individual was very cautious in his entire approach to the interview, even before the Dictaphone was turned on and after it was turned off, so it is felt that note taking would have had the same effect on him.

At the end of each interview the researcher made notes in relation to his reflections and observations about the interview itself, the setting, its duration and the general atmosphere.

4.8.1 Theme Sheet Details (Research Instrument)

A theme sheet or general list of topics to be covered in the semi-structured interviews was developed in advance of each interview. It was used as a guide to direct the interviews down the routes of particular importance to this research, rather than as a rigidly structured questionnaire style instrument.

There were some variations in content and sequence of topics covered in each interview, as is normal in in-depth interview situations. Certain areas of investigation were either very relevant or irrelevant to the individuals being interviewed. 'Probes', which are follow up or contingency questions used to achieve a fuller or clearer response, were used in all the interviews. Some of these probes were pre-set, in anticipation of limited answering in relation to various themes, however many developed during the actual interviews and as such helped in development of theme sheets for the subsequent interviews. A sample theme sheet is included in Appendix B and a brief outline of the main themes follows

Theme 1: Development Details

As the interviews were conducted on a development specific basis, for the reasons already outlined, it was decided to seek contextual information on the environment within which processes of concern occurred. The ability to provide this context rich data is generally accepted as a considerable strength of qualitative methods. The

initial questions were straight forward and factual in nature, seeking information on the development content and the materials used in various components of the development super-structure (i.e. external and internal walls, roof, ground floor and upper floors). These questions were designed to build interviewee confidence, as this information should be readily recalled by those involved in the developments. Most of this information was known before the actual interviews, through examination of the plans submitted to the relevant Local Authority for Planning Application purposes. These questions helped to verify the interviewee's involvement in the development and the accuracy of their memories regarding the specific development. So they acted as an initial gauge of the reliability of the interviewees' responses.

Theme 2: Participation in the Subject Developments

In a further elaboration of the development specific context within which this investigation was set, information was sought on the main participants in various stages of the development process. This assisted in development of a full picture whereby interviewees could identify the parties involved in the development, and this information could be used subsequently in probes relating to participation in material choice.

Theme 3: Participation in Material Choice Processes.

Participation in material choice processes is explored as a central theme in each interview. The main probes in this regard relate to the three stages of structural material choice- material selection, specification and supplier selection. Further direction is sought through the exploration of participation levels within the stages of material choice processes. Probes were used to discover the main decision makers and other parties involved in material choice and information was sought on the parties not directly involved but yet influencing material choice processes.

Theme 4: Material Choice Criteria

The fourth main theme covered in all interviews sought to discover the main criteria which the interviewees consider when involved in structural material choice processes. Furthermore the exploration of perceived differences in material choice criteria between different participants in the development team and different types of developer were investigated.

Theme 5: Structural Material Changes

The interviewees were asked to identify any changes that they see developing in residential material usage. Some specific probes were used where necessary to suggest recent material changes in order to explore the effects of material changes on material choice processes. However, where possible deviations from normally used materials, which were mentioned by the interviewees, were used as a medium for exploring the participatory dimensions of changes in material choice processes. In certain instances this theme afforded the opportunity to explore the interviewees' views on the adaptiveness of the industry to new materials and main restraints to change in this context. These areas became of greater importance as the interviews progressed, as it became apparent that some rich data could be generated on the power and conflict dimensions of organisational buying behaviour in this context.

4.9 Conclusions

This chapter described the overall methodology adopted in this study and briefly reflected upon the theoretical basis of the methods used. A diagramatic representation of the research methodology followed the statement of the study aim and objectives. Reflection on the appropriateness of mixed method research design leads into a discussion of the dominant-less-dominant system of combining qualitative and quantitative methods, as used in this study. The dominant qualitatively orientated interviews were undertaken on a development specific basis, with interviewees from both the design and development disciplines. The mechanisms underlying the less-dominant phase - a mail survey of speculative residential home builders in the Dublin area – will be dealt with separately in Chapter 6, after the interview findings. The exploratory nature of the interviews assists in the development of the mail survey, which will take an illustrative and extension orientation in its objectives in order to compliment the interview phase. The conclusions and recommendations chapter aims then to tie the various strands of the study together. The methodology and methods argued for in this chapter are used to produce the results which will be initially analysed in the next chapter.

CHAPTER 5

DOMINANT INTERVIEW PHASE FINDINGS

Chapter 5: Dominant Interview Phase Findings

5.0 Introduction

This chapter presents the findings of the dominant development-specific interview phase of the research, the background and procedures of which were described in the previous chapter. It is broadly arranged around the research objectives encompassing both preset (Appendix B) and emergent themes, as outlined in the map of interview findings in Table 5.2. The chapter is structured as follows. Initially an outline of interview data management and analysis procedures is provided. In the next section details on the five subject developments and the interviewees are furnished in order to provide contextual insight into the subject developments (Theme 1). This context building process is continued in the following section on development details. Development specific information regarding participation in the development process across four stages - from the data gathered through Theme 2 is then discussed with a diagrammatic presentation. As envisaged in Objective 1 and Theme 3, participation at each of the three framework generated levels (i.e. involvement, decision makers and influencers) is next presented in the section on structural material choice - the three material choice process stages (i.e. material selection, specification and supplier selection) are dealt with in some detail. This is followed by a discussion of the main structural material choice criteria that emerged, each of which is classified as one of four categories developed to assist in the interpretation of these findings. These criteria related findings were generated in fulfilment of Objective 2 and Theme 4. The material choice process model is presented in its working format through the integration of interview findings and the study framework, as proposed in Objective 3. The model displays a summarised form of the researcher's interpretation of the participatory and criteria related findings on a development specific basis in order to facilitate comparison and contrast of these parameters across the developments.Next comes analysis and findings concerned with Objective 4 and Theme 5 which encompasses the findings related to changes in structural materials. These range from a brief exploration of the organisational buying behaviour implications of general material changes to the exploration of attitudes to timber frame and Irish timber. The chapter then closes with a conclusions section.

5.1 Data Handling Procedures

Numerous authors have suggested systems for qualitative data management and analysis and each appears to use different terminology to describe their systems. A comprehensive guide to the terminology used in qualitative research and analysis may be found in Gubrium and Holstein (1997). Whereas there are a variety of approaches to dealing with qualitative data once collected there is general agreement that a systematic and transparent approach to analysis is of paramount importance. Spiggle (1994) and Sandelowski (1995) both feel data analysis and interpretation are key components of producing qualitative findings, Mason (1996) refers to data analysis and explanation, Tesch (1990) refers to de-contextualization and re-contextualization, Robson and Hedges (1993) refer to data handling and thinking, while Marshall and Rossman (1989) refer to data reduction and interpretation. Whilst the distinction between analysis and interpretation must be understood it is also important to recognise that both processes are interlinked and interdependent, as Sandelowski, (1995:372) puts it:-*"There is no clear line in qualitative work between data preparation and analysis and between analysis and interpretation, as the data preparation process itself triggers analysis and an analytic structure is often the basis for an interpretation"*. The primary components of Sandelowski's (1995) system are outlined below and are related to the stages of data management undertaken in this study, as outlined in Table 5.1.

Data Collection has already been discussed in detail in the previous chapter.

Data Preparation *"...typically means transcription, a technique that involves the selective preservation of the research interview"* (Sandelowski, 1995:372). The researcher listened to the tapes soon after each interview so as to gain a developing picture of the data during the interview period. The taped interviews were transcribed by the researcher in parallel with the ongoing interviews (Transcription).

Data Analysis: *"...analysis then continues with efforts to understand each transcript as a whole and then to develop a consistent approach to accounting for the data."* (Sandelowski, 1995: 372). The transcripts were then read - in no particular order - so as to get an overview of the data (first reading). The second phase of readings was used to identify themes both within and between the individual developments and across the designers and the developers (Second Reading). Data was then coded and moved into various new files on the basis of these themes, each interviewee was given a code and all data from their transcripts were marked accordingly (Abstraction and Comparison).

Interpretation: *"...is the knowledge produced - the end product of analysis where the researcher construes or renders the analysed data in such a way that something new is created in a different form, yet faithful to data in its original form."* (Sandelowski, 1995: 372). The theme based files were examined and interpreted in order to accept them, adjust them, or reject them and counter evidence was sought to refute them. Examples of additional interpretation of the data from that presented in the main textual findings can be found in the material choice criteria table and the application of the study model to each of the subject developments, later in this chapter. The processes of data abstraction, comparison, integration and refutation as outlined in Table 5.1 form part of the analysis and interpretation as presented in this chapter. Table 5.2 display the study aim and maps the study objectives to the corresponding preset and emergent themes, which form the framework for the presentation of the findings to follow. It also includes an indication of the main organisational buying behaviour research influences, outlined by Kauffmann (1996), that are touched upon in the relevant sections of the analysis.

The format used is in accordance with Brannick (1997) who suggests the categorisation of qualitative data on thematic grounds directed by the theoretical framework and the research question, with concepts, categories and propositions emerging throughout the data collection and analysis phases. Further interpretation of the interview data is presented in the final two chapters as the results of the second phase of the primary research are analysed. This chapter presents the data on a themed basis and includes data both indicative and contra-indicative of the overall finding.

Step	Purpose	Result
Transcription	To provide a written version of the data, for ease of analysis.	Formed basis for cross-referencing and general analysis and familiarised the researcher with the data.
First Reading (random and literal)	To gain a literal sense of the entire data.	Gained a good overview of the data and got early ideas for data categorisation.
Second Reading (across developments and parties-interpretative)	To identify potential themes and patterns in the data both within and between developments and interviewees.	The coding of sections of data from each of the transcripts in relation to emergent and pre-set themes.
Abstraction and Comparison	To facilitate meaningful comparison and analysis of the theme based data as a whole.	The data was reorganised, facilitating the consideration of the evidence relating to the emergent and pre-set themes.
Integration and Refutation (reflexive reading)	To present the evidence from the data and to check for counter evidence.	The presentation of the data in an ordered manner which remains sensitive to the context and content of the data and includes any evidence which is contrary to the themes.

Table 5.1: Interview Data Management and Analysis Procedure.

Study Aim: "To explore structural material choice processes in the Irish residential construction sector and to integrate the findings and study framework in a model."		
OBJECTIVES	**THEME SHEET THEMES**	**EMERGENT THEMES**
General background	1) Development Details • Interviewee details • Materials used 2) Development Stages	• Changes to preset development stages • Diagramatic representation of participation
1) To explore participation in material choice processes in the Irish residential construction sector.	3) Participation in Material Choice Processes (Individual and group Influences) Involvement↔Material Selection Deciders ↔Specification Influencers ↔Supplier Selection	• Importance of development system • Comparison of participation in different types of development (Process/Stages and Organisational Influences)
2) To Explore structural material choice criteria in the Irish residential construction sector.	4) Primary Criteria in Structural Material Choice • Differences across:- - trades/professions - developer type - development type (Product/Seller, Individual, Group & Organisational Influences)	• Economic criteria • System related criteria • Standards/Regulation criteria • Performance criteria
3) To integrate the study findings and the study framework through the presentation of a study model.	Integration of themes 3 and 4	• Summary of researchers interpretation of participatory and criteria dimension of interview findings. (Process Influence)
4) To explore structural material changes in the Irish residential construction sector.	5) Structural Material Changes • Material changes • Adaptiveness of industry • Impediments to change • Views on timber frame • Views on Irish timber	• Conflict • Power • Risk • Developer/Supplier Relationships (Individual, Group, Organisational, Product/Seller and Process Influences)

Table 5.2: Map of Objectives and Themes as Represented in Interview Findings

5.2 Interview Details

The interviews were undertaken from mid-May to mid-June 1997 in the offices or homes of the interviewees. They ranged between 30 minutes and 90 minutes in duration. The format and content of each interview varied, however, a pre-determined set of topics or themes were covered in them all. A sample theme sheet is enclosed in Appendix B. The data gathered from twelve interviewees formed the basis of this dominant stage of the

research process. In the previous chapter the primary rationale underlying the restricted number of interviews is discussed. However, it is important to briefly reiterate the difficulty encountered in gaining access to parties involved in suitable residential developments, particularly when agreement to participate had to be forthcoming from at least two different firms / parties for each development. Similar difficulties were encountered by Cherns and Bryant (1984) in their attempts to conduct an exploratory study of the client's role in construction management. They firstly selected a number of decision-makers in potential subject client organisations having particular regard to their need to obtain data on an appropriate selection of building clients. This *"appropriate selection"* was based upon three main dimensions, which they wished to represent: the organisational, the professional and the contractual. They found that the most effective mode of gaining access to the target client organisations was through the use of informal contacts, rather than cold formal approaches. This is consistent with the researcher's experiences in attempting to line up suitable interviewees for this research. While Cherns and Bryant (1984) fail to mention the number of parties interviewed for the purposes of their research it may be noted that in common with this research a relatively small 'bag' of interviewees was used.

There were two interviews conducted in relation to each of the five selected developments. One was with the client (developer) and the second with the designer (architect or draftsman). In one case there were two parties interviewed at the same time, both were in-house in the apartment development company. These were the company principal and the quantity surveyor. A trial interview was also carried out with an architect / academic. Due to the relevant nature of this interview aspects of its content are included in this analysis. So the total number of individuals interviewed was twelve (Table 5.3). Around 250 pages of single space, font size 10, transcripts were generated from just over 10 hours of tapes.

INTERVIEWEES	CODE	COMMENTS AND REFLECTIONS
Architect – Speculative Housing Development (1)	**A1**	The head architect on this development of approximately 70 houses was initially reticent however as the interview progressed it became free flowing and relaxed.
Quantity Surveyor –Speculative Housing Development (1)	**QSD1**	The in-house development firm quantity surveyor was open and relaxed in his approach to the interview. The interview was wide ranging and regularly digressed into non-core topics.
Architect – Speculative Apartment Development (2)	**A2**	The head architect on the development of approximately 300 apartments was initially slightly apprehensive about the interview, however he quickly relaxed and it developed into an open interview.
Partner Development Firm – Spec. Apartment Develop (2)	**D2**	Joint interview with development firm partner and QS, which allowed for immediate exchange of ideas through the two interviewees. The interviewee left the room on a couple of occasions to take phone calls.
Dev. Firm Quantity Surveyor – Speculative Apartment Dev. (2)	**QSD2**	The in-house quantity surveyor was present for the entire interview. The interview was open and relaxed. The interview remained reasonably free flowing with the QS even with the interruptions.
Local Authority Architect - Local Auth. Housing Dev. (3)	**A3**	The Local Authority architect who designed the development of c. 60 houses was very careful throughout the interview. Responses were brief and considered. He declined to respond to two questions and was conscious of the Dictaphone throughout.
Quantity Surveyor Contractor – Local Auth. Housing Dev. (3)	**QSC3**	The head contracting firm quantity surveyor was cordial throughout the interview but was inclined to tender brief responses to various questions. Various probes were used to expand the important topics.
Architect – Single Timber Frame House (4)	**A4**	The architect on the single timber frame house was very interested in the research and gave open and wide ranging responses. He tended to concentrate heavily on timber frame specifically in his responses.
Developer / Owner – Single Timber Frame House (4)	**D4**	The owner/developer was nervous about the interview and gave very brief responses to questions. Despite numerous reassurances he felt that the information he could give would not be useful to the research.
Draftsman / Engineer – Single Dormer House (5)	**A5**	The draftsman on the single dormer house was open and relaxed throughout the interview. His responses tended to be general rather than specific to subject development, as his involvement was limited.
Developer / Owner – Single Dormer House (5)	**D5**	The owner/developer offered lengthy and wide-ranging responses throughout the interview. However, he was frequently concerned - and reassured - that the information he gave was useful.
Architect / Academic – Trial Interview	**A6**	The trial interview with an academic/architect was useful in developing the theme sheet, but also provided some rich insights into the core topics. The interviewer as a former lecturer of the interview sometimes tended to control the flow of the discussion.

Table 5.3 Interview Details and Reflections of Interviewer.

5.3 Development Details

This initial section of the interview findings relates to the first preset theme from the theme sheet enclosed in Appendix B, (Development Details). It aims to enhance the contextual information available to the reader in order to assist in developing a clear picture of the environment within which the research was conducted. It is worth briefly reiterating the details of each development at this point. Development 1 comprises of approximately 70 houses constructed in County Dublin by a speculative development firm. Development 2, again in County Dublin, was constructed by a speculative development firm and comprises of approximately 300 dwellings, the majority of which are apartments, with the remainder being townhouses in duplex style units. Development 3 is a local authority development of approximately 60 houses and is also situated in County Dublin. Development 4 is an owner-developed timber frame house located in County Offaly. Development 5 is also an owner-developed single dormer style house situated on the outskirts of a County Kildare Village. Table 5.4 (same as Table 4.1 in previous chapter) provides a brief outline of development content details as gathered from the interviewees, planning office searches, and researcher observation - through visits to the completed developments. The information furnished is relatively minimal as the researcher offered the interviewees confidentiality regarding their identities and that of the subject developments, as can be seen in the sample introductory letter as enclosed in Appendix A.

Development Type	Location	Size	Interviewees
Speculative Houses	**Co. Dublin**	**c. 70 houses**	**QS (development firm) & Architect**
Speculative Apartments	**Co. Dublin**	**c. 300 apartments and houses**	**QS & Partner (development firm) & Architect**
Public (Social) Houses	**Co. Dublin**	**c. 60 houses**	**Local Authority Architect & QS (contractor)**
Single Timber Frame House	**Co. Offaly**	**1 house**	**Owner-Developer & Architect**
Single Dormer House	**Co. Kildare**	**1 house**	**Owner-Developer & Draftsman**

Table 5.4: Outline of Subject Developments

Each interview opened with a number of questions relating to the materials used in the main structural elements of the subject developments. These questions were included in order to focus the interviewees' thoughts on structural materials in the subject developments. They also helped to establish the level of reliability of the individual's knowledge of specific developments, as the researcher had checked the planning applications in relation to each of these developments (except the Local Authority housing which did not require planning permission) in order to ascertain the materials used. As already stated the researcher also asked some questions regarding the content of the developments, as a further check of interviewee recall of the subject development details. These two checks allied to the researcher's visits to the completed developments revealed no major discrepancies in any of the interviewees' accounts of these featureswhich adds to the credibility of the rest of the interview contents. Table 5.5 outlines the materials used in the external walls, the internal walls, the ground floor, the upper floors and the roofs of each of the five subject developments.

DEVELOPMENT	EXTERNAL WALLS	INTERNAL WALLS	GROUND FLOOR	UPPER FLOOR	ROOF
1 - Speculative Housing	hollow concrete block single leaf some brick facing	load bearing and party-concrete block partition - timber stud	insitu concrete slab	tongued and grooved floor boards on timber joists	prefabricated timber trusses on timber joists
2 - Apartment	concrete block / brick two leaf cavity structural grade blocks	load bearing and party-concrete block partition - timber stud	precast concrete slab	precast concrete slabs	site cut / framed timber rafters
3 - Public Housing	concrete block / brick two leaf cavity	load bearing and party - concrete block partitions - timber stud	insitu concrete slab precast concrete slab	tongued and grooved floor boards on timber joists	prefabricated timber trusses on timber joists
4 - Timber Frame House	concrete / timber two leaf cavity	load bearing - timber frame & concrete block partitions - timber stud	insitu concrete slab	tongued and grooved floor boards on timber joists	prefabricated timber trusses on timber joists
5 - Dormer House	concrete block / brick two leaf cavity	load bearing - concrete block	insitu concrete slab	tongued and grooved floor boards on timber joists	site cut / framed timber rafters

Table 5.5: Breakdown of Materials in Main Structural Elements of Each Development

5.4 Involvement in Development Stages

Stemming from Theme 2 of the theme sheet (Participation in Development Stages) the interviewees were asked to outline the main stages in the subject developments and to identify the parties involved in these stages. The main purpose of this section of the interview was to continue the context building exercise. Furthermore, it concentrated the interviewees' thoughts on the specific developments and participants therein in advance of exploring the core aspects of the study. Whilst a considerable volume of data was gathered on this aspect of the individual developments it is felt that a summarised diagrammatic representation of the information gathered on each development is the most effective manner of reporting. The information has limited direct relevance to the core concerns of this study – the exploration of structural material choice processes – but rather acted as an ice-breaking and context setting introduction for the interviewer and interviewees.

In most interviews it was necessary for the researcher to suggest certain stages. The five stages initially used as probes in the interviews, where necessary were: development initiation; design; planning; construction; and development disposal. During the interviews it emerged that design and planning stages are overlapping increasingly, with developers and their advisers increasingly consulting local authority planners in advance of lodging applications. To reflect this apparent blurring of the lines between stages, these two stages were combined. Indeed there is an apparent integration of all the stages in the development process, with design works continuing during construction resulting in the lodging of revised planning applications, and the growing trend of off-the-plans and pre-completion disposals of speculative developments. However, the only other change which the researcher made to the stages, as proposed in the theme sheet, was to change the disposal stage to the completion stage to reflect the range of possible ownership outcomes of development projects. The disposal stage presupposed that the developer would dispose of the completed dwellings and ignored the possibility that developments are quite often retained by the developer, as is the case with owner developers, local authorities and investors.

A diagrammatic representation of the participation of the various parties to the individual developments over the four stages is provided in Figures 5.1 to 5.5.

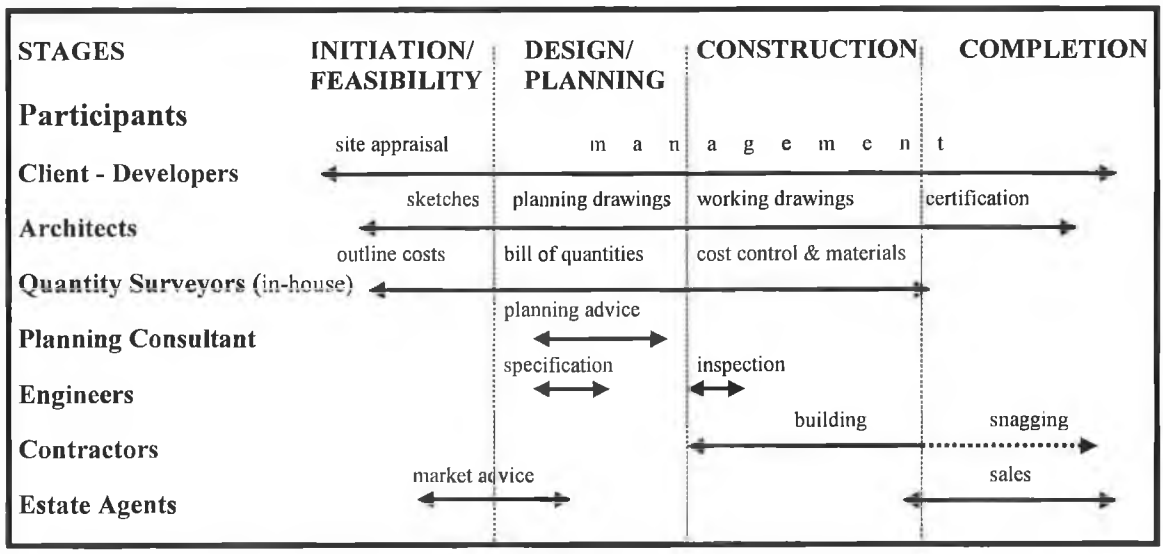


Figure 5.1 Involvement in Speculative Housing Development (1)

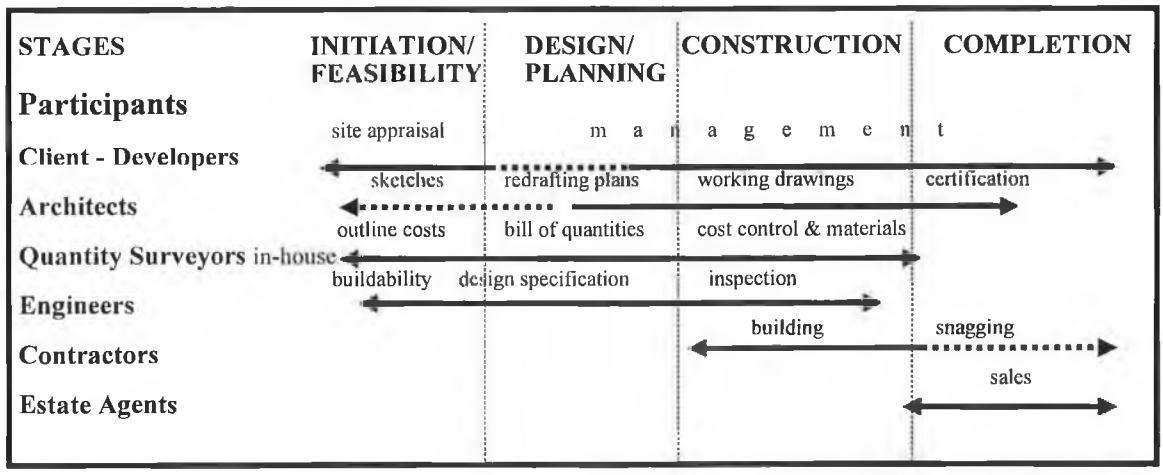


Figure 5.2 Involvement in Speculative Apartment Development (2)

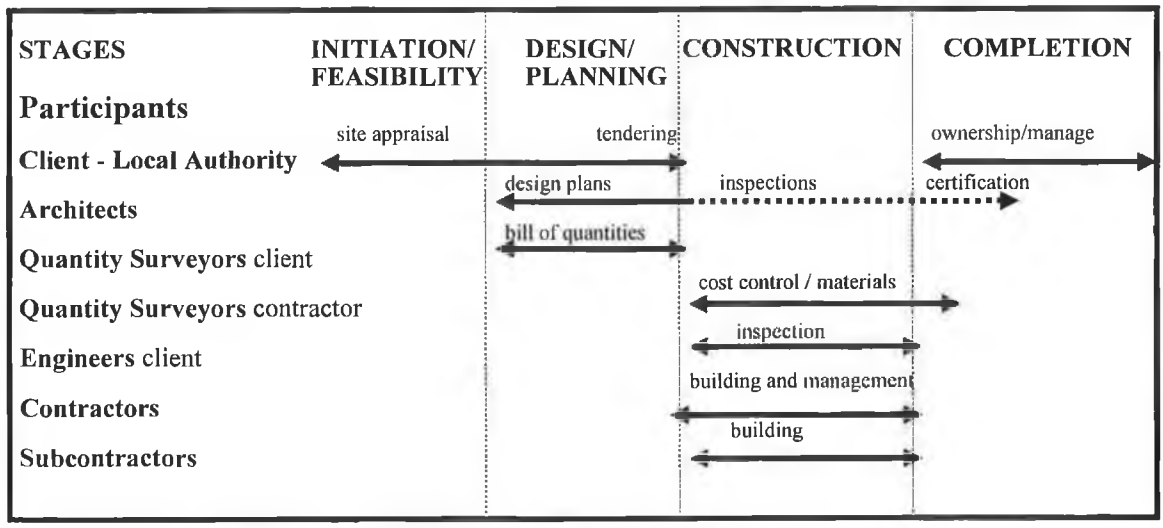


Figure 5.3 Involvement in Local Authority Development (3)

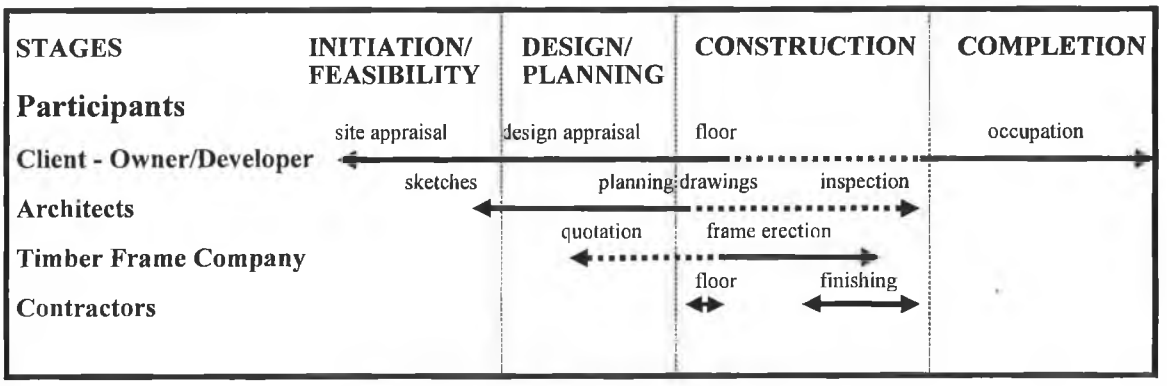


Figure 5.4 Involvement in Single Timber Frame House Development (4)

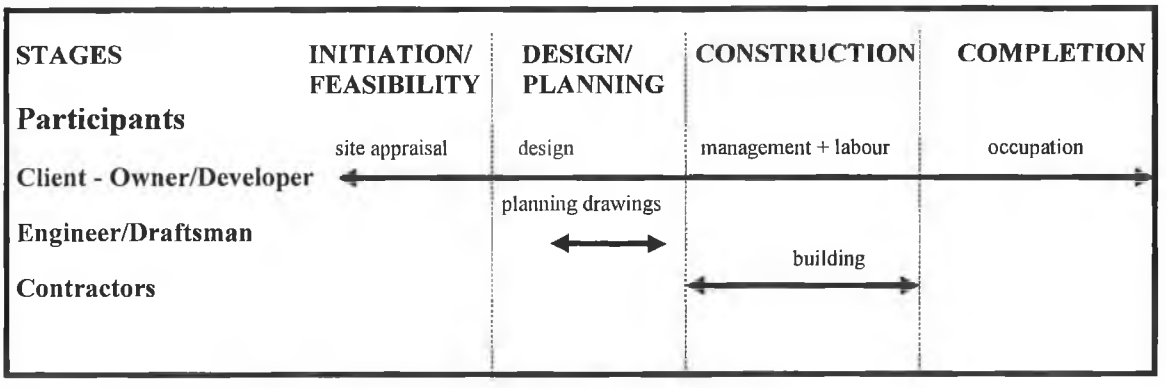


Figure 5.5 Involvement in Single Dormer Development (5)

5.5 Structural Material Choice

In line with Theme 3 (Participation in Structural Material Choice Processes) and Objective 1 (as outlined in Table 5.2) the interviews explored participation in structural material choice processes. The three stages of material choice processes and the three levels of participation were explored as envisaged by the study framework developed in Chapter 3. In order to maintain the free-flowing nature of the interviews it was not possible in all cases to ensure sequential coverage of all the above levels of participation in each stage. The dual concerns of time restraints and the desire to avoid interrupting the flow of the interviews sometimes constrained the ability to cover all aspects of the participatory frame in the depth of detail desired. However, all stages and levels were covered in each interview, albeit in slightly different ways and sequences in each case. The findings are presented below on the basis of the three stages, each of which is subdivided in the three participatory levels and a number of emergent themes are also

included in the findings. Initially this theme was analysed on a development specific basis however in order to improve the flow and facilitate comparison across the developments the presentation of the findings was amended. The study model displays a summarised version of the results on a development specific basis instead. Some emergent themes are also discussed at various points throughout.

In certain circumstances the interviewees discussed the choice of non-structural materials and non-timber products in order to illustrate their points and for this reason the analysis may switch in its applicability to structural materials specifically. It was aimed to target structural timber specifically in the specification and supplier selection stages in order to narrow the focus of the study and to concentrate on the interviewees' responses one aspect of material choice, as processes may differ with different types of materials.

The main previous study to investigate the area of buying processes in the construction industry was conducted by Bellizzi (1979). He surveyed US based commercial construction contractors to ascertain the influence means of six parties in the buying processes for capital materials, accessory equipment, operating supplies and major materials, across nine buying process stages. While the nine stages relate closely to Robinson Faris and Winds' (1976) buyphases, none of the stages directly correspond to any of the three stages adopted in this study. His use of a single level of participation (influence) also impedes direct comparison. However, we will briefly relay the results of what appear to be the closest corresponding stages in regard to the buying process for major materials from Bellizzi's study at the start of each of the three stages below.

5.5.1 Structural Material Selection

Material selection refers to the initial decision(s) relating to the type of materials - timber, steel, or concrete, primarily - to be used in the structural elements (i.e. external and internal walls, ground floor, upper floors and roof). The Bellizzi (1979) study found that presidents / vice presidents / owners ranked as the participant group with the highest average influence ranking in the 'anticipation or recognition of a problem (need) and a general solution' stage, with architects and consulting engineers receiving the lowest average rating.

The interviews would appear to support the view proposed by the trial interviewee: *"...but there is very much so a standard way of building... again with apartments one is following a tried formula also..."* (A6). It emerged that many of these material selection decisions appear to be made implicitly, during the selection of an overall construction system. Evidence of the prevalence of development systems or formulae may be seen from the following statements: *"That decision was made I suppose a number of years back where [developer's name] would have decided that they were going to go with these traditional materials - be it block-work, timber and a small amount of steel to support large opes that kind of thing, and we just follow through from one project to the next"* (A1). *"...But tradition has sort of carried on and people are slow to change and often reluctant to change when you have a system going which is working"* (QSD1). *"Yea well probably the general design of the building in the beginning, would usually have a construction system or construction method in the broadest sense in mind. So if we are designing a block of apartments for instance, I would know that generally the cheapest way to build them is with load bearing masonry and precast unit. So we wouldn't design something that was wider than precast units would go or whatever, so there tends to be decision made at that level"* (A2). *"You can't go far wrong, its what it, they're standard, you know they are standard building products for housing"* (QS2).

In the context of the Local Authority these standards are more formalised *"...that is determined by the fundamentals of standard approved designs"* (A3). The Local Authority architect also expressed the view that material selection for each structural element is not undertaken by many designers or developers and certainly not in his own context. *"I wouldn't tend to see myself going out shopping for steel, timber, or concrete, with regard to the implementation of the design. I would be tending rather to have a specification laid down"* (A3).

The single houses were both designed to the individual needs of the owner-developers however, neither strayed dramatically from tried and tested development systems. The single bungalow (development 5) used what could be considered as the 'traditional' development system and materials. The timber frame system, as used in development 4, is perhaps more standardised than the 'traditional' system despite its minority status in Irish construction, as substantial parts of the structure are prefabricated under controlled factory conditions. While relatively new in the Irish context it is the predominant system in the US, Australia and substantial areas of Northern Europe and as such is a well established development system.

5.5.1 a) Involvement in Structural Material Selection

Initially involvement is discussed as it is the level of participation that achieved the widest coverage in the interviews. It is the level of participation which the interviewees appeared to associate with most readily. The number of parties involved and degree of involvement of each party in the material selection stage appears to vary widely across individual developments. The two speculative developments (developments 1 and 2) involved considerable input from consultants external to the development firms. *"...the actual structure was made I suppose between the developer, the structural engineer and the architect, fairly early"* (A2). Both of these developments in addition to the local authority housing development necessitated the use of considerable engineering expertise, due to unusual site and topographical conditions. This resulted in the decision to use upgraded structural concrete materials in each case as recommended by the structural engineers.

In addition to the involvement of the housing, architectural, quantity surveying, and engineering departments of the local authority, the Department of Environment (DOE) appear to have some input into the material selection stage in public housing developments. The DOE's involvement arises through their responsibility for approving all local authority building projects. In relation to housing developments the local authority work from standard approved designs as the normal basis for their developments. *"They are drawn up in here, they'll be revised from time to time, before a standard design becomes a standard design it has to comply with DOE criteria, which are published criteria. But it is also normal for us to if we were embarking on a non-standard house type, for us to advise the Department that this is a new house type"* (A3). As such the DOE could be seen to have some degree of input into material selection, if only as safeguard against the use of insufficiently tested or excessively expensive materials. It is interesting to note that the local authority architect interviewed was quite determined to point out the exact extent and limitations of the role of the DOE in this regard. *"There are quite extensive possibilities for change in the matter of elevational treatment and window detailing and the likes of that. But the fundamentals of room size, of fire protection, a* [more] *substantial, perhaps, standard of construction would apply* (as set out by the DOE)*"* (A3). This is indicative of interviewee's wary approach to the interview, as it displays his concern that the precise role and responsibilities of each party be clearly outlined, as noted in Table 5.3. A later response to a question regarding local authority policy on local authority apartment development further illustrates the formality and caution with which he approached the interview. *"I think I dealt with that earlier, there is a limit to how much I can say beyond what I have already said"* (A3).

As was the case with all of the developments the client in each of the developments dominated the material selection stage. In the case of the single dormer house the client initially developed sketches of his and his wife's *"ideal house"* while living in Australia. This sketch formed the basis of the house design *"...the whole thing very much as I, myself and Mary like, did, except for it is kind of a mirror vision"* (D5). The draftsman's involvement was very limited in so far his primary role was to develop the sketch into formal planning drawings using the traditional blockwork construction system. *"[Client name] just wanted a set of drawings, you know, but it was a slightly different situation in that his family helped"* (A5). In contrast the architect in the timber frame owner-developer house (development 4) appears to have taken a very active part in persuading the client to the timber frame system. *"It was down to [client's name] ultimately, but it was advised by the architect. Now we try to push timber frame houses, because we like timber frame houses, I live in a timber frame house"* (A4). The owner-developer reaffirmed this view:-*"Well am, [architect's name], the architect, he has a timber frame house and there are a few around of the timber frames, they are supposed to be very warm, so that's why I said I'd chance it and for speed as well"* (D4). The client's family were also involved in the decisions relating to house design, however the client himself maintained the dominant role in structural material selection, upon the advice of his architect. This can be contrasted with the two speculative developments and the local authority development where the actual end users of the completed dwellings had no direct input into the selection of structural materials.

Both of the owner-developers had considerable experience in the construction industry in advance of undertaking the development of their own houses. For this reason the researcher suggests that with less experienced clients the designers may be more involved in the selection of materials than was the case in development 5. *"Generally speaking when you get down to the finer elements of the structure, how it is supported and all that, they [clients] wouldn't be particularly interested in that unless it was somebody that had sort of expertise in the construction business"* (A5). The involvement of the architect in material selection in the local authority development, although restrained by standard approved designs was probably the strongest of any of the developments. Due to the separation of the design and construction functions through the appointment of a building contractor to undertake the works by tender, based upon the completed plans and specifications, the local authority development resulted in the actual builders having no role in the material selection stage.

It is therefore suggested that the procurement path chosen for the execution of construction works is important in determining participation in material choice processes. It is interesting to recall in light of this suggestion that certain contractor based systems can lead to a vast separation between the design and building functions. This was a primary concern of Emmerson (1962) in his review of the UK construction industry, as discussed in Chapter 1.

5.5.1 b) Decision Makers in Structural Material Selection Stage

In this context, decision makers or deciders are those parties who ultimately decide what structural materials will be selected. From the interviews it transpired that the client was in each instance the final decider where these decisions explicitly arise. However as already discussed individual material selection decisions may not explicitly arise in many instances as the development system can largely determine the materials to be used in each structural element.

The inhouse quantity surveyor interviewed regarding the speculative housing development (development 1) indicated that any deviation from the normal system or materials would be assessed and decided upon by the senior management of the development firm. *"Well we would assess it in here, to see ourselves, as such we might ask our architect to see for opinions, but we would make the decisions in the end"* (QSD1). He went on to clarify the parties likely to be making these decisions within the development firm "...*well it would be between; there's a contracts director, myself and maybe the MD or that. It would be a couple of people in head office."* (QSD1). Similarly, in regard to the speculative apartment development (development 2) the architect expressed the view that if a change in materials was to occur it would be made *"...by the developer usually, but they would ask the question, they would not go out and choose a structural system without reference to the engineer"* (A2). This would largely be concurrence with the views of the trial interviewee *"... if it was large scale housing and things like that, I would be inclined to feel that the client would be the main decision maker there"* (A6).

The apartment development architect drew an interesting distinction between developments carried out by builder developers and those where the all of the building works are contracted out. *"If the developer is the builder he will usually dictate much more strongly what, how they will build it, what is the cheapest for them. If the developer [builder] was a contractor then*

the architects and engineers would decide on what they felt was the most economic solution, and that would be presented as a fate-de-complete to the tenderers" (A2). The local authority development strengthened this point as it would appear that the architect assigned to development 3 was the decision maker regarding material selection as indicated by the quantity surveyor in the contracting firm. *"...the overall finished product would be designed by the architect and he would want a particular type of finish"* (QSC3). The architect was however constrained by various other departments within the local authority and the DOE guidelines. In addition, it would appear the DOE hold a ratification role over all designs and as such over any alterations in structural material or system usage.

The two single owner-developed houses presented a relatively straight-forward situation for identifying decision makers when compared to the larger developments discussed above. The client in both cases could be seen to have made the final decisions on material selection and explicit decisions were made in both cases. With the multi-dwelling developments all the parties had previously been involved in similar developments and the tried and tested systems largely prevailed. In contrast, consideration was given to the materials to be used in each structural element by the developers in both developments 4 and 5, even though neither ultimately deviated significantly from the tried and tested structural materials, as already discussed.

5.5.1 c) Influencers in Structural Material Selection

Influencers in organisational buying behaviour as referred to in this study are parties who influence decisions but are not directly involved in them. They can come from both within and outside the development team. Webster and Wind (1972) have suggested that parties may fulfil different roles and levels of participation over the stages of a given buying situation. As the study framework envisages that each of the three stages can involve a number of separate but related decisions it is possible that the various parties can be directly involved in certain decisions, whist in others they may be influencers or have no input whatsoever. A number of different influencers were mentioned by the interviewees including planners, material suppliers, tradesmen, and social and family groups, end users, and insurance companies each of which are discussed briefly below.

The influence of individual town planners in relation to structural material selection was felt to be insignificant by most of the interviewees. However, one interviewee felt that

individual planners generally have a lot of power in regard to a variety of aspects of individual developments including materials. *"The main problem from that point of view [development plans being relatively 'loose'] would be that if you happen to get a particular planner, in a particular area, who has a lot of power, who has a bee in his or her bonnet about a particular approach, then that can be a problem"* (A2). Another interviewee cited the impact of certain individual town planners on the use of brick in the area *"...yes, they would certainly be trying to direct you away from certain materials or external finishes, you know. Brick, brick is one of the hobby horses of the planners, they just don't like brick in certain areas."* (A5). Other interviewees pointed to the impact of specific development plan provisions in given areas which may impact upon material selection to some degree, however this more a reflection of the influence of the planning system rather than individual planners. An example of this arises quite often in the case of infill developments in conservation or architecturally distinctive areas. Developments in these areas will normally have to be designed in sympathy with the existing streetscape or landscape.

Material suppliers were recognised as potential influencers of material selection decisions by a number of interviewees, whether through calls from sales representatives (QS1 and D2), mailed literature and information (A5, QS1 and A4), sample houses, 'as seen in X showhouse' (D2) or trade shows (A5). However, again the sentiment expressed by a number of the interviewees was that unless a change in development system was being considered such influence did not come into play. *"Well I suppose you are depending on suppliers to push their products you know"* (A1). In a similar vein the apartment development architect expressed the view that if material suppliers were attempting to influence developers or designers they may have to go to great lengths to persuade people to change materials. *"If the trade people are interested and they think you are interested and it will mean hunking you off to London or Germany, they would do it, you know, it depends on the product"* (A2). Again in relation to a change in materials the single dormer house draftsman explained that *"...generally speaking when you come across something like that in the first instance you check the supplier or manufacturer, get as much information from them as you possibly can and then you feel it needs any further research after that, you would go checking up the various standards"* (A5).

Tradesmen were mentioned as possible influencers by three of the interviewees. Their input into material choice processes appears to be more prevalent in the later supplier selection stage, however two interviewees (D2 & A2) expressed concern about the

present shortage of bricklayers and felt that this was a driving factor in the increased adoption of the timber frame system. Another interviewee (QSD1) was concerned about the effect of any change in materials on the works programme and the running order of tradesmen in the construction process. It is interesting to note that the owner-developer of the single timber frame house (D4) when asked if anyone other than the architect influenced him in his structural material selection decisions, stated that no other party had. When probed about the influence of the timber frame manufacturer he stated *"No none at all"* (D4).

Social and family influencers appear to have been a factor in the single dormer house development particularly in the latter two stages of material choice, but even in relation to material selection. The owner-developer discussed the input of his brothers and friends *"...well, I suppose having worked with the lads [brothers and friends], having worked on building sites and all that, I suppose we [husband and wife] picked out the materials ourselves"* (D5).

End user influence in the subject developments varied immensely. The owner-developers of the two single houses had considerable control over the entire development process, whereas the purchasers of the individual units in the speculative developments had little-or-no input into the construction of their dwellings. The late involvement of end users and the rigidity of the planning system act as a major constraints on the customisation of speculative housing *"...certainly they [purchasers] would not be able to change the materials, not externally, because that is what they[developers] have got permission for and it would be subject to a new permission if they were to change the external materials"* (A1). The local authority appear to be more open to gathering end users views than speculative developers, which may be largely due to their continued interest in the management and maintenance of these developments. *"We have tenant training evenings, which in effect is a process within the first year after occupation of the houses, where various LA officials deal with the people who moved into the houses and the feed back is available from a meeting like that"* (A3). There was little evidence of any similar system of information gathering amongst speculative developers or their advisors, which would afford end users the opportunity to become influencers in material selection in future developments.

Finally, none of the interviewees identified insurance companies as influencers in material selection. However, two interviewees recalled the difficulties that were

experienced up to a few years ago in relation to both lending and insurance on timber frame houses (A2 and A4), but both now felt that these difficulties had been sorted out.

5.5.2 Structural Timber Specification

The structural timber specification stage, as proposed in the study framework (Chapter 3), refers to the decisions determining timber characteristics. Once material type has been selected for each structural element, it is necessary to define various characteristics of these materials. The Bellizzi (1979) study included two stages which broadly correspond to the specification stage in the present study – 'determination of general characteristics and quantity of needed item' and 'setting specific description of characteristics and quantity of needed item'. Company (inhouse) engineers achieved the highest average influence rating in both of these stages, however architects and consultant engineers achieved the second lowest influence rating of the six participants groups. Whilst the primary concentration of the interview questions regarding both specification and supplier selection referred specifically to structural timber, the responses and probes sometimes concentrated on structural materials in general. For this reason the findings concentrate on structural timber but also include a significant amount of data on structural materials more generally. Timber characteristics may refer to both structural and aesthetic requirements. Specification can cover various aspects of the materials such as dimensions, strength, thermal, fire and sound insulation values, compliance with relevant standards and regulations, colour and finish, etc. Again, the findings on participation in structural timber specification will commence with the most comprehensively covered level – involvement and progress to a discussion of decision makers and influencers.

5.5.2 a) Involvement in Structural Timber Specification

A significant finding to emerge from the interviews is that specification decisions can vary widely in terms of involvement due to the nature of the decisions. The more technical aspects of timber specification appear to be dominated by design professional such as architects and engineers, whilst decisions relating to type of timber used appear to controlled by the client to a greater degree. This particularly comes to the fore in the speculative developments *"...but what we [architects] would specify, or the engineer, would be the size of the joists for instance and the strength:- strength class A, strength B, or strength class C; and*

obviously once it meets the correct moisture content and all of that. Now how the builder achieves that is up to himself, he can shop around and use an Irish grown timber or maybe an imported timber that decision would be his" (A1). The local authority development again demonstrates the high involvement of the designers in the technical aspects of specification. *"... within the classification of red deal or white deal there would be various species which it would be up to the contractor... It would essentially be as per our specification, the timber sizes, tolerances, quality requirements are to be closely specified, the spes [specifications] is to its greater extent a standard document. It would be modified in the case of each job in regard to special things that might arise in a particular job"* (A3). This statement also illustrates the importance of the development system in determining specifications which are largely standardised.

The two single house developments exhibited interesting deviations from the pattern of designer dominated technical specification. The timber frame development removed a considerable amount of the specification decisions from the client and the architect, as the timber frame company have standard specifications for most of the structural elements. *"The timber frame companies they have a standard layout or let us say a standard schedule, but you can specify a different type of timber, you can specify a different section of timber, it is up to yourself, now it will add cost"* (A4). The client, upon the advice of the architect, increased the dimensional specification of a number of the structural timber elements in order to maximise the stability of the overall structure and reduce noise levels. In a similar vein, the client in the single dormer house increased the dimensional specifications of a number of the timber elements from those specified by the draftsman. In one such instance the client decided to use substantially larger ceiling joists than were specified in the plans, in order to decrease noise levels from upstairs and to leave a significant proportion of the joists exposed for decorative purposes in the ground floor ceilings. *"...like seven by one and a halfs [dimensions of joists as specified by draftsman] that's cat altogether, that's terrible..... I said I think nine by threes would look better"* (D5).

It was also noted that the seniority of individuals involved in the specification stage, in larger developments, appears to decrease from the levels evident in the initial material selection stage. Where the material selection decisions appear to take place largely during development initiation and selection of development system, the specification decisions appear to largely occur during the preparation of the planning and working drawings. *"It would become more delegated, the initial decisions, both in terms of the principle of the property company deciding what they want to do, and the principle in an architect's office, generating the direction. Now the further down the route, when you come to the construction stage, the developer would probably be thinking about his next job. His project manager or the guys who actually run the jobs, would be hands on. Equally*

here, at that stage there would be one or two people who would be running the job, attending to the day-to-day needs, getting the detail drawings out" (A2).

5.5.2 b) Decision Makers in Structural Timber Specification

The ultimate decision makers in regard to structural timber specification would appear to be the developers. Even where architects, engineers and quantity surveyors specify various characteristics through the drawings and bill of quantities these documents are ultimately ratified by the developer, who may make changes. In this regard the principle of the apartment development firm described his role in the design process as *"...putting manners on..."* the designs produced by architect in order to make them more buildable and to eliminate anything that *"...would cost a fortune or whatever"* (D2). Where engineers are involved in the design process their input is normally in relation to specific structural elements, such as foundations and load bearing capacity of walls, floors or roof structures etc. Another insight was gained later in the same interview, which would indicate that when engineers specify certain performance related specifications for structural elements they become more or less set in stone, whereas architect's specifications are potentially more susceptible to alteration. *"...We got an architect initially to come up with a basic blockout design... brought them to our quantity surveyor and engineer, to try to see how we could support it – the most economical – because often architects draw something that not easily supported, it would cost a fortune or whatever"* (D2).

Decision making in timber specification decision in the local authority development appeared to lie with the designers - architects, engineers and quantity surveyors - all of whom are inhouse in various departments of the local authority. However, some degree of conflict was apparent about the degree of control that the local authority architects sometimes attempt to exert over the specification decisions, which are left to the discretion of the contractor. The quantity surveyor in the contracting firm described how sometimes the LA designers may seek input into the specification of finishes which would not strictly be within their authority to do. *"He [the local authority architect] would want a particular type of finish, that may be to such a degree that he will actually select the type of brick he wants, but he is not entitled to that to such an extent"* (QSC3). A difference between the degree of detail in specification undertaken by the local authority as opposed to speculative developers was alluded to by the inhouse quantity surveyor of the head contracting firm. He discussed the detail of their joinery (windows and doors) specifications *"...they have to*

have all the throating, weather cappings and all the bits and pieces attached to it, they [local authority architects] inspect it and they very much insist on it. They have produced detailed drawings and you must produce to their drawings, you don't have much choice. You have to go and get a manufacturer to manufacture for you and they will vet the manufacturer as well" (QSC3). This degree of specification by the designers helps to avoid conflict down the line as it is possible that ambiguity in the specification could lead to considerable disputes.

As already stated the decision to use the timber frame system for the construction of the single house involved in development 4 resulted in the movement of a large proportion of the specification decisions to the timber frame company. However, the specification documentation issued by the timber frame company was based upon the planning and layout drawing developed by the architect and were the subject of alterations and ultimate ratification by the developer, upon the advice of his architect. Therefore, the ultimate decision making role remained with the client. The client took a dominant decision making role in specification decisions setting, altering and ratifying the various specifications.

5.5.2 c) Influencers in Structural Timber Specification.

Influencers in structural timber specification decisions are relatively diverse. For example the local authority architect referred to the influence of Forbairt in this regard *"It involves a certain input , which I didn't mention earlier, from Forbairt. We would be quite reliant upon their advice on quality standards of timber"* (A3). Similarly, the DOE's input into local authority developments is likely to influence the specification to some degree, as high quality construction is required by their standards. The planners' influence in material selection stretches into specification as well, particularly in the aesthetics of the materials specified on external finishes, such as brick and roof tile / slate colour. *"They [planners] could have the condition there that might like to have some say in what you are going to do, but that would be more colour they would be thinking of."* (QSD1). As with material selection the developer of the single dormer house referred primarily to the influence of family and friends in the specification decisions. In relation to the increased dimensional specification of timber ceiling joists the developer pointed to the influence of two of his brothers, both of whom are carpenters.

The group of decisions envisaged as constituting the specification stage of structural material choice within the study framework, appear to occur across a wide span of the

overall development period. They cross into the material selection and supplier selection stages, which would support the view that organisational buying behaviour stages are not purely sequential. Rather there is a degree of iteration between stages, as suggested by Browne and Brucker, (1990) and Speckman and Gronhaug (1986).

5.5.3 Structural Timber Supplier Selection

The third and final stage of structural material choice processes explored relates to the selection of structural timber suppliers, as proposed in the study framework in Chapter 3. The Bellizzi (1979) study found that presidents / vice presidents / owners of contracting firms achieved the highest average influence ranking of the six nominated participant groups in the 'evaluation of information and proposals and selection of supplier' stage in regard to major materials buying in US commercial construction. The selection of structural material suppliers can be limited by the type and characteristics of the materials selected and specified in the earlier stages. Concrete products are particularly prone to being dominated by a small number of suppliers, as they are normally supplied directly by the manufacturer. However, structural timber products - the primary concern of this study - are mainly supplied by builders providers, who stock a variety of timber species and grades, both imported and Irish.

5.5.3 a) Involvement in Structural Timber Supplier Selection

A significant change in participation appears to occur from specification to supplier selection decisions, as the involvement of designers diminishes and site based involvement and influence become more important. The most dramatic swing in involvement occurs in the local authority development, where the local authority architects, engineers and quantity surveyors cede control of supplier selection to the head contracting firm:- *"...in general it is the contractor's responsibility to perform the contract and that includes the supply of materials in accordance with the contract documents"* (A3). The increased use of contractors and subcontractors has implications for involvement patterns in supplier selection. This is particularly apparent where materials and labour contractors are used as opposed to labour only contractors. Certain tradesmen traditionally supply their own materials, such as electricians and plumbers, however some of the traditional labour only contractors are beginning to move towards the supply of materials as well. The inhouse quantity surveyor dealing with the speculative housing development described the shift

towards plastering contractors supplying materials as well as labour. *"The likes of plastering and all of that where you have to provide the majority of the materials and plasterer was labour only. We have got a situation now where our plasterer supplies everything, all his own materials, including the sand, cement – for external render – which we had never done"* (QSD1). It is important to monitor trends in this area, as the impact of any widespread switch towards labour and materials contracting in carpentry would result in significant changes in the locus of control within the structural timber supplier selection stage. It is interesting to note that Lewin and Johnston (1996:105), in their study of the effects of organisational restructuring on industrial buying behaviour, cited the increased prevalence of strategic outsourcing as an important factor in buying centre composition.

Each of the three multi-dwelling developments exhibited different purchasing structures. The only one to include a formal purchasing officer was the contracting firm in the local authority development, whose function was described as follows:- *"we have a purchasing officer, so his function is to purchase the materials and he would have an influence over where the materials are coming from, he has the first line there. There can be over-riding things where we are into, where we go beyond the general stuff"* (QSC3). In development 1 a strong head office approach to purchasing emerged, where the quantity surveyor and the contracts manager appeared to take the dominant role. However, the apartment development exhibited a reasonably high degree of on site involvement in the purchasing process *"...well the set up here, we have a fairly small office staff, so we order from our sites, the foreman would have ordered from the site, but everything is checked here [head office], like prices. We liase then with the site, to tell them who is say the best on price and then the foreman or the site clerk can give feedback, 'OK he is best but I can't get delivery', we run the two, because there is a correlation between the site and the office... an experienced foreman knows exactly what he needs"* (QSD2).

There are two levels to the supplier selection stage where timber frame construction is adopted. Firstly, the timber frame manufacturer must be selected and secondly the structural timber must be sourced. By deciding to use the timber frame system the developer effectively eliminates him/herself from the second element of this process, as the timber frame manufacturer will source the individual structural elements and supply an overall package. In the first instance the client in development 4 and his architect were involved in the selection of a timber frame manufacturer. By contrast, the client in development 5 remaining involved, with his brothers, in the selection of structural timber suppliers.

5.5.3 b) Decision Makers in the Selection of Structural Timber Suppliers

The decision making role in structural timber supplier selection in both developments 1 and 2 appears to have ultimately lain with the senior inhouse members of the development firms. The quantity surveyor in development 1 indicated that he was the ultimate decision maker in this regard *"...as to what's purchased, I do the purchasing as well"* (QSD1). Whilst the apartment developer emphasised the involvement of site based personnel in supplier selection and purchasing, it would appear that the ultimate decider in this regard would be head office based. Similarly, despite the existence of a purchasing officer, the contracting firm quantity surveyor stated he and other senior members of the management team would be the ultimate decision makers, especially where new or unfamiliar materials or suppliers are being considered. Whilst the architect appears to have been deeply involved in the timber frame manufacturer selection the ultimate decision was made by the client:- *"Well it was kind of [architects name] pushed towards that way [the selection of a particular timber frame company], you know"* (D4). *"We would have advised him, but he also got quotations from a number of different timber frame companies and he decided on [selected firm name], now maybe because I got them to build my house, I don't really know, they were a bit cheaper anyway, but only marginally"* (D4). The client dominated the decisions in this stage in development 5.

5.5.3 c) Influencers in Structural Timber Supplier Selection

Material suppliers emerged as the main influencers in structural material supplier selection and builders providers specifically in regard to structural timber. For example, one interviewee mentioned the importance of market information supplier by builders providers:- *"We are constantly sent updates from different suppliers of timber, they are a constant source of information – what timber is available, and they keep in touch with us in regard to the demand. So I would be guided by local suppliers here, and also what comes in the post, and am what is generally going on in the market."* (A4). Tradesmen also appear to strongly influence the supplier selection decisions as discussed by the speculative housing development quantity surveyor in regard to choice of bricks: *"We have a couple of older experienced brickies... just from their experience they would tell you straight off whether they thought it was going to be brittle or not"* (QSD1). In regard to the selection of material suppliers he stressed the importance of builders providers supplying quality timber and suggested that it is out of consideration for the carpenters that builders providers who supply only quality timber are selected. *"...we also like our sites to run as easily as possible, to be fair to the lads on site, so quality of material,*

there's no good us having a go at lads because there's things arriving on snag lists - partitions or something is wrong, something is warping, we are using technically substandard timber" (QSD1).

Other site based influencers mentioned included the site clerk (D2 & QSC3), project manager and foremen (QSD1, D2 & QSC3), all of whom offer feedback on the performance of materials and suppliers. This feedback can effect the structural timber supplier selection decisions in developments. The influencers in the two single house developments also included material suppliers and tradesmen, but family (owner-developer's brothers) again came to the fore as material supplier selection influencers in the case of the single dormer developer.

5.6 Structural Material Choice Criteria

The main criteria which each of the interviewees considered in material choice were explored in the interviews, as envisaged in Theme 4 of the theme sheet and Objective 2 of the study, as outlined in Table 5.2. A vast range of criteria emerged, some of which interviewees themselves considered important and others which they felt different parties considered important. As part of the researcher's interpretation of the criteria related data a table is constructed to display all the criteria mentioned by the interviewees (Figure 5.6). In a similar manner to the approach adopted by Lehmann and O'Shaughnessey (1982), who identified five categories of product choice criteria and in order to improve the presentation of the findings five criteria categories were developed. These categories are:- economic criteria, construction system related criteria (system effects), standards and regulatory related criteria, supplier related criteria, and material performance related criteria. These categories form the basis of the researcher's interpretation and reporting of structural material choice criteria. The criteria are briefly compared across developments and roles at the end of this section. A tick (✓) signifies the interviewee having mentioned that particular criterion as being important from their perspective. The various letters signify their having mentioned a given criterion as being important to another party, in their view (the letters are explained in a legend at the bottom of Figure 5.6).

	A1	QS D1	A2	D2	QS D2	A3	QS C3	A4	D4	A5	D5	A6
ECONOMIC												
Cost/Return		✓	✓	✓		SD						SD
Material Price	SD		✓		✓	QS	✓	QS			✓	
Labour Availability		✓	✓				✓					
Saleability		✓	✓		✓		SD	SH				
Fit With Budget	SH					✓	LA	✓		✓	✓	
SYSTEM EFFECTS												
Fit With Standard System	LA			✓	✓	✓				SD		SD
Buildability		✓	✓		✓			✓		✓		
Construction Speed		✓						SH	✓	SD		SD
STANDARDS + REG												
DOE Standards						✓				✓		
Building Regulations	✓		✓	✓		✓		✓		✓		LA
Other Standards								✓		✓		
SUPPLIER												
Supplier Track Record								✓				
Supplier Relationship					✓		✓	✓				
Material Availability								✓				
Service/Delivery					✓		✓					
PERFORMANCE												
Maintenance	✓		LA			✓					✓	
Building Life	✓					✓	LA				✓	
Material Quality	LA	LA		LA	✓		LA		✓	✓	✓	LA
Aesthetics		✓		✓			A		✓		SD	
Durability			LA	✓		✓					✓	
Robustness						✓						
Stability								✓				
Thermal Insulation								✓	✓			
Sound Insulation				✓				✓			✓	
Fire Insulation				✓		✓		✓				

✓ = interviewee's own criteria A = architect criteria QS = quantity surveyor criteria E = engineer criteria
LA = local authority criteria SD = speculative developer criteria SH = single house builder criteria

Figure 5.6: Interviewees' Structural Material Choice Criteria

5.6.1 Economic Criteria

The economic category of material choice criteria comprises of five different factors relating to the economics of using different materials. The material choice criteria which

emerged from the interviews which related to materials on a stand alone basis were material price and the availability of labour to build using certain materials. The broader economic considerations which arose were the cost/return relationship, finished product saleability and how the material fits into the overall budget.

The **price** of individual materials was mentioned as being either of self or attributed importance by seven of the interviewees. It appears to be of particular importance to the quantity surveyors, as two of the three interviewed mentioned its importance to them and three of the architects identified it as being of considerable importance to quantity surveyors *"I would be concerned more with the individual costs of bricks and blocks and timber, that would be my main criteria"* (QSC3). **Labour availability**, was mentioned as a factor by three of the interviewees, particularly in the context of a shortage of brick-layers which is currently being experienced. One architect discussed the effects of this shortage in terms a developer's search for alternative forms of development: *"Basically because the price of block-laying and brick-laying has gone, the labour price has gone ballistic, ...we had one very large house builder who was looking at steel frame and timber frame, was actually experimenting, going through all of it, trying to see to what extent we can eliminate or reduce areas or trades that have become disproportionately expensive"* (A2). QSD1 felt that the shortage of brick-layers was disproportionately driving-up the cost of using bricks and blocks in construction, but that the longer term relationship which exists between developers and trades contractors helped to stabilise these rises to some degree: *"When there is a lot of work out there labour starts to do the talking, so they nearly can start commanding their own price then. But most of them are cute enough as well in the sense that we generally carry a reasonable lot of land, so they always know there is work ahead of us"* (QSD1).

The other three economic criteria take a slightly broader view of the effects of material choice on the overall development. The **cost/return** relationship emerged as being of particular importance to speculative developers: *"The speculative developer is interested in the bottom line, the actual cost and the actual margin that is there"* (A6). However, the cheapest material may not always offer the best mode of increasing margins *"Certainly doing things the cheapest way doesn't give the best return, by and large"* (A2). Equally, the incorporation of the most expensive, highest quality materials, normally will not be reflected in the return either. *"It just doesn't add up[use of top price/quality bricks] if those costs are there, the returns aren't there for you... there are plenty of good quality bricks out there on the lower price..."* (QSD1).

The more important economic criterion from the viewpoints of both the single-house owner-developers was the degree to which materials fit within the overall **budget**. *"But as I say, I would rather go for quality first, obviously its a case of you have to put out the money and you have only so much"* (D5). *"Everything has its cost implications from the client's point of view, I mean like, sometimes you can't go for the top of the range materials, you know, that you might like, whatever, but it has to fit in with his budget."* (A5). *"Yea, the architect's only concern, as far as cost is concerned, is that what he designs his client can afford"* (A4). This was also attributed as the important economic criteria in relation to the Local Authority development (A3 and QSC3).

Saleability of the finished product emerged as being particularly important to speculative developers as evidenced in their own criteria and in the criteria attributed by other parties. In relation to design and material choice the apartment architect stated that any changes from the norm must be justified in terms of return and saleability. *"We have got to convince the guy [developer] that it is going to come back to him, worth while, you know, if you do the job well it is going to sell well"* (A2). Interestingly the timber frame house architect mentioned potential resale value as a criterion that may be a deterrent to clients considering using timber frame construction. *"As far as the client is concerned, I think what they are worried about as far as timber frame housing, is will it have a resale problem"* (A4).

5.6.2 System Effect Related Criteria

Three main development system related criteria emerged from the interviews as being of importance when choosing materials. These criteria are: how materials fit with a standardised system of design and development, the effects of materials or designs on buildability, and the effect of materials on construction speed/time. These criteria are particularly important in the multi-dwelling developments (developments 1, 2 and 3).

The whole issue of standardised designs and construction to a formula, has already been discussed earlier in this chapter. Standardisation has a direct effect on materials as they are often chosen to **fit the development system**, which can inhibit the potential for dramatic changes in structural material usage. Three of the interviewees involved in the multi-dwelling developments felt that this was an important factor in their own material choice decisions (QSD2, D2 and A3) *" I would say 99% of apartments are built the one way... there's a system going"* (QSD2). While a further two interviewees felt that it was important to other types of

developers (A1 and A5). *"Local Authority housing again is a bit different, you are limited to traditional materials, there isn't too much scope for change there"* (A1).

Buildability refers to the ease or difficulty with which a particular design or component can be built. It was mentioned by five of the interviewees as being a consideration in their choice of materials. An example of this can be illustrated by QSD1's account of an instance where a particular type of protruding bay window, which the architect had designed into the development, was recognised as causing serious construction problems. *"They (the architects) had put in crazy bay windows, we had to try and regularise them a little bit to make them more buildable, more builder friendly"* (QSD1). A4 suggested that improvements in buildability can be achieved with timber frame, which he felt was an important criterion in system selection. *"You can achieve the design that they (clients) want easier with timber frame than conventional"* (A4).

Speed of construction was mentioned by one of the multi-dwelling development interviewees directly. He was discussing speed in the context of maintaining the development system and buildability and stated that *"...house building- its a pure operation in time"* (QSD1). Two of the other interviewees felt that speed was important to speculative developers (A5 and A6) *"For those building a lot houses, the more standard they can make that, you know, its both for speed of construction and ease of construction"* (A5). The developer and architect of the single timber frame house also felt that this was an important criteria in material / system choice: *"So the client will be looking at it from the time it takes 'til the house is finished"* (A4) and again: *"They are supposed to very warm, so that's why I said I'd chance it and for speed as well"* (D4).

5.6.3 Standards and Regulatory Criteria

There are various regulations and standards which may be considered by those involved in development, relating to both overall building performance and individual material performance. The main two mentioned were the Department of the Environment standards and the Building Regulations. The local authority was particularly concerned with the **DOE Standards**, *"...before a standard design becomes a standard design it must comply with the DOE criteria"* (A3). The draftsman/engineer involved in development 5 also mentioned them *"...generally speaking the DOE outline specifications is what everything would be complying with"* (A5). However,

most of the interviewees referred to the **Building Regulations**, which set out the statutory minimum performance standards for construction. *"Obviously we are going to have to comply with the Building Regulations"* (A1). *"The Building Regs are performance based. There are technical guidance documents, but they do not specify particular materials, rather it must be demonstrated that construction meets these standards"* (A6). Some of the other standards mentioned include **strength class** and **stress grading** for timber (A1 and A4) and the **bearing capacity** or strength of concrete blocks (QSD2).

It emerged in the course of the trial interview that it normally falls to the architects that designed a given development to certify compliance of the individual dwellings with the Building Regulations. He cited a particular instance to illustrate the potential problems with this system of policing Building Regulation Compliance. *"The builders on that particular site more or less employed the architects to get planning permission, do elementary drawings to satisfy the requirements of the Building Regulations. [The builders] didn't want to see the architect on site, basically wanted the architect to certify it at the end of the day and I found out when carrying out the survey that they didn't understand the Building Regulations"* (A6). Whilst the speculative housing development would appear to show a greater ongoing involvement for the architects. *"They do you a design to planning, and then from that point on you get the drawings up to working drawings standard, and then they would monitor things, and then they would certify houses at closing. Obviously if they have to certify and they see something wrong that they think is incorrect form of construction they will intervene, and that will have to be sorted"* (QSD1). However, the architect dealing with the same development was less committal regarding ongoing inspections. *"We would have an inspection then to see that it is built in accordance with the planning permission, and that from a visual inspection that it would be in accordance with the Building Regulations, and then we would issue a compliance certificate on that"* (A1). This raises two questions, as posed by the trial interviewee, firstly, can architects determine if non-visible structural elements, such as foundations, comply with building regulations, upon completion. Secondly, can we rely on the will of architects to pull developers up on substandard construction detailing, as they are likely to wish to retain an ongoing relationship with the developer. On this basis the wisdom of allowing designers to certify Building Regulation compliance of developments which they design is somewhat questionable.

5.6.4 Supplier Related Criteria

The four supplier related criteria which arose in the interviews were: service and delivery standards, material availability, supplier track record and designer-supplier / buyer-supplier relationships. Whilst both cost and material quality were mentioned by a number of

interviewees these were already covered in the economic criteria. The supplier **track record** and the architect-**supplier relationship** were mentioned by A4 *"Oh, yea, we have built up a good relationship with [timber frame company name], because we know how they work. We can make promises to our clients that we know, based on track record with them, that they will deliver on time and will be fairly good and are fairly cheap"* (A4). Another interviewee discussed the relevance of supplier relations and **delivery** *"..but there are other criteria as well that come into play, maybe problems with delivery, relationship with the firm, the quality of the materials and so on..."* (QSC3). QSD2 stressed the combination of price, quality and **service** in supplier selection *"You know, if you are getting service and quality, you know you can rely on, if you order up timber for a house, that you are going to get decent quality timber, all the time and at the right price, it is a balancing act of the three of those"* (QSD2).

5.6.5 Performance Related Criteria

The researcher identified ten different criteria related to material performance from the interviews. Some are relatively closely linked to each other, and are grouped together for this reason. They are as follows: future maintenance, durability, robustness, stability, building life-span, material quality, aesthetics, and thermal, sound and fire insulation. Three of the interviewees mentioned both **future maintenance** reduction and **building life** as considerations which they felt were important in material choice (A1, A3 and D5): *"Robustness is very much to the fore in our decisions, as is serviceability, building life and the question of maintenance ongoing of the [LA name] estate"* (A3). Future maintenance was mentioned by A2 as an important criteria for the LA and building life was mentioned in the same context by QSC3. *"That's what they go for, is a longer life cycle of the product, than they would in a speculative scheme. Where the (LA name) design houses they are going to be standing in 200 years time. They can go in a 100 or 60 years time, but there is a structure there to refurbish. But with a spec house it would be different, the whole structure would be down in a number of years"* (QSC3).

Robustness (A3) is similar to **durability,** which was mentioned by A2 as being of importance to the LA and was also identified by two of the other interviewees as being a factor in their selection processes (A3 and D5). *"Of the main structure, they are things that you are hoping are going to be there for at least the lifetime anyway, we were definitely going for durability and quality there"* (D5). **Material quality** was a recurring theme throughout many of the interviews, it is intertwined with a number of the previous criteria. Particular importance was given to quality in the LA development and the two single houses (QSC3, D4, A5 and D5). *"The selection of materials and the quality of materials and workmanship I reckon on local authority housing is far higher than in any speculative housing scheme"* (QSC3).

Aesthetics appeared to be important to the speculative developers (QSD1 and D2), more so than the local authority. *"We are very flexible in design, we are always looking for new ideas with the same materials, a bit of extra flair, you know. We don't have to get it approved down the line and the County Council they do... it is too inflexible... Expensive materials and still they look second class, we would build a better looking house cheaper than the County Council would build it"* (D2). The LA architect seemed to contradict the view that they have little scope to change aesthetically, certainly elevationally (external appearance). *"There are quite extensive possibilities for change in the matter of elevational treatment and window detailing and the likes of that, but the fundamentals of room size and fire protection, a more substantial, perhaps, standard of construction would apply"* (A3). The architect engaged on the timber frame house development highlighted **stability** as a consideration in material selection and suggested that contrary to the common perception of timber frame as a less stable form of construction than conventional blocks and mortar, it may in fact be more stable. *"When you build a block house it is on a plastic damp proof course, there is absolutely no bond what so ever, there is nothing holding it down other than its own weight, whereas a timber frame house is bolted down, you know what I mean"* (A4). There may be a degree of self-justification evident in this statement from a proponent of the timber frame system, as he later goes on to say that timber frame may not be suitable for local authority housing as it tends to come in for more abuse (see Section 5.8). He also mentioned **thermal, fire and sound insulation** as important considerations in material choice and general house design. Thermal (heat) insulation was an important factor in D4's decision to use timber frame construction. *"It seems to be very easy to heat"* (D4). Fire and sound insulation are particularly important in high density development such as apartments. *"Well in apartment blocks when we are talking about dividing it, it is to do with getting the fire certs and all that, sound and all that, you know. Where you want a split between them, that stays in concrete, or hollow block or whatever"* (D2).

The main criteria in the speculative developments relate to producing a saleable product, which meets what developers and their advisors perceive to be the expectations of the market, while adhering to the necessary regulatory building standards and remaining efficient from both the cost and time perspectives. The local authority are more concerned with the development of high quality robust housing, which will have a long life-span and will require the minimum of maintenance. They are very restrained by standardised designs, but are not as concerned with costs as speculative developers. *"They [local authority] would have the best of materials, expensive materials, and still they look second class. We could build a better looking house cheaper than the county council"* (D2). *"The council houses now, the best of stuff goes into them because there is always a come back on the council... the council can't move away like a*

developer" (D5). The two single house developers may not be very representative of single house builders, because they both had an in-depth knowledge of construction themselves and took active roles in the management process. However, the researcher feels that many of their criteria may strongly relate to those of other own-house developers, particularly in terms of their desire to incorporate quality materials and to create a certain degree of individuality in the finished house, as suggested by the trial interviewee. *"The person that is very receptive to more innovations, the one-off-house, the person looking for a unique type of design"* (A6).

The designers all emphasised the importance of Building Regulation compliance as foremost in their material choice criteria. Fit with the overall budget appeared to be highly important to the designers in the single house developments and the local authority development.

5.7 Material Choice Processes Model

Having explored participation and material choice criteria as proposed in the study framework we move towards the presentation of the study model as envisaged in Objective 3. The purpose of the model is to integrate the study framework and the researcher's interpretation of the interview findings regarding participation and criteria in material choice processes, on a development specific basis. The basis of this model lies firmly in the study framework as outlined in Chapter 3. Initially two of the core concepts of the framework are combined to form the core of the material choice model. These are the three stages in material choice processes (Figure 3.10) and the three levels of participation (Figure 3.11). Boxes are created to display the deciders, those involved and influencers in each of the stages - structural material selection, structural timber specification and structural timber supplier selection. Figure 5.7 below illustrates the core of the material choice model.

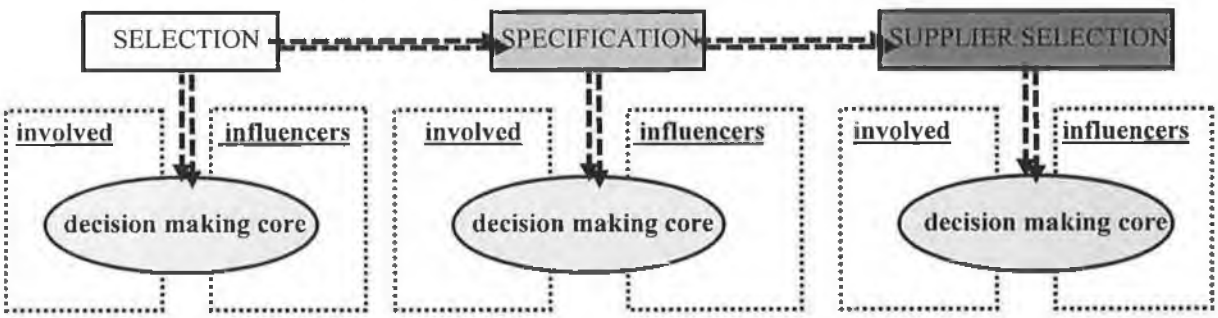


Figure 5.7 Material Choice Model Core.

The second stage of the model presentation involves the representation of the material choice criteria as identified by the interviewees. These criteria are represented in the outer core of the model and are divided into developer and designer criteria. The developer criteria are presented in the upper section of the model and the designer criteria are presented in the lower section of the model. Figure 5.8 displays the criteria section of the model.

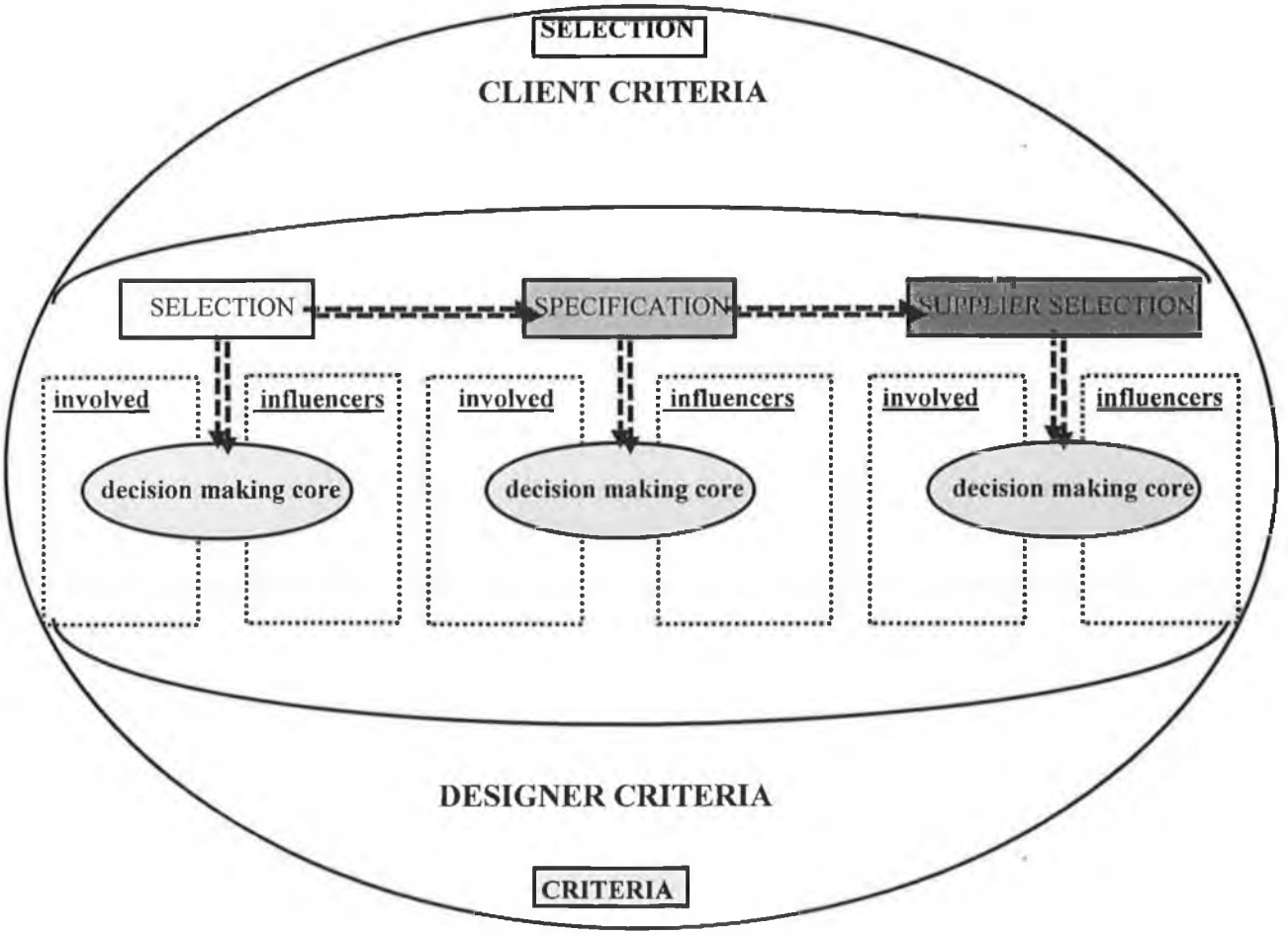
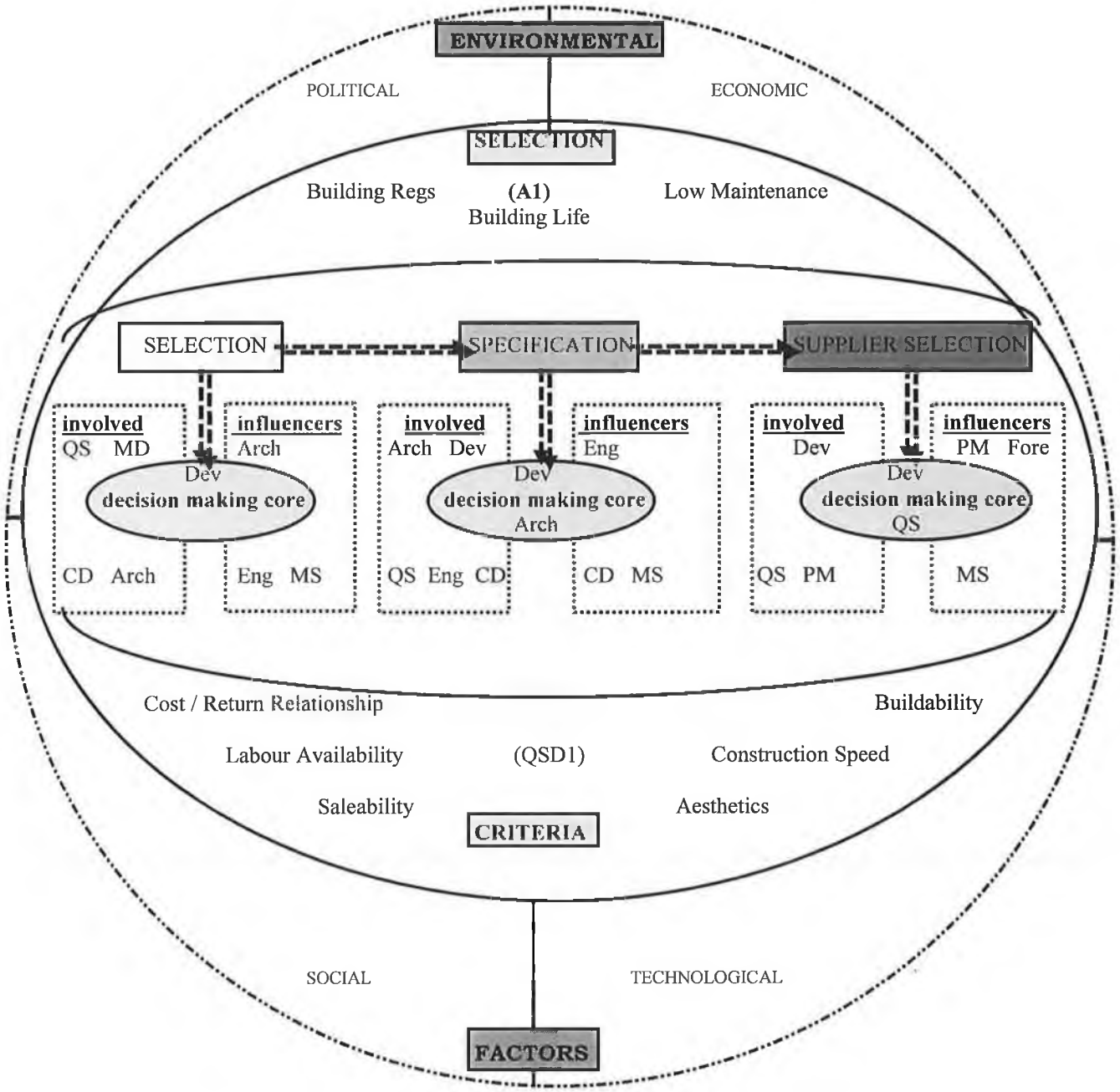


Figure 5.8 Material Choice Criteria – Outer Core of Model

The outer circle of the model represents the environmental factors that can affect the construction industry and thus impinge upon material use. It is divided into political, economic, social and technological factors, or a PEST analysis of the external environment in which development takes place. Section 1.5 provides a PEST analysis of the residential construction industry. The information gathered during the interviews on participation and

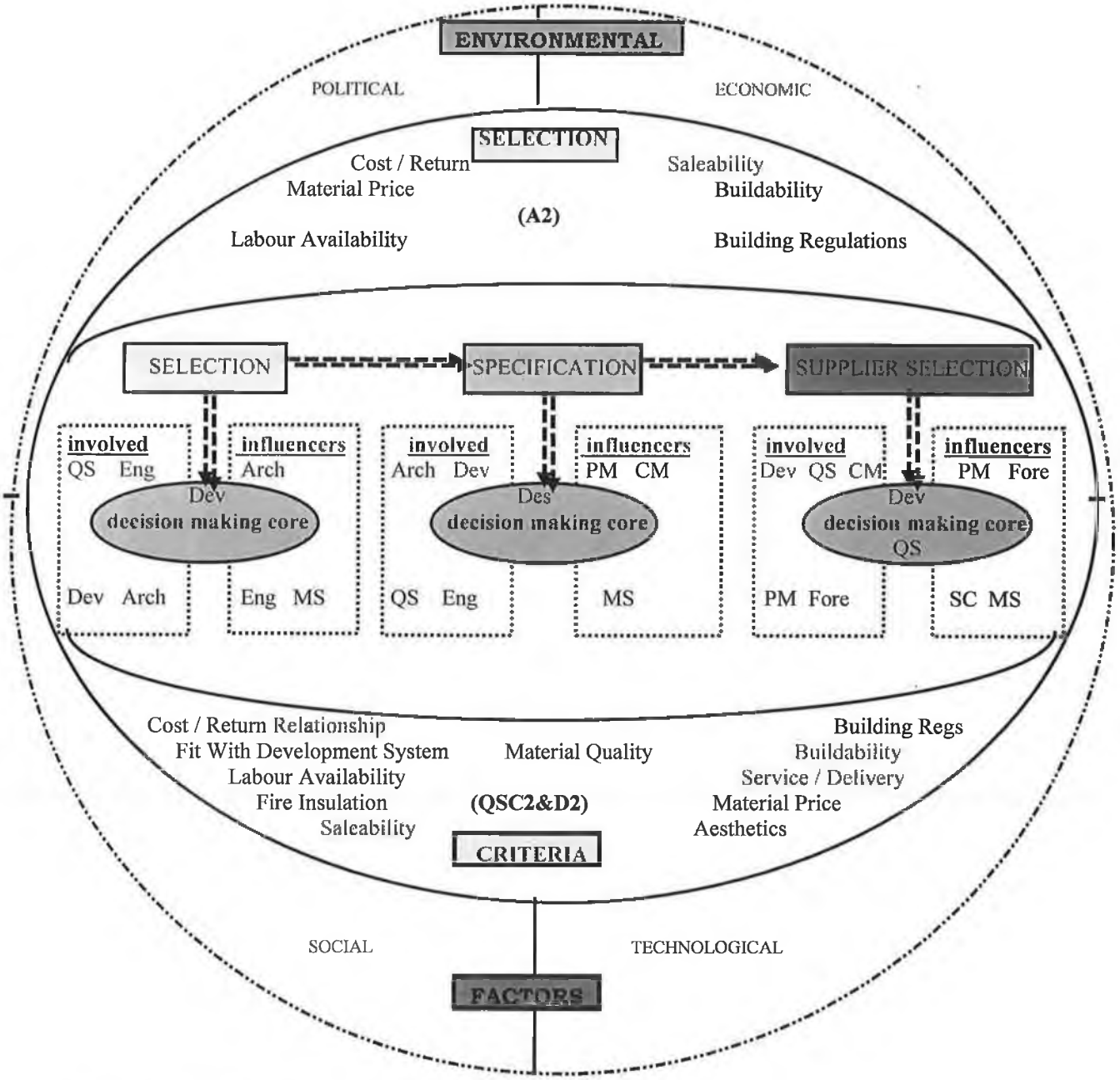
criteria is imputed into the model on a development specific basis. This facilitates the presentation of a summarised version of all the participatory and criteria data gathered in the course of the interviews, which is not possible in the main text of the findings above. The presentation on development specific basis enables readers to compare and contrast the various developments. Each of the participants mentioned in each of the developments is allocated a code, which are outlined in the participant code boxes below Figures 5.9-5.13.

Figure 5.9: Material Choice Model For Development 1 (Speculative Housing)



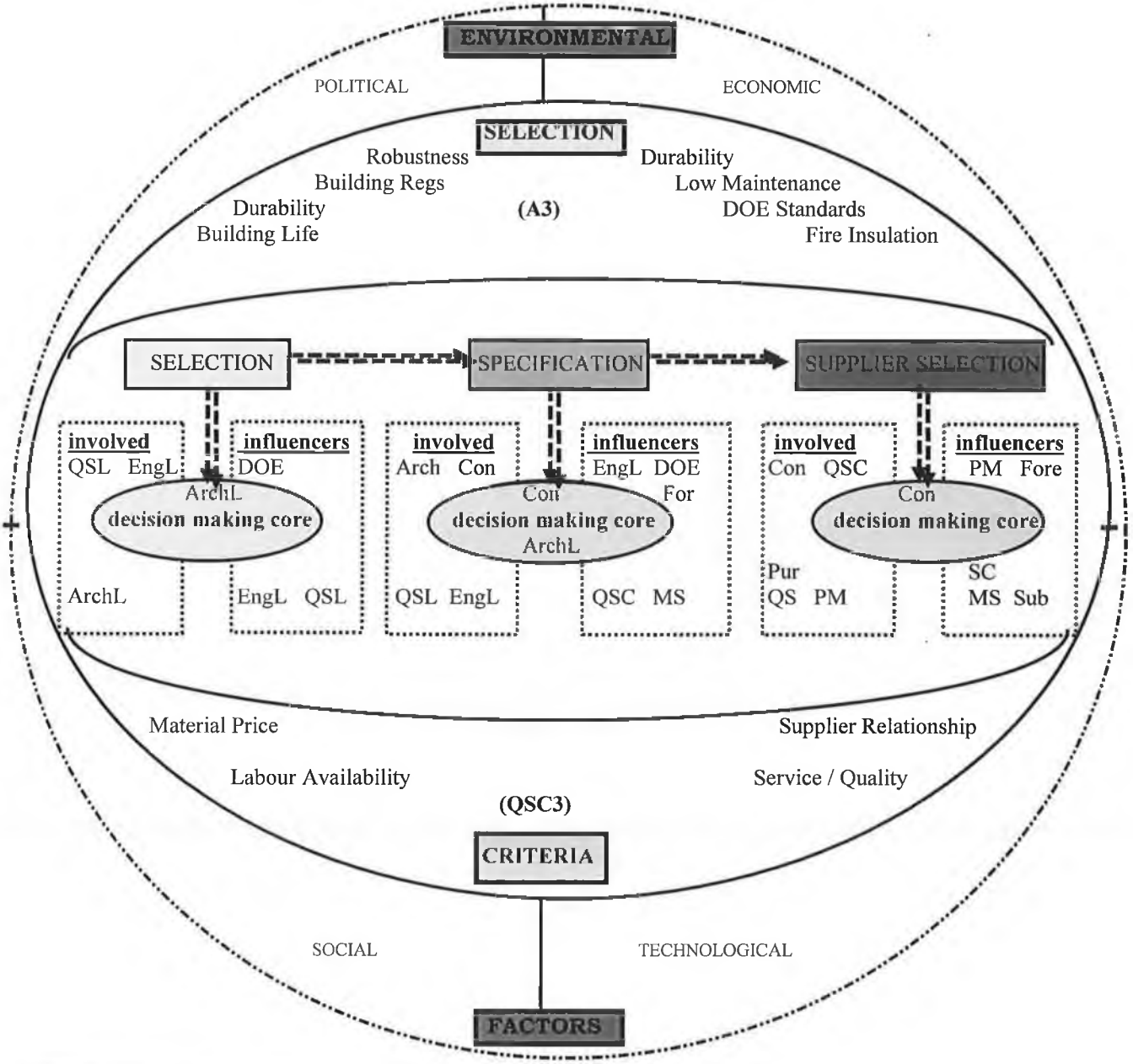
Participant Codes
Dev - Development Firm Senior Management
QS - Quantity Surveyor (Development Firm)
Arch - Architects
Eng - Engineer
CD - Contract Director (Development Firm)
MD - Managing Director (Development Firm)
PM - Project / Site Manager (Development Firm)
MS - Material Suppliers
Fore - Foremen (Development Firm)
SC - Site Clerk (Development Firm)

Figure 5.10 Material Choice Model For Development 2 (Speculative Apartments)



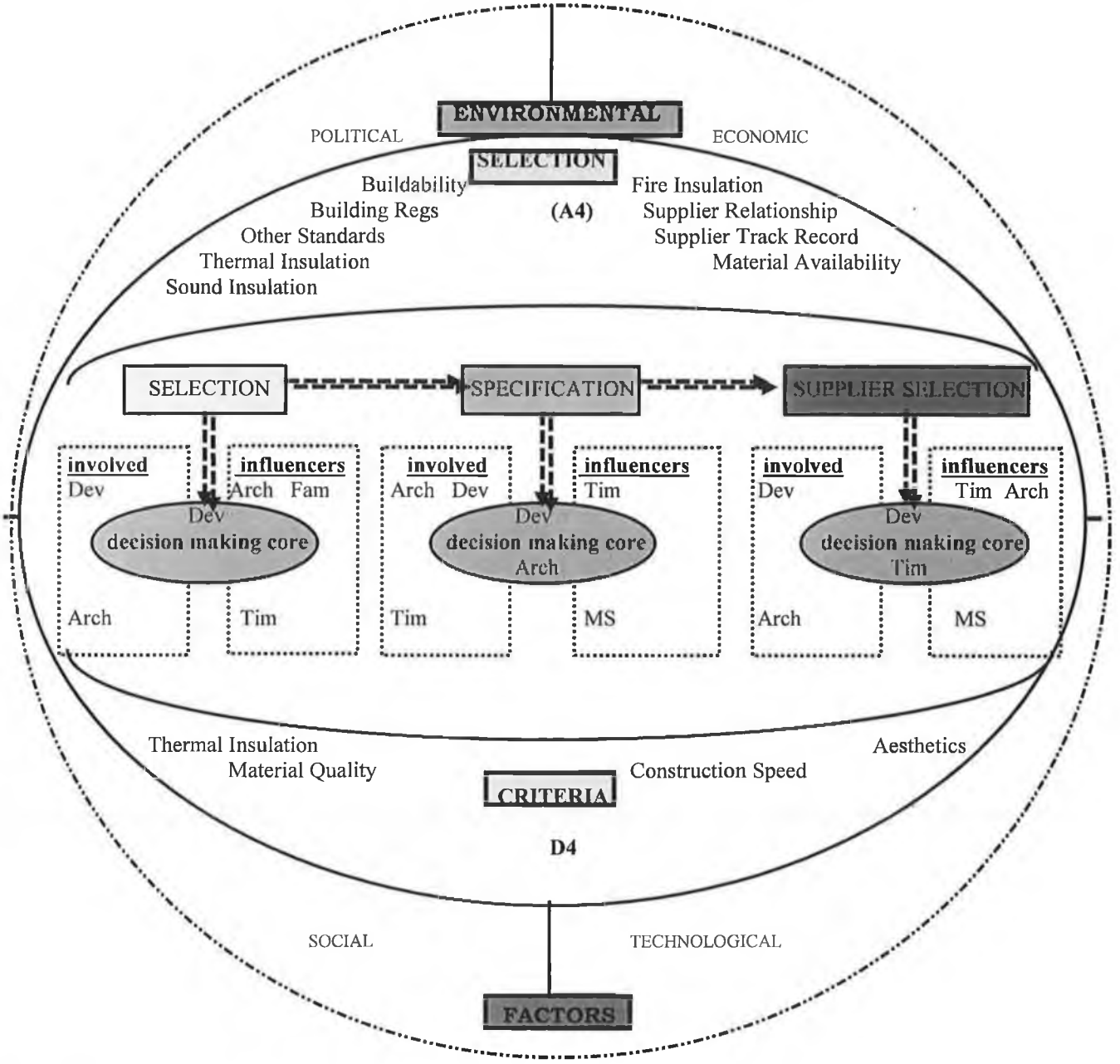
Participant Codes
Dev - Development Firm Senior Management
Des - Design Team (Developer, Architect, Engineer)
QS - Quantity Surveyor (Development Firm)
Arch - Architects
Eng - Engineer
CM - Contract Manager (Development Firm)
PM - Project / Site Manager (Development Firm)
MS - Material Suppliers
Fore - Foremen (Development Firm)
SC - Site Clerk (Development Firm)

Figure 5.11 Material Choice Model For Development 3 (Local Authority Housing)



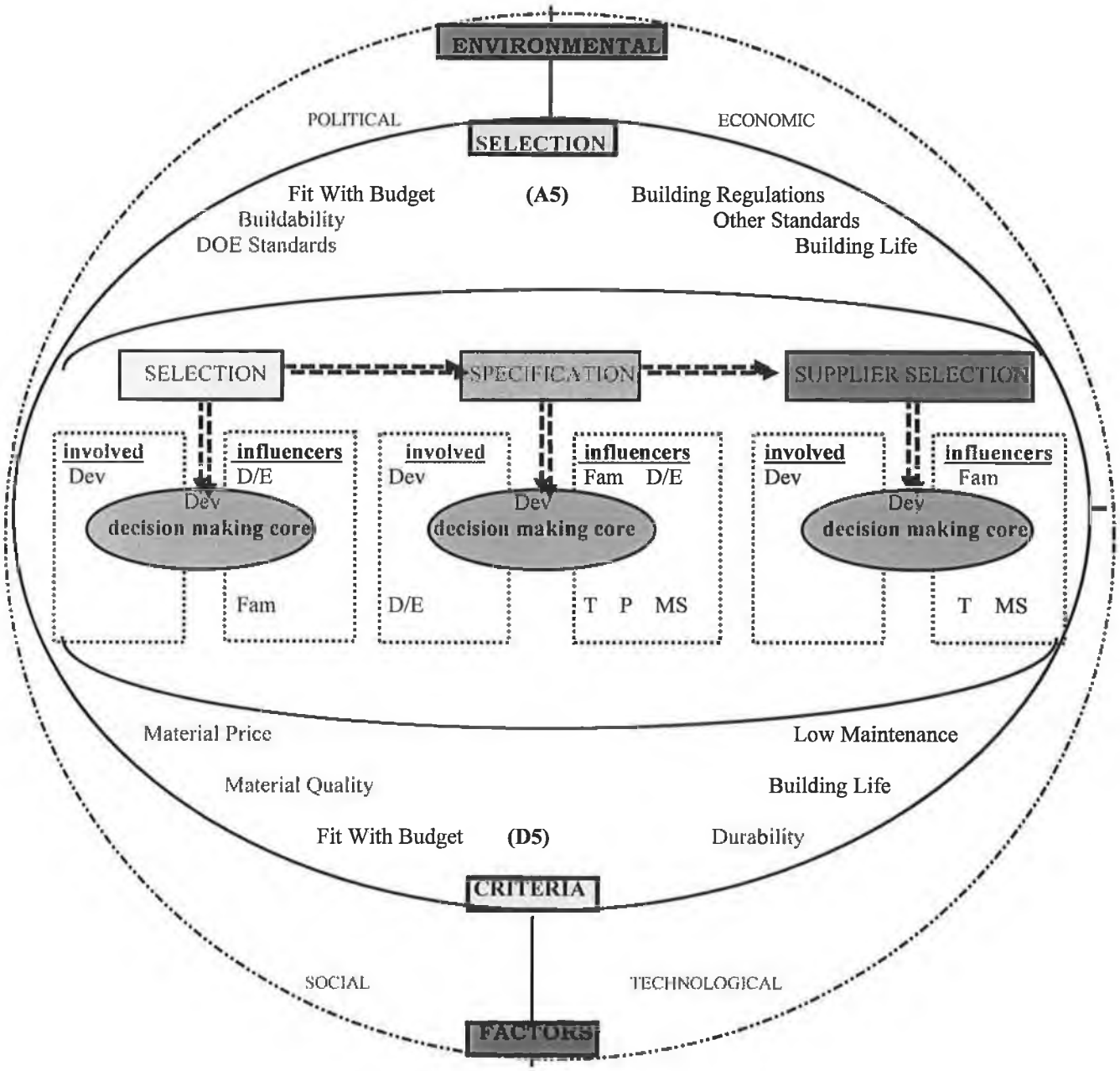
Participant Codes
Con - Head- Contractor Firm Senior Management
QSC - Quantity Surveyor (Contractor)
QSL - Quantity Surveyor (Local Authority)
Arch - Architect (Local Authority)
EngL - Engineer (Local Authority)
CD - Contract Director (Contractor)
PM - Project / Site Manager (Contractor)
MS - Material Suppliers
Fore - Foremen (Contractor)
SC - Site Clerk (Local Authority)
Pur - Purchasing Officer (Contractor)
For - Forbairt
DOE - Department of the Environment

Figure 5.12 Material Choice Model For Development 4 (Timber Frame House)



Participant Codes
Dev - Developer / (Client and Wife)
Fam - Client's Family
Arch - Architect
Tim - Timber Frame Manufacturer
MS - Material Suppliers

Figure 5.13: Material Choice Model For Development 5 (Single Dormer)



Participant Codes
Dev - Developer / Client (Husband and Wife) (D5)
Fam - Client's Family
D/E - Draftsman / Engineer (A5)
MS - Material Suppliers
P - Planners
T - Tradesmen

5.8 Changes in Structural Materials

Robinson Faris and Wind (1967) suggested that familiarity and newness of a purchasing situation impact upon organisational buying behaviour in various ways and they introduced the buyclass concept to reflect this. The three categories of purchases introduced by them were straight rebuy, modified rebuy and new task, as discussed in Chapter 3. The interviews would suggest that the development system adopted by many developers considerably restricts the amount of new task purchasing in many development situations. However, it is considered important, as indicated in Objective 4, to briefly examine organisational buying in the context of material changes. Theme 4 of the theme sheet (Table 5.2 and Appendix B) seeks to explore five preset elements of material change. The first relates to the identification of any structural material changes the interviewees can think of. The second and third seek to explore the views of interviewees on the adaptiveness of the industry to new materials and main impediments / drivers relating to material change. The two main material changes to be explored specifically in this study were timber frame and Irish timber, each of which will be discussed in detail below. Whilst, participation and criteria in structural material choice are the primary concerns of this study, it is important to briefly explore power, risk and conflict, as they are fundamental elements of organisational buying behaviour theory (Sheth, 1996). Conflict, power and risk constitute emergent themes in the study, rather than being explicitly explored dimensions, and as such the data gathered relates to a diverse range of aspects of the overall development process. Initially this section will commence with a review of the main material changes mentioned by the interviewees.

The views of the interviewees varied widely in relation to changes in materials and development systems. A number of the interviewees expressed the view, certainly initially, that there were few if any changes in residential construction materials occurring at the moment. *"There might be changes in design, or house or room layout, that kind of thing, but its not really a problem or an issue when it comes to materials"* (A1). *"There hasn't been any major [material] changes really, its just a variation on a theme really, its all the same"* (QSD2). *"Am, in residential construction I wouldn't really be aware of any changes"* (QSC3). Some of the changes in systems and materials that were identified, unprompted, by the interviewees included the concrete eco-house and pre-insulated concrete blocks (QSD1), increased use of

prefabricated materials and components, driven by the growing emphasis on construction speed (A2) and a move towards higher quality materials (D5).

The three drivers in terms of material change, identified by the interviewees were the desire to increase construction speed (A2), the shortage of bricklayers (A2) and the increasing emphasis on energy efficiency (QSD1). The impediments to material change identified were the conservative nature of various members of the construction industry and end users and risk aversion. There were a number of different views expressed as to the reasons that the industry is slow to change *"I think one of the big problems to hinder change is that you got a developer and his team are mainly subcontractors, so you are dealing with say 5 different subcontractors and to start to use different materials they will have to throw them out and it is difficult enough to control them as it is"* (A1). *"It is probable that the (local authority name) would be at the more conservative end of movements towards change in regard to materials"* (A3). *"Well I think that the thing about the building industry is that there is a very conservative approach, mainly because with architects, they don't want to change, if something has worked for 50 years why change it"* (QSC3). A2 argued that the younger people particularly, in the industry, are quite open to change and that in fact it is the public who are conservative when it comes to material change *"So I don't think the people are afraid of using new products on technical grounds, I do think they are afraid of presenting something that they felt they mightn't be able to sell. In housing I would say that it is the image of, the icon of a house, most people buying a house have a very clear symbol of what a house is... if the front of it was clad in corrugated metal they would freak... I think the presentation of the image of housing is very conservative, apartments less so"* (A2).

Much of the data gathered on impediments to material changes revolve around risk, be it market orientated risk as indicated by A2 above, or material performance / future liability related risk as mentioned by a number of the interviewees. Risk aversion and the fear of potential future liability may be illustrated by the following interviewee statements:- *"...I mean it is the architects, they are certifying the work and it is their name that is going to be on it, so if there is a problem in 20 years it will come back on them and they don't want the liability"* (QSC3). *"Architects, engineers, designers and builders tend to stick with the known and proven method and materials, in order to minimise comeback on product, right"* (A4).

5.8.1 Conflict and Power

Conflict was not explicitly explored in the interviews however a couple of instances of conflict did emerge during the analysis of the interview transcripts. One interviewee suggested that conflict is higher where building works are undertaken by contractors

rather than by the developer themselves. *"You see in developer driven programmes it's everyone's on the one side, its actually very pleasant, you are working as a team. In contractor it can be much more adversarial, particularly some contractors can tender for jobs on the basis of saying well it will cost us ten million to do, but we reckon we can get a half million extra, so we will bid nine and a half. They are gunning the whole time for that five hundred in extras, kicking up fierce dog fights."* (A2). It would appear that when the contracting system is used it becomes very important to have a clear specification and a clear definition of roles in place in order to reduce the potential for conflict. The contracting firm quantity surveyor in the local authority development stressed the importance of detailed specification documentation in contract situations. This ensures that all those tendering are tendering on the same basis. It acts as a safeguard for both parties in order to ensure that disputes on any aspect of the completed development can be referred back to the specification for resolution. The roles issue arose in terms of the local authority architect seeking input into the choice of bricks, as already discussed, which the contractor felt was outside his remit. In this vein it is considered important to ensure that any move towards the increased use of material and labour contracting in the residential construction industry should be accompanied by a strong commitment to developing very details specifications of material characteristics, in order to reduce conflict.

The most obvious manifestation of power in this study is the power held by developers, which remained strong throughout each of the subject developments. The only possible exception would be the local authority development where the contractor's power base became strong during the building phase. It is likely that developers can rely on a range of power bases including reward, coercion, legitimate, attraction, and expert power (French and Raven, 1959 & Bonoma, 1982). However, the power bases available to other participants in the material choice processes are generally more limited. Design consultants such as architects are more reliant on expert and information power. However, these bases can be very effective, as witnessed by the extent of the architect's influence in the decision of the single house developer to adopt the timber frame system in development 4. In other cases designers can find their power to be relatively ineffective, as was the case with the draftsman in development 5.

Material suppliers appear to be reliant on information and attraction power bases, which are relatively weak in the overall context of power bases. However, two of the

interviewees pointed to the power of one particular material supplier, Cement Roadstone Holdings (CRH) as significant power brokers and influencers in terms of material change. Their ability to maintain concrete products as the dominant force in residential construction was cited by the quantity surveyor in development 1, as evidence of their power. He felt that CRH were a significant barrier to the timber frame industry gaining significant market share. On the other hand the timber frame development architect expressed the view that CRH would be better off developing systems which complement timber frame construction systems. His view was that timber frame usage would continue to grow, despite the concrete industry's attempts to combat it through the introduction of concrete frame housing and other concrete based composite materials.

Town planners can potentially exercise a number of bases of power. The harder coercive and legitimate power bases may be open to planners in regard to external structural material usage in the exercise of their ultimate decision as to whether planning permission is granted or in the conditions they attach to a grant of planning permission. However, the move towards pre-application consultations between developers and planners tends to increase the potential for planners to exercise the softer bases of power such as expert and information power in the material choice process.

5.8.2 Irish Timber

Irish structural timber has made considerable inroads into the domestic timber market by displacing imported structural timber in recent years, as discussed in Chapter 2. The researcher views this as a good example of 'modified rebuying' (Robinson Faris and Wind, 1967) in the structural materials market and as such it is interesting to explore the attitudes of construction industry participants to Irish timber. There appears to be a considerable problem for Irish timber in terms of the perceptions of quality, as expressed by a number of the interviewees:- *"So it's down to the quality of Irish timber, it's not always the best. It tends not to be as straight, or it warps or whatever ...we work on a quality system here, quality materials. Now, I have no problem once Irish timber is fine, now, I am not on the ground the whole time listening, but it seems there are problems with it, it can be technically substandard"* (QSD1); and *"I wouldn't have native timber in the place. I have seen native timber, while it has come along a terrible lot in recent years, it is still not as good as the imported timber. Its far more inclined to warp and everything like that, you would pick it out straight away"* (D5).

On the other hand some interviewees appeared to have little problem with it, so long as it met the requisite standards. "*So once it reaches the grade, you are guaranteed that what you would be getting and that's what you want - a guarantee that its the same as what you got the last time*" (QSD2). "*Well there was a kind of a traditional feeling there about the use of foreign timber, because the Irish timber back in the 70's and that, wasn't good enough for using as a structural timber, you know. But if somebody puts a grade on it that says it meets the requirements, then I am not particularly worried whether it is native or not, so long as it meets the stress grading and so on*" (A5). One of the roots of the poor quality perception of Irish timber stems from the poor and uneven treatment which Irish timber historically has received from both processors and builders, according to one architect. "*He [the builder] gets timber that's not kiln dried, that's not pressure impregnated and he gets it cheap and uses it and you get shrinking and warping and wobbly roofs and all that*" (A4). The views expressed by the various interviewees on Irish timber overall were not very favourable. While it is not known how representative these views are, it is none the less a point of some importance for the timber industry to address.

5.8.3 Timber Frame Construction

The timber frame development system is one of the most dramatic changes in structural materials to occur in Irish residential construction in recent decades and represents a good example of new task buying. Whilst a number of the interviewees professed to having considered using timber frame construction only one of the subject developments involved its use. The material choice process in this regard has already been discussed earlier in this chapter. A diverse range of views were expressed by interviewees regarding timber frame construction. Some interviewees felt that it will grow in usage, others felt it would not. Some looked favourably upon it, others did not. Those who liked it are not necessarily the ones who felt that it will grow. A1 expressed his wish to experiment with timber frame construction, but felt that there is resistance from both developers and purchasers and that the market needs to be educated as to its benefits "*I know as a practice that it is something we want to look at, timber frame construction, we can see a lot of benefits there for it, but we can't get a developer that is interested. I can see it down the road where we would have a developer that would be interested. I think again it is purchaser perception of timber frame housing, that there needs to be some education there, but I can see a day when it will be more widely used*" (A1). A2 discussed his own dislike of timber frame, but felt that it is particularly suitable for rural one-off houses, which were traditionally community built. "*Personally I am not a huge fan of it, I prefer*

concrete walls to be quite honest with you... but timber frame seems to be becoming far more practical in single houses" (A2).

D2 and QSD2 have examined timber frame as an alternative to traditional housing and expressed the following views. *"Well we have looked at timber frame building for a housing scheme to see how it would fare... it worked out very, very expensive, prohibitive at the minute"* (QSD2). *"It's being driven mainly by the scarcity of brick-layers isn't it, people looking at timber frame"* (D2). The local authority architect felt that timber frame had not yet been proven to be sufficiently robust to justify its use. *"It is not something we would totally reject, but there has been some experience over quite a long time which still requires overcoming in the light of perceptions of quality control and potential risk in the fire safety area, etc."* (A3). The architect who designed the timber frame house went one stage further *"I think as far as LA housing is concerned, that type of housing tends to go in for more, lets say abuse, than your standard speculative housing and in a lot of cases, let us say, timber frame might not be suitable for LA housing"* (A4). He also felt that *"...a lot of people are scared of timber frame and people have various catch phrases for it, one being prefab... and another being cardboard housing"* and that the adoption of timber frame is very much a locational phenomenon *"...they're flying yea, Kildare, Port Laoise and up the North. Ireland generally is very slow about changing, but I think it will change"* (A4).

Both A5 and D5 expressed their reluctance to use timber frame construction, however, they pointed to the widespread use of this method in their area *"...well certainly the biggest change in the last number of years is the trend towards timber frame construction, you know, like practically every private development going on in the area at the moment has a large element of timber frame construction... I must say personally I prefer the conventional construction, what I would be worried about is the familiarity with the construction techniques"* (A5). *"Most of the houses around here now are timber frame houses... I just prefer the more solid bricks and mortar house, perhaps that is only a traditional thing"* (D5). It is interesting to contrast this view of timber frame as being a less solid form of construction to the comment by the timber frame development architect mentioned earlier, in the criteria section, where he suggested that because timber frame is bolted to the floor slab it is possibly more solid than conventional blockwork construction. The quantity surveyor in the contracting firm felt that timber frame will not grow to any great extent because of our tradition of using concrete. *"I don't think the timber frame structure is going to grow, because this country has sort of developed, its kind of, concrete block technology to the limit"* (QSC3).

Timber frame construction appears to be gaining acceptability amongst certain sections of the industry. There is growing evidence of speculative developers using this form of construction, such as Manor Park Homes. The researcher feels it will gain market share over the coming years, particularly if the shortage of block layers continues. However, certain perceptions of inferior quality need to be addressed by suppliers, both at industry and consumer level. A6 expressed the view that timber frame suppliers were failing to aesthetically differentiate timber frame construction from traditional bricks and mortar construction. If, as it appears, the current shortage of bricklayers is driving the move towards timber frame construction, rather than its own image or perceived benefits, its longer term future may not be very good, as a down turn in construction levels would result in an easing of the demand for blocklayers.

5.8.4 Reflection on Development Team / Supplier Relationships

In view of the importance attributed to relationships in organisational buying processes emerging from recent literature (Thompson, 1996 and Tanner, 1999), a brief exploration of supplier relationships is now included as an emergent theme.

The view was expressed in the literature review that due to the small scale of most Irish residential development organisations strategic partnerships were unlikely to occur between development teams and materials suppliers. The rationale underlying this belief was that neither party would be willing to commit the necessary resources to create cross-function teams (Sheth, 1996) to develop and maintain such formalised arrangements. The interview findings would appear to support this belief, but would also suggest that speculative home-builders may develop functional relationships (Tanner, 1999) with certain suppliers. He describes a functional relationship as *"repeated transactions with salesperson centred relationship"* (Tanner, 1999:246) *"As I say it is a small market in Dublin, you know, you have your five or six suppliers, for each type of product, be it concrete or timber. So you are going to each of these every time, and, you know, you would be dealing with the same rep"* (QSD2). *"And from a suppliers point of view they target a number of different builders that they will try and beat on price, you know, there might be a few suppliers who would target us, and try to please us and try to make sure that they have the right price for us and everything"* (D2). The combination of these statements would suggest that a functional relationship exists between the developer and certain suppliers. It is interesting to note one of the advantages of the one joint interview undertaken with the quantity surveyor and the managing director of the apartment

development was underlined in this context, as clarification of a point made by one party was forthcoming from the other.

A stronger relationship, yet still not strategic partnering, was alluded to by the quantity surveyor in the speculative housing development firm. He described how recently one of the main timber suppliers that they use had started to take a copy of the specification documentation for each house type in a given development. From this documentation they could calculate the amount of timber required for each structural element at each stage of construction. This meant that the site foreman could phone the supplier and inform him of what stage each house in the development was at, and from that information the supplier could deliver the requisite amounts of timer to the site. This means that the site management do not have to calculate their exact requirements when ordering, thus relieving some of their workload. It is suggested that this form of value-added service is an important step in suppliers' attempts to build stronger relationships with developers and increase the level of dependence with an important influencing group - site management.

The greatest scope for the development of strategic partnering may lie in the adoption of new materials and systems. In particular, framed and pre-fabricated development systems as there is a need for strong cross-functional interaction in order for such systems to work efficiently. For example, with a timber frame development system a number of important aspects of interaction and co-dependence can be cited. Designers must provide very precise drawings and outline specifications for frame manufacturers to design and manufacture the frames. The frame manufacturers must ensure that the initial ground and floor slab works carried out by the builders are in accordance with the plans and specifications before completing frame manufacture. On site, generally the frame manufactures must erect the frame, which requires the co-operation of the site management and the various subcontractors. Once erected the various site personnel need to be aware of the implications of working on such building constructed using such a system. So, it is suggested that the adoption of such a system would involve far greater inter-dependence between development team and frame manufacturers, who are effectively the main material suppliers.

Little scope for much more than market exchanges - one shot transactions without thought of further exchange - (Tanner, 1999:246), would appear to exist in the case of the single house developers, as they are building their houses to meet their own needs for the foreseeable future. However, some further business may be possible through later extensions or repairs to the property, and through referred business. The architect in the timber frame single-house indicated that he has an ongoing relationship with one of the timber frame companies, which he used in the construction of his own house. However, it appears to be a functional arrangement where the architect appears to push his clients towards using the timber frame system. While he indicated that he normally seeks quotations for the three main timber frame manufacturers, he stated that he has a preference for the one he used originally in the construction of his own house.

5.9 Conclusions

The interview findings uncovered a number of new insights into the structural material choice processes in a variety of different residential development situations. One common element which emerged from each of the developments was the important final decision making role which the client appeared to hold in the early material selection stage. Designers participated to different degrees in each development however, their involvement seemed to be greatest in certain timber specification decisions. Site management's participation in material choice also differed in each case, however, where they were involved, it appeared to be towards the latter specification and supplier selection stages.

Material choice criteria varied between clients and designers and across developments. The architects particularly highlighted the importance of selecting designs and materials that fit with the client's budget and that present little problem in terms of compliance with Building Regulations. The different clients were concerned with a wide variety of factors. Speculative developers showed particular concern over the cost/return relationship and buildability, while the own-house developers both felt that overall building quality and material quality were particularly important.

The residential construction sector material choice process model presented the participatory and criteria findings from the interviews. This model is rooted in the study framework as developed in Chapter 3 and displays a summarised version of the research findings on a development specific basis.

Changes in structural materials appear to have been relatively scarce in recent years, however there is considerable scope for further research into the organisational buying behaviour consequences of changes in structural materials. Timber frame construction appears to be quite topical amongst both designers and clients at the moment and there were a diversity of views expressed on its use. Irish timber appears to continue to face a quality image problem compared to its imported counterpart. Little evidence of strong relationships were found between developers and suppliers, however a couple of instances where considerable scope for relationship development were highlighted.

The interviews addressed a wide array of topics surrounding structural material choice processes in Irish residential construction. However, certain aspects of the study could be extended through the introduction of a quantitative survey. The following chapter discusses the advantages of such an endeavour and describes the methodology underlying the selected mail survey of Dublin based speculative home-builders, as presented in Chapter 7.

CHAPTER 6

LESS DOMINANT HOME-BUILDER SURVEY METHODOLOGY

Chapter 6: Less-Dominant Home-Builder Survey Methodology

6.0 Introduction

As already indicated in the earlier chapters, the study includes a secondary less-dominant primary research phase. Chapter 4 has dealt with the overall background to the methodology of the study and described the dominant interview phase in detail, this chapter deals with the mechanisms underlying the less-dominant survey phase. This separate survey methodology chapter is included in order to underline the timing and emphasis distinctions between the two phases of primary research. The survey flows from the interview findings and is primarily aimed at extending certain aspects of these findings. While the interview phase was exploratory and descriptive in nature, the survey follows in the descriptive vein (Brannick, 1997). Initially, a review of the rationale behind and objectives underlying the home-builder survey are outlined. This is followed by a description of stages involved in sampling. A discussion of the survey options precedes the outline of the main sections of the mail questionnaire and the administration procedures.

6.1 Less-Dominant Survey Phase

Initially it is important to outline the primary rationale behind the decision to embark upon the less-dominant survey phase of this mixed method design. The primary purpose is to illustrate potential avenues of extension of the investigation of material choice processes in the construction industry. The specific elements to emerge from the interview findings that could be effectively extended through a survey are outlined below.

- Participation in material choice processes and more specifically structural timber choice could be examined in a more structured manner to present a clearer picture of participation levels in the various stages, as proposed in the study framework. The development specific interviews allowed for the exploration of participation in a context rich environment, however, a survey facilitates the presentation of a clearer indication of the prevalence of various parties in structural timber choice processes.
- Criteria in structural material choice emerged from the interviews, however a survey

could extend the structural timber choice criteria picture through providing a ranking of the various criteria to emerge. A survey could provide a separation of structural timber choice criteria as they relate to each of the three stages proposed in the framework.

- A survey could allow for the extension of the model presented in Chapter 5, in order to illustrate the participatory and criteria related factors discussed above from the perspective of a given group within the construction industry, as opposed to on the basis of individual accounts in relation to specific developments as presented in Chapter 5.
- The diversity of views expressed by interviewees on Irish structural timber and on the timber frame development system offer considerable scope for further investigation in the form of a survey.

The decision to concentrate specifically on speculative residential developers was based upon their importance due to the large proportion of dwellings produced by this group, as discussed in Chapter 1. Senior members of the development firms emerged from the interview findings as a dominant force in material choice processes and for this reason they are selected as the target group in this less-dominant survey phase of the research. Given the genesis of this study as an econometric examination of timber consumption in Ireland it was decided to concentrate heavily on structural timber choice processes as opposed to general structural material choice processes. The less-dominant survey facilitates a refocusing upon the choice of structural timber specifically and addresses a number of issues that are of particular importance to those involved in the Irish structural timber market.

The less-dominant phase of the primary research involved in this study emanates primarily from the core aim and objectives of the study as outlined at the start of this chapter. However, a more focussed aim and survey-specific objectives are outlined below.

Survey Aim: To extend the study of structural timber choice processes in the speculative residential construction sector and to illustrate the application of the study model to this sector.

Survey Objective 1

To extend the investigation of the three levels of participation in the three stages of structural timber choice processes within the Dublin area speculative residential development sector.

It is considered useful to extend the investigation of the three levels of participation (influencers, parties involved, and deciders) in each of the three stages of structural timber choice processes (structural material selection, structural timber specification and structural timber supplier selection). It proved difficult and indeed undesirable to rigidly adhere to these categories during the interviews, as it could have inhibited the flow of the interviews and thus stifled the opportunity to discover the nature of material choice processes in the subject developments. This objective aims to facilitate the development of a more comprehensive picture of participation in one specific segment of the residential construction industry.

Survey Objective 2

To extend the investigation of structural timber choice criteria, in relation to speculative residential developers in the Dublin area, through the rating of criteria in each of the three stages.

Various criteria which parties consider in timber choice emerged during the interviews and from related studies (Kozak and Cohen 1996 & Construction Marketing Network 1997). These form the basis for the extension of the second core element of the material choice model. The objective is to guage the relative importance to speculative residential developers of these criteria in each of the three stages. These two objectives can be combined to extend the study model's application to the speculative residential sector.

Survey Objective 3

To measure the views of speculative residential developers in the Dublin area on the timber frame construction system.

Timber frame construction is an area of residential structural material change that appears from the interview findings to be quite topical amongst industry participants. The interviews highlighted a variety of views on its benefits and likely future performance. The timber frame industry is currently attempting to increase its foothold in the speculative development sector. The repercussions of a significant swing towards the use of this system would have significant influence on the structural material market and thus structural material choice processes. It is therefore useful to provide an illustrative measure of the views of speculative residential developers on this system.

Survey Objective 4

To measure the views of speculative residential developers in the Dublin area regarding Irish structural timber.

Irish structural timber has dramatically increased its share of the domestic construction timber market over the last 10 to 15 years, as discussed in Chapter 2. However, there appear to be mixed views on its relative merits compared to imported softwood. The interviews highlighted the diversity of such views, it was therefore considered beneficial to further examine this aspect of structural material choice as an important modification in structural material choice.

As already mentioned it was decided to carryout a survey of speculative home builders in the Dublin area, which is aimed to be illustrative rather than necessarily representative of speculative developers as a whole. There follows a discussion of the mechanics of the survey process as adopted in this phase of the study.

6.2 Survey Sample Selection

It is important to describe the procedures involved in the preparation and execution of a survey in order to increase confidence in its reliability. Tull and Hawkins (1990:465) suggest seven steps to be followed in the sample selection process, which is a crucial part

of the preparatory stages of survey execution. These steps are: population definition; sampling frame specification; sampling unit specification; sampling method specification; sample size determination; sampling plan specification; and sample selection. (Tull and Hawkins 1990:465). Each of these steps is discussed below in the context of this survey.

6.2.1 Step 1: Population Definition

The population refers to the group of people or objects which are similar in one or more ways, and which form the subject of study in a given survey. In this survey the group of interest are speculative residential home-builders in the Dublin area. Home building firms were selected because they are responsible for the production of a large proportion of new housing, particularly in urban areas. No finite listing of all the firms that could be considered as constituents of this group was located. However, the sampling frame described below appears to be the most comprehensive list available. The population can be defined in terms of elements, sampling units, extent and time. In this case the Managing Directors (element), of home building firms (sampling unit), in the Dublin area (extent), at the time of the survey (time) - August / September 1997- constitute the population.

6.2.2 Step 2: Sampling Frame

In selecting a sampling frame the researcher must recognise the scale and limitations of the population chosen. The comprehensiveness of this population must be defined. It is difficult in practice to give an equal chance of access to all the individuals included in a population. In many cases it may not be possible to compile a comprehensive list of potential candidates for inclusion in a sample frame. For this reason it may be necessary to limit the scope of the frame due to time, monetary, or geographic constraints.

The membership list of the Dublin branch of the Irish Home Builders Association was used. Dublin was chosen as the *extent* of the survey population because the list of Home Builders provided by the Irish Home Builders Association (IHBA) was specific to Dublin. The Executive of the Irish Home Builders Association who supplied the list expressed the view that it is reasonably representative of Home Builders in the Dublin area. The Dublin area is interesting because it accounts for a substantial proportion of

total new housing construction in Ireland (see Chapter 1). The *time* of the survey was August - September 1997, the list was based at the 21st of July 1997.

The list consisted of 530 member firms at the end of July 1997. This is more than double the membership at July 1996, which stood at 222 firms. The IHBA Executive expressed the view that the Association represents the vast majority of home-builders in the Dublin area. Most home-building firms are members of the IHBA in order to avail of the various services and expertise the IHBA can offer. These services include the National House Builders Guarantee Scheme (NHGBS). The IHBA is part of the Construction Industry Federation (CIF). It is increasingly important that new dwellings are covered under the NHBGS, which offers cover for period of ten years against structural failure to purchasers of new residential units.

The IHBA list certainly represents the most comprehensive and tightly targeted sampling frame that the researcher could locate. The Kompass Directories merely list firms under the broad category of building, consisting of both residential and non-residential builders, contractors, and even some surveyors and estate agents. The Golden Pages have no separate category for home builders or developers and most of the listings under "building general contractors" are not involved specifically in home building. The IHBA membership list is not available to the general public and was furnished to the researcher by an Executive of the Irish Home Builders Association, for the sole purposes of this research. The researcher was informed that many of the firms listed were very small operations, perhaps building one or two houses a year. The list does not include contact names within the individual firms, but contact addresses are included for each listing and the telephone numbers are included for 186 of them.

6.2.3 Step 3: Sampling Unit Specification

The sampling unit is the basic unit containing the elements of the population to be sampled (Tull and Hawkins, 1990:469). In some cases the sampling unit can be the same as the element (Malhotra, 1993). However, in this case the sampling unit comprises the individual home building firms on the Irish Home Builders Association membership list, whilst the element is the Managing Director thereof. It was decided to use the Managing Director as the *element* in this survey because company size and structure varies amongst development firms. However, one common factor which is likely to exist in each

company is the existence of a Managing Director. The Managing Director should have a good overall view of the entire development process, particularly in the smaller firms. Other potential contact points such as quantity surveyors, contracts mangers or purchasing managers may or may not exist within firms and may have quite a limited knowledge of the overall development process.

6.2.4 Step 4: Sampling Method Specification

A number of factors must be considered in the specification of the sampling method. Firstly, is probability or non-probability sampling used? It is difficult to design a sampling method which is purely probability or random, as each element of the population must be included in the sample frame and must have a calculable non-zero chance of selection (Williams, 1997). Within the confines of the sampling frame discussed above probability sampling was used, once some cleaning of the list was undertaken as described in later sections. Secondly, is single unit or cluster sampling used? In this survey individual firms were selected singly. Thirdly, is stratified or unstratified sampling used? There was insufficient information on the individual firms on the IHBA list to facilitate stratification. Finally, is single or multiple stage sampling used? In this survey a single stage approach was used.

6.2.5 Step 5: Sample Size Determination

In consumer surveys it is relatively common to have a sample of 5% or less (Czaja and Blair, 1995), however due to the relatively small sample frame used in this study (530 IHBA Dublin area member firms), a considerably higher proportion of the population could be covered. A census of the 530 firms was considered initially, however, due to administration costs and time considerations it was decided that 200 questionnaires would be the maximum number feasible, representing around 37% of the sample frame. 32 firms were deleted from the list due to replication of addresses as it was felt likely that such firms would have the same Managing Director. This reduced the sample frame to 498 firms, which increased the final sample size to around 40%. Table 6.1 details the sample sizes used in a number of other organisational and industrial behaviour studies. The sample size in most of these studies was smaller than the sample used in this study, however most got higher response rates than was envisaged or achieved in this survey. The only lower response rate was achieved by Bellizzi (1979), who also carried out research on the construction industry.

Authors	Survey method	Year	Subject	Respondents	Sample Size	Response
Bellizzi, J.A.	Mail	1979	Buyclass in Commercial Construction	General Construction Contractors	650	140
Martilla, J. A.	Mail	1971	Product Adoption	Paper Converters	106	n/a
Evans, R. A.	Mail and phone	1981	Product Involvement in Industrial Purchases	Purchasing Mgt. Assoc. Members	94	63
Webster, C.	Mail	1993	Buyer Involvement	Industrial Buyers	129	c. 100
Tanner, J. F.	Phone + Mail	1996	Buyer Perceptions of Purchase Process	Photocopier Buyers	118	101

Table 6.1 Comparable Industrial Surveys.

6.2.6 Step 6: Sampling Plan Specification

This stage involves the determination of the operational procedures for sampling unit selection, it is basically planning for potential problems. The primary step taken at this stage was the cleaning of the IHBA membership list of any firms with the same address as earlier companies on the list, as already discussed. Three other firms were also excluded as they were used in the pretesting procedure as outlined later in this chapter. The final number of firms from which the sample could be drawn was 495. The sample selection procedure is discussed below.

6.2.7 Step 7: Sample Selection

The selection of the actual sample elements involved the selection of the survey sample from the cleaned IHBA membership list. In order to reach the target sample size of 200 member firms from the 495 remaining firms the researcher alternated between selecting every second and third unit on the list (i.e. 2,5,7,10,12,15...). The last two units were selected from the remaining list on the basis of numbers randomly selected by associates of the researcher between 1 and 495. The 200 selected firms were all included in the sample and received the home-builder survey.

At this stage a database on Microsoft Access of the names and addresses of the sample firms was set up. Each firm was given a reference number. This reference number was then incorporated into the return address on the stamped addressed return envelopes, in order to identify the respondents so as follow-up procedures could be targeted solely at non-respondents. Mail Merge was then used to personalise the cover letters, print the outgoing address labels and insert the individual reference numbers on the return address labels.

6.3 Survey Method Selection

The primary alternatives in terms of survey methods are mail, telephone, fax, e-mail and face-to-face. The relative advantages and disadvantages of each method are discussed in most market research texts (e.g. Malhotra, 1996 & Tull and Hawkins, 1990). A mail survey was found to be the most appropriate method to fulfil the requirements of this phase of the study, as discussed below.

Whilst telephone surveying was considered, it was found during early attempts to contact various interviewees and industry sources, that mail was more effective, a point reiterated by Hague:- *"A strong argument in favour of telephone interviewing in business-to-business market research is that virtually anyone targeted for interview will be on the phone. The only exception is the construction industry, where building sites are either not on the phone or difficult to trace"* (Hague, 1993:48). Mobile phones are relatively widespread in the industry, however no individual contact names or directory of mobile numbers was available.

The Irish Home Builders Association membership list did not include fax numbers and it had been found through the pretests that the clarity of the survey was significantly reduced through this medium. Again there is no comprehensive list of e-mail addresses available for home builders and it is unlikely that a large proportion have e-mail access. Face-to-face surveys are expensive to administer, in addition to being difficult and time consuming to arrange and execute. The difficulty encountered in arranging the personal interviews with construction industry participants in the development specific phase was already mentioned. It is reasonable to assume that the same difficulty would be encountered in trying to arrange any large number of interviews.

Mail surveys offer advantages in terms of:- cost; accessibility to a wide population; ability to present visual aids (e.g. tabular format of questions, or graphics etc.); guaranteed uniformity of question layout, wording and sequence (thus reducing interviewer bias); and a reasonable chance of reaching the targeted individual within the subject organisations (the MD of home building firms).

There are also drawbacks to using a mail survey. Most pertinently, the low response rate normally associated with mail surveys. To counteract this problem and so to reduce non-response bias two follow-up stages were included, as described later. Mail surveys lack flexibility in data collection and the timescale involved in data collection is generally longer than with other methods.

The main reasons a mail survey was used were: postal addresses were the only point of contact available for all the sample frame units; the difficulty experienced in contacting construction industry parties by telephone or in person; the length and detailed nature of the questionnaire would have made it difficult to administer either in a face-to-face setting or over the phone; and monetary resource constraints dictated that mail was the most efficient medium.

6.4 Response Rate To Mail Survey

Mail surveys are generally acknowledged as having the lowest response rate when compared to telephone or face-to-face surveys, as they are less personal and easier to ignore. However, mail was the most appropriate mode of survey execution for the reasons outlined above. A concern regarding the response rate anticipated for this survey arose when an Executive of the IHBA informed the researcher that they considered 15% as a good response rate to any communications they send to their own members. Tull and Hawkins (1990) suggest a number of ways to reduce non-responses and thus answering some of the questions about the validity of a survey. These include measures aimed at increasing the respondents' motivation to reply such as:- composing a questionnaire and letter which grabs and maintains the respondents' interest; offering an incentive to reply - be it monetary or otherwise; and making a number of attempts to convert non-responses into responses. (Tull & Hawkins, 1990 McDaniel & Gates, 1996 & Malhotra, 1996).

Numerous articles have been written on the effectiveness of various measures aimed at increasing response rates in consumer surveys. However, the research is more limited in regard to industrial surveys. It should be noted that significant differences have been found in the effectiveness of different techniques aimed at improving response rate between commercial and consumer surveys (Faria and Dickinson, 1992 Paxson, 1992 & Chawla et al., 1992). A considerable number of factors have been examined in relation to their influence on response rates such as monetary incentives, charitable donations, follow-up mailings, sweepstakes draws, pre-notification by telephone or mail and offers of anonymity. Yet there is contradictory evidence on the effectiveness of all these techniques (Faria and Dickinson, 1992). The four most important factors in increasing response rates in surveys of the general population have been found to be saliency, sponsorship, follow up contacts and incentives (Paxton, 1992).

Saliency is the degree of applicability or relevancy that the survey has to the target population. The more relevant and interesting it is, the more likely it is to achieve a high response rate. It can be difficult to increase the core saliency of a particular topic in the survey. However, various measures can be taken to enhance the saliency of a survey including improved questionnaire and cover letter design, layout and appearance (Tull and Hawkins, 1990 & Paxton, 1992). The questionnaire format used in this survey incorporates a number of design elements to improve what is a relatively complex instrument. Firstly, the researcher developed a number of matrix or tabular formatted questions, rather than using multiple boxes, in order to make the questionnaire more respondent friendly. Secondly, the cover page of the questionnaire included a picture of a builder examining drawings and was titled Home Builder Survey, in order to ensure the participants were aware of the specific relevance of the questionnaire to them. Thirdly, the letter emphasised the importance of their participation in the study and the fact that their co-operation would help in the development of construction industry theory.

It has been found in various studies that the involvement of a University ***sponsor,*** as opposed to a commercial sponsor, yields higher and faster response rates (Faria & Dickinson, 1992; Dood et al., 1973 & Hawkins, 1979). Paxton (1992) suggests that this increased response for University sponsored surveys may be due to psychological

indebtedness, or the prestige and legitimacy attached to the University. The survey distributed for this study carried the name of the Institute (Dublin Institute of Technology) prominently on the letter-head and on the covering page. The envelopes were also stamped with the DIT frank so as to reinforce the source of the survey. The DIT is likely to be the most readily associated educational institution within the construction industry. It has long been involved in the training of both tradesmen and professionals for the industry (i.e. architects, construction and property economists, structural, building services and civil engineers, and various tradesmen through the School of Trades).

Follow-up contacts are generally acknowledged as a primary method of increasing response rates. In fact it is considered as a crucial aspect in the reduction of non-response bias, which is the bias caused by potential differences between respondents and non-respondents (Malhotra, 1996 Paxson, 1992 & Chawla et. al, 1992). Dillman (1978) proposed a framework called 'The Total Design Method' for maximising mail survey response rates. He recommends the use of a personalised cover letter, which should be attractively designed and be signed by the researcher in ball point pen, a simple to fill out questionnaire and at least two follow up contacts. The researcher decided to do two follow up stages as permitted within the research budget and time-frame. These steps are examined in greater detail at the end of this chapter.

Incentives can have varying success rates when used in conjunction with surveys. It has been shown that monetary incentives are not nearly as effective in industrial surveys as they are in consumer surveys (Paolillo & Lorenzi, 1984 & Faria and Dickinson, 1992). The incentive which was used in this study was the offer of a summary copy of the research findings to the respondents, upon request. While there is some doubt over the effectiveness of this strategy (Kerin et al., 1981), it was more feasible than a charitable contribution or a monetary or sweepstakes type incentive, due to cost constraints.

6.5 Questionnaire Content

The questionnaire, as enclosed in Appendix D, comprises of six main sections, each of which comprise a number of related questions. The main areas of investigation include: participation in timber choice processes, criteria involved in the three stages of timber

choice, organisational details including the degree of out-sourcing of work, and views on timber frame construction and Irish timber.

6.5.1 Section 1: In-House or Out-Sourced

The increasing use of out-sourced expertise and labour in construction has been a growing feature of the industry over recent decades. Many development firms and building contractors only directly employ a skeleton staff for managerial and administrative purposes. Most of the design and construction functions are contracted out to specialist firms. The greater the level of out-sourcing, the more external participation that is likely to come into play in material choice processes. This is particularly the case where works are contracted out on a labour and materials basis, as opposed to on a labour only basis. Section 1 lists the main services and trades involved in construction and asks the respondents to identify which are undertaken on an in-house basis and which are out-sourced. With the out-sourced trades the respondents are further asked to specify whether labour only, or labour and materials contracting is used. The services specified are architectural, quantity surveying, engineering and site management. The trades specified are carpentry, blocklaying, roofing, ground work, site labour, plumbing, plastering and electrical.

6.5.2 Definitions

On the first page of the questionnaire, just under Section 1, a number of definitions are included in order to provide a uniform basis for understanding certain terms used in the latter sections of the questionnaire. These definitions include the terms 'structural materials', 'structural timber', 'material selection', 'timber specification' and 'timber supplier selection'. The definition of these terms is considered important, as it is important that all respondents work on the same definitions and it assists in establishing the relevance of the survey to the industry.

6.5.3 Section 2: Participation in Timber Choice.

Section 2 asks the respondents to identify the parties who are influencers, involved in and deciders, in the three stages of structural timber choice processes. The first stage is the selection of structural materials, which is the broad choice between timber, steel, masonry and concrete. The second stage is the specification of structural timber, which is subdivided into four separate decisions:- the choice between softwood or hardwood; the

specification of timber standards and dimensions such as stress grading, strength class and SR11; the choice of type and species of timber (white or red deal / spruce or pine); and fourthly the decision to use Irish or imported timber. Finally, the selection of structural timber supplier stage was included. The ten categories of parties who may participate in these stages emerged from the industry interviews and the researcher's own knowledge of the industry.

6.5.4 Section 3: Timber Choice Criteria

The third section of the questionnaire involves rating the importance of various criteria as they feature in three structural timber choice stages. The first stage, material selection lists ten different criteria, ranging from appearance to cost considerations and the respondents are asked to state whether each criteria is very important, important, neither important nor unimportant, unimportant, or very unimportant. In relation to structural timber specification, seven criteria are listed and the same number for structural timber supplier selection. In all three stages a separate box is left at the end titled 'other', where respondents were offered the opportunity to specify other criteria that may feature in their decisions. These criteria emerged from the interviews and from two related material choice studies (Kozak and Cohen, 1996 & Construction Marketing Network, 1997).

6.5.5 Section 4: Views on Timber Frame

The fourth section of the questionnaire focuses on the respondents' experience of and views on timber frame construction. They are asked to compare timber frame construction to traditional 'bricks and mortar' construction, using a 'better than, same as, worse than' rating scale, on four different plains:- construction cost, speed of construction, saleability, and buildability. Timber frame construction is growing in terms of market share according to the suppliers of timber frame housing and many other industry sources. Its future in Irish construction will have a major impact on the shape of the structural material market. For this reason the respondents' views are sought as to whether timber frame's market share will grow, stagnate, or decline.

6.5.6 Section 5: Views on Irish Timber

The views and experience of respondents on the use of Irish timber are sought in this section. They again are asked to use a 'better than, same as, worse than' rating scale to compare Irish structural timber to imported structural timber on the following

parameters:- structural integrity, kiln drying, consistency of quality, price, availability, load bearing capacity and product appearance. For many years a number of questions have hung over the quality and consistency of Irish structural softwood. These doubts surfaced in a number of the interviews and as such the area warranted further investigation in this phase of the study.

6.5.7 Section 6: Organisational Details

This final section of the questionnaire seeks information on the respondent firms and their primary activities. It endeavours to discover whether firms are primarily involved in residential or non-residential construction, private or social development, houses or apartments, large, medium or small scale developments and upper, middle or lower end of market. These details are important in the identification of different segments of the residential construction industry, which facilitates the use of cross tabulation of results in the survey analysis.

6.6 Pilot Testing and Pretesting

Pretesting and pilot testing are crucial parts of any survey, involving the development and refinement of questions and the execution of trial runs to test and refine the entire process. The more stringent the pretesting procedure adopted the less likely that mistakes will be made during the final survey process. It is vital that the questionnaire undergoes a rigorous testing and development process, in order to remove any ambiguity from the questions and to ensure that it is easily and uniformly understood by the selected population.

The pretesting procedure for this survey initially involved consultation with various academics and fellow researchers in order to iron-out the structural difficulties with the questionnaire format. This stage resulted in certain changes in the rating systems used and minor formatting alterations. The second stage was a pilot test which involved the mailing of four questionnaires and the faxing of a further two to industry sources. Three of whom were developers, one an architect/academic, another a quantity surveyor and finally a timber industry consultant. It is acknowledged that this is not strictly a pilot test in so far as only half of these trial surveys were sent to the target population of home-builders. However, this combination of developers, academics and industry experts

helped to identify the areas of potential difficulty in the questionnaire, while getting a broader view on the terminology used and general layout.

Each of the pilot test participants were asked to fill-out the questionnaire and then phone the researcher with any comments they might have and to return the completed questionnaire. This process resulted in various changes, where ambiguities appeared in their understanding of the questions themselves or the completion instructions. One question relating to the seniority of the individuals involved in each development stage caused immense problems in terms of uniformity of understanding. Difficulties also arose in the development of a suitable scaling system which could account for the various organisational structures involved in the development process. It was decided after much consideration to drop this question, as its revision and inclusion would have involved a large expansion in the space required with in the actual questionnaire and the time required from respondents to complete it. The ability of an instrument to gather certain information and the willingness of participants to complete the survey must be considered.

The time which the pretest respondents reported for filling out and commenting on the questionnaire ranged from 15 minutes to 40 minutes. It was estimated that the average time needed for the revised questionnaire should be around 20 minutes, as the respondents were not requested to comment on the format and one of the original tabular questions was eliminated. Its exclusion resulted in the opportunity to slightly expand the sections on timber frame housing and Irish timber. The results of the pilot questionnaires were coded and entered into SPSS, the computer statistics package, in order to assess how analysable the data would be. Again this process resulted in minor alteration to the scaling systems used in two of the questions.

6.7 Covering Letter

The covering letter was brief (one page), inviting the respondents to participate in the study by completing the survey. It explained the purpose of the study and offered confidentiality to respondents. The incentive offered to participants was a copy of the summary findings of the study, upon request. A sample copy of the letter is included in Appendix D.

6.8 Mailing and Follow-Up Procedures

The initial mailing of 200 questionnaires took place in mid-August 1997. It included the questionnaire, a stamped addressed return envelope and a covering letter. It was addressed to the Managing Directors of the selected firms. 20 usable responses were received by the end of the first week. The second stage was a phone call to the firms' offices a week after the questionnaires were mailed, to remind the respondents of the questionnaire and to request their co-operation in the study. Where possible the researcher sought the name of the Managing Director in order to personalise the second mailing stage. A number of firms had no phone numbers listed either in the IHBA membership list or the telephone directory. In these circumstances the second stage was omitted. The third stage involved mailing a similar package to that used in the first stage, with minor changes to the cover letter requesting their participation. This package which was mailed three weeks after the first one, was personalised where possible and was only sent to those firms which had not already replied. The researcher coded the return envelopes in the first mailing in order to avoid recontacting existing respondents in the subsequent stages. The total number of usable responses was 47 or 23.5%, a further 18 were returned unanswered (14) or insufficiently answered (4).

6.9 Conclusions

This chapter has outlined the mechanics of the mail survey, which constitutes the less dominant phase of the primary research. The survey of Dublin based speculative home builders, who are members of the Irish Home Builders Association aims to be illustrative rather than necessarily representative of views of speculative residential developers. Whilst the response rate was relatively low, the 47 responses nonetheless constitute almost 9% of the total number of firms included in the Irish Home Builders Association's Dublin area membership list. This chapter follows on from the development specific interview findings in Chapter 5 and lays the groundwork for the home builder survey findings which builds on and extends the interview findings. The results of the collated data from the survey are presented in the following chapter, and the final chapter draws the two phases together in the form of conclusions and recommendations.

CHAPTER 7

HOME-BUILDER SURVEY FINDINGS

Chapter 7: Home-Builder Survey Findings

7.0 Introduction

This chapter presents the findings of the less-dominant phase of the primary research programme as introduced in Chapter 4 and developed in Chapter 6. The aim and objectives of this phase of the research are to extend the objectives and build upon the findings of the dominant interview phase (Chapter 5). It is an extension of the development-specific interviews, as it provides a broader picture of various aspects of structural timber choice processes in speculative residential construction in the Dublin area. The concentration of this survey phase narrows from that of the interview phase on two main fronts. Firstly, the focus switches from the overall residential construction industry to the speculative residential construction sector in the Dublin area. Secondly, senior management of speculative development firms are targeted, whereas the dominant qualitative interview phase aimed to gather a cross-section of designer and client views.

This chapter builds on the participatory dimension by providing a ranking of each of the three participation levels in each of the three framework stages of structural timber choice processes, as envisaged in Survey-Objective 1. Secondly, it extends the investigation of structural timber choice criteria by providing a relative importance ranking of criteria in each of the three framework stages, as proposed in Survey-Objective 2. Structural timber choice criteria, as they emerged from the interviews and previous related studies (Kozak and Cohen, 1996 & Construction Marketing Network, 1997), form the basis of this third section of this chapter. These participatory and criteria findings are presented in an adapted form of study model, through its application to the speculative residential development sector in the Dublin area. A diverse range of views were discovered and highlighted in relation to the use of both timber frame construction and Irish timber, through the interview process, as indicated through the inclusion of Survey-Objectives 3 and 4. The survey offers the opportunity to develop a clearer picture of the extent to which the targeted group of speculative residential developers in the Dublin area hold such views. Whilst references to the interview findings are

made throughout this chapter the conclusions and recommendations chapter (Chapter 8) effectively ties the various strands of this study together.

7.1 Survey Details, Limitations and Management

The questionnaire (Appendix D) was mailed to the Managing Directors of 200 member firms of the Irish Home Builders Association in the Dublin area, in mid-August 1997. Forty seven usable responses were received, equating to a twenty three and a half percent usable response rate. The total number of returned questionnaires, including unanswered (14) and unusable (4) responses, was 65 or 32.5%. Due to the small sample size and limited number of responses, all statistics used include both numeric and percentage values. The small sample size and the concentration on IHBA member firms in the Dublin area, should each be recognised as limitations of this survey of speculative residential developers. While the survey was ready for distribution in late July, it was decided to hold off mailing until mid-August, as the building industry traditionally takes the first two weeks of August as holidays and it would have been pointless sending a questionnaire during that period.

Once the questionnaires were returned the data cleaning process was commenced. It was decided to omit four returned questionnaires as respondents failed to complete substantial sections, or made serious errors in the completion procedures, thus rendering them unusable. The usable responses were all numbered and dated in order to aid sorting and editing. A data coding system was developed to numerically represent all the data collected, for entry into a statistical processing package – Statistical Package for the Social Sciences (SPSS). This package was used to provide the accumulated statistical information required for the analysis. These statistics are all presented in tabular form and the most pertinent aspects are discussed in the remainder of this chapter.

7.1.1 Response Bias

A concern that should be addressed in regard to all quantitative surveys is the issue of response bias. Particular attention needs to be paid to the possibility that the respondents differ in some way from non-respondents and thus that the results may be biased by the

omission or under-representation of some segment of the survey population. It is difficult to assess how representative the respondents to this survey are of the target population – speculative residential developers in the Dublin area. The Irish House Builders Association keep no record of member firm characteristics, and there are no published statistics available on the number of speculative residential firms in Dublin, or indeed in Ireland generally. Therefore, there is no base to compare the characteristics of respondents to non-respondents. It has been recognised that two primary method of addressing concerns about response bias are firstly, to achieve as high an initial response rate as possible and secondly, to convert initial non-respondents into responses (Faria and Dickinson, 1992). As already discussed in the previous chapter, steps were taken to increase the initial response rate, including the development of an appealing cover sheet for the survey, individually signed letters, and the use of the DIT franked envelopes. The follow up procedures aimed at converting initial non-respondents to respondents included reminder phone call and a second mailing of the survey to non-respondents. Nonetheless, it is acknowledged that the survey findings are more illustrative than necessarily representative of the Dublin based speculative developers. Due to the relatively small number of responses all results are presented in both percentage and numeric terms. It has it has been recommended that when less 100 responses are being analysed, the number of respondents should be stated along with percentage values (Brannick, 1997).

7.2 Respondent Firm Details

In order to establish an overview of the respondent firms, Sections 1 and 6 of the questionnaire seek details of the respondent firms' structure and core operations. Section 1 ascertains the breakdown of in-house and out-sourced labour, trade and professional services in home building firms. Table 7.1 illustrates the results of this section, showing the breakdown of in-house and out-sourced on a numeric and percentage basis for each of eight trades and four professions. The out-sourced trades are further divided into labour-only-contracting and labour and materials contracting.

All the trades examined were largely out-sourced, however a considerable difference emerged between the types of contractors used across the different trades. Both carpentry (37/79%) and blocklaying (39/83%) were dominated by labour-only-contracting, while the electrical (46/98%) and plumbing (43/91%) trades showed a predominance towards labour and materials contracting. Almost three-quarters (35/75%) of the firms provided site labour on an in-house basis. One firm (2%) used a mix of in-house and contracted for carpentry, block-laying, roofing and ground works. All of the firms used the services of architects, however, only 6% (3) had in-house architects. Engineering services were also primarily procured externally, with only 11% (5) in-house engineers and 4% (2) of firms not using the services of engineers. 8% (4) indicated that they do not use quantity surveyors, however, they represent the dominant design professionals on an in-house basis, with 47% (22) of firms directly employing them. Site management is contracted out by only one (2%) of the respondent firms.

	In-House	Sourced Externally Contracted	Labour Only Contracted	Labour and Materials Contracted	Mixed In-House and Contracted	Not Used
Carpentry	7 (14.9%)	40 (85.1%)	37 (78.7%)	2 (4.3%)	1 (2.1%)	
Block-laying	1 (2.1%)	46 (97.9%)	39 (83%)	3 (6.4%)	1 (2.1%)	
Roofing	1 (2.1%)	46 (97.9%)	20 (42.6%)	25 (53.2%)	1 (2.1%)	
Ground Work	9 (19.1%)	38 (80.9%)	28 (59.6%)	9 (19.1%)	1 (2.1%)	
Site Labour	35 (74.5%)	12 (25.5%)	7 (14.9%)	5 (10.6%)	0	
Plumbing	0	47 (100%)	4 (8.5%)	43 (91.5%)	0	
Plastering	1 (2.1%)	46 (97.9%)	17 (36.2%)	29 (61.7%)	0	
Electrical	0	47 (100%)	1 (2.1%)	46 (97.9%)	0	
Quantity Surveying	22 (46.8%)	21 (44.7%)				4 (8.5%)
Architectural	3 (6.4%)	44 (93.6%)				0
Engineering	5 (10.6%)	40 (85.1%)				2 (4.3%)
Site Management	46 (97.9%)	1 (2.1%)				0

Table 7.1 Breakdown of Professional and Trade Services in Home Building Firms

Section 6 of the questionnaire seeks operational data on the respondent firms. Of the 47 respondent firms the majority were primarily involved in house building (33/70%), with a further 19% (9) involved in both house and apartment building and the remaining 11% (5) primarily involved in apartment building. Only one (2%) of the respondent firms was involved in the construction of social housing, with the remaining 46 (98%) building private residential developments. 47% (22) of the respondent firms indicated that their developments normally exceed 50 dwellings, 36% (17) professed to being primarily involved in developments of between 11 and 50 houses and only 17% (8) indicated that primary involvement in developments of 10 dwellings or less. The majority (28/60%) of respondents develop houses aimed at the mid-market (£80,000-150,000), with 25% (12) in the upper end (over £150,000) and only 15% (7) in the lower end of the market (below £80,000). Due to the use of Dublin home-builders as the sample frame it is not surprising that 83% (39) of the respondent firms were only involved in development in Dublin and the surrounding counties, 14.9% (7) in developments nation-wide and only 1 (2.1%) in development on an international front. The respondent firms varied in terms of numbers of direct employees, from 70 employees to 1 man operations, the most common number of employees per firm or modal value was 3 employees, accounting for 8 (17%) of the 47 firms. The average number of employees per firm was 11.96, however, the scale of the largest 7 firms (between 23 and 70 employees) makes this statistic somewhat misleading, as 63.8% (30) of the firms had 8 or less employees.

7.3 Participation in Timber Choice

The three primary stages in structural timber choice - material selection, timber specification and timber supplier selection - which were introduced and used in earlier parts of this study, constitute the core framework for investigating material choice process participation in this survey. The timber specification stage is broken into four separate but related sub-stages. These are: the choice between hardwood and softwood; the specification of timber dimensions and the standards; the selection of timber type and species; and the choice between imported and Irish timber. The respondents were asked to rate the participation levels of nine different development process parties in each of the material choice stages as - influencers, parties involved, or deciders - if any. The full numeric and percentage results are

illustrated in Tables 7.2 to 7.7 and Charts 7.1 to 7.6. The tables show both the numeric and percentage values, while the charts illustrate the percentage values of responses which identified each party in each of the three levels of participation in the individual structural timber choice stages.

The number and percentage of respondents who indicated that any number (between 0 and 8) of the prescribed parties were: influencers, involved in, or deciders, in each of the structural timber choice stages is represented in Table 7.8. Eight was used as the upper limit because this was the maximum number of parties identified by any respondent in any role. The mean or average number of parties identified by respondents in each of these roles is illustrated in the end column of Table 7.8.

The mean number of parties identified in a given role was be calculated using the following formula:

$$\text{MEAN NUMBER OF PARTIES IDENTIFIED AS HAVING X ROLE IN Y DECISION} = \frac{[(R_0 \times N_0) + (R_1 \times N_1) \ldots\ldots (R_7 \times N_7) + (R_8 \times N_8)]}{T}$$

Where:
N = Number of parties (0-8) identified as having X role in Y decision,
R = Number of respondents who identified N number of parties as having X role in Y decision,
T = Total number of respondents (47).

Further, this table shows the combined average number of parties identified as having participated in any of the three levels in each stage. These statistics were calculated by finding the sum of the mean number of parties influencing, involved in and deciding on a given stage ($Y_{1\text{-}6}$). These statistics are presented in bold type in the far right hand column of Table 7.8.

So for example if we examine Table 7.8 it can be seen that 19 respondents (40.4%) indicated that one party influences the material selection stage and 21 respondents (44.7%) indicated that no party fulfilled an influencing role. We can further see that the average number of parties identified by respondents as having influence in the material selection stage was 0.91

parties. From the bold mean figures it is possible to extrapolate that the combined average number of parties identified in any of the three material selection roles is 3.42 parties.

$$\text{MEAN NUMBER OF PARTIES IDENTIFIED AS HAVING INFLUENCER } (X_1) \text{ ROLE IN MATERIAL SELECTION } (Y_1) \text{ STAGE.} = \frac{[(21x0) + (19x1) + (3x2) + (1x3) + (1x4) + (1x5) + (1x6) + (0x7) + (0x8)]}{47}$$

This equates to an average of 0.91 parties on average being identified in the role of influencer in the material selection stage. From Table 7.8 we can further see that 1.32 parties on average were identified as being involved in the selection of structural material and that 1.19 parties on average were decision makers in this regard. So the combined average (mean) number of parties participating in the material selection stage is calculated as the sum of the three averages above, which totals 3.42 parties.

The significance of these statistics lie at the heart of organisational buying theory, as interpreted in this study, which aims to highlight the diversity and complexity involved in organisational buying. They point to the dangers of suppliers viewing a single point of contact within an organisation as sufficient in attempting to influence buying decisions. The fact that respondents identified on average between 2.5 and 3.5 parties as having some role to play in the six timber choice stages strengthens this view.

The combination of development-specific data from the interviews and cumulative statistical data helps to illustrate the varying combination and changing relative participation levels of the various parties during the various stages of structural timber choice processes. A similar approach to that adopted in this survey phase, based on percentages of responses, was used by Banting et al. (1991) to illustrate departmental involvement in six stages of material purchase within the chemical industry.

7.3.1 Structural Material Selection

Structural material selection is defined in the questionnaire as the choice between steel, concrete, masonry and timber, for use in the main structural elements. It is not surprising given the findings of the interviews that senior management of the development firms were identified in the role of decision-makers by 62% (29) of respondents. Engineers (11/23%) and architects (7/15%) were the second and third most important in this regard. Designers

emerged as the main force in terms of both involvement and influence in structural material selection. Architects were the most commonly nominated party as being involved in (17/36%) and influencing (8/17%) material selection. Engineers were also identified by 17% (8) of respondents as being influencers. The least likely party to have a role in material selection were purchasing officers. This may be due to the relatively uncommon occurrence of this specific job title within development firms. Chart 7.1 and Table 7.2 display the full results relating to material selection participation. For example from Table 7.2 we can see that 3 respondents or 6% of the 47 analysed responses, identified development firm senior management as being influencers in the material selection decision. This is represented in Chart 7.1 by the first bar on the left-hand side.

Chart 7.1: Percentage of respondents who identified each party in each of the three participatory roles in the material selection decision.

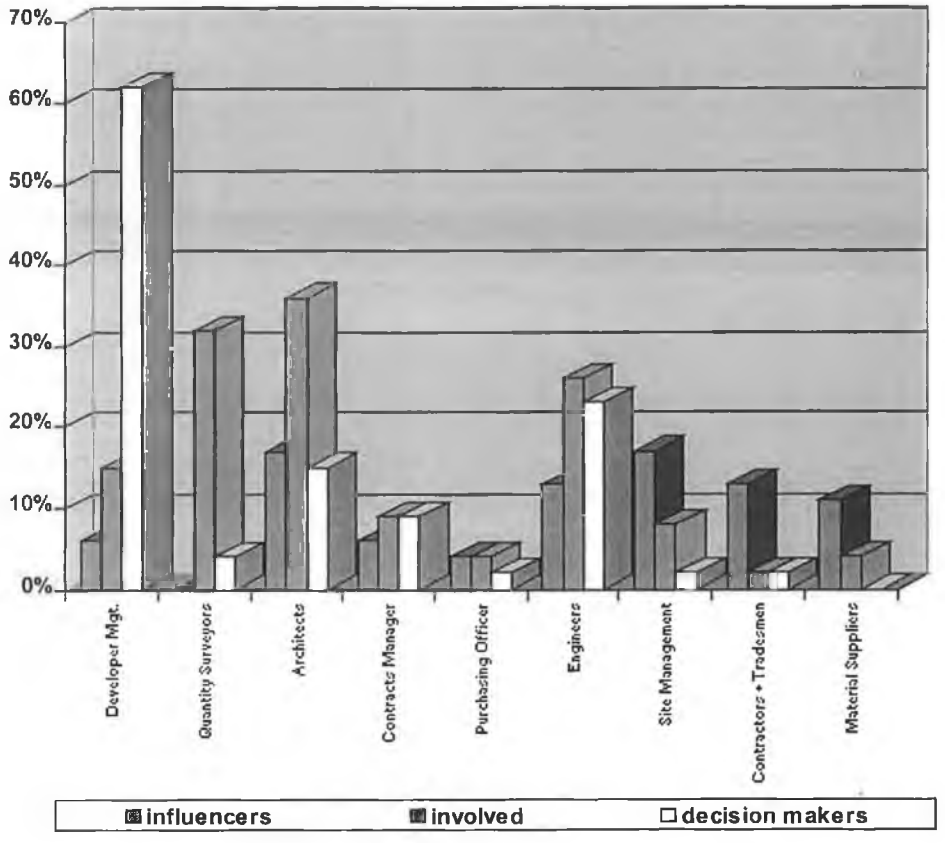


Table 7.2: Statistical Breakdown of Participation in Structural Material Selection

PARTIES	No Part	Influencer	Involved	Decider
Development Firm Mgt.	8 17%	3 6%	7 15%	29 62%
Quantity Surveyors	30 64%	0 0%	15 32%	2 4%
Architects	15 32%	8 17%	17 36%	7 15%
Contracts Manager	36 76%	3 6%	4 9%	4 9%
Purchasing Officer	42 89%	2 4%	2 4%	1 2%
Engineers	18 38%	6 13%	12 26%	11 23%
Site Management	34 72%	8 17%	4 8%	1 2%
Contractors & Tradesmen	39 83%	6 13%	1 2%	1 2%
Material Suppliers	40 85%	5 11%	2 4%	0 0%

NOTE – NO PART REFERS TO THE PROPORTION OF RESPONSES IN WHICH THE PARTIES WERE NOT ATTRIBUTED ANY PARTICIPATORY ROLE IN THE MATERIAL SELECTION STAGE OF THE STRUCTURALTIMBER CHOICE PROCESS

7.3.2 Structural Timber Specification

The specification of structural timber characteristics represents a natural progression from the decision to use timber. This second stage of the study framework aims to identify the parties participating and the level of their participation, in the specification of structural timber in Irish speculative residential construction. Four steps in the timber specification process were included in the questionnaire in order to provide a more comprehensive view of the numerous decisions involved in this stage of timber choice. It is interesting to note that the development firm senior management (developers) rated their own decision making roles at the lowest level of any of the stages examined, in the two most technical steps - timber dimensions / standards specification and timber type / species specification. The designers were identified as having their greatest decision making roles in these two steps, which would largely correspond with the findings of the interview phase.

Structural Hardwood or Softwood Specification

Over half (25 / 53%) of the respondents indicated that development firm senior management are the deciders in regard to the choice between hardwood and softwood structural timber. 32% (15) identified architects as deciders and both engineers and contracts managers emerged in this role in a small number of responses. Architects (13/27%) and engineers (9/19%) were identified as the parties most likely to be involved in this step. As was the case

with all the stages examined the role of influencer yielded a relatively small response in terms of the number of parties identified. In relation to influencing the choice between hardwood and softwood material suppliers (9/19%) and site management (7/15%) were identified as the most likely parties to fulfil this role. Chart 7.2 and Table 7.3 illustrate the complete results of this topic. It is suggested by the researcher that the choice between hardwood and softwood may not be explicitly arise in many development situations The decision to use of timber in most structural elements infers the use of softwood because hardwood is a far more expensive material.

Chart 7.2: Percentage of respondents who identified each party in each of the three participatory roles in softwood /hardwood specification

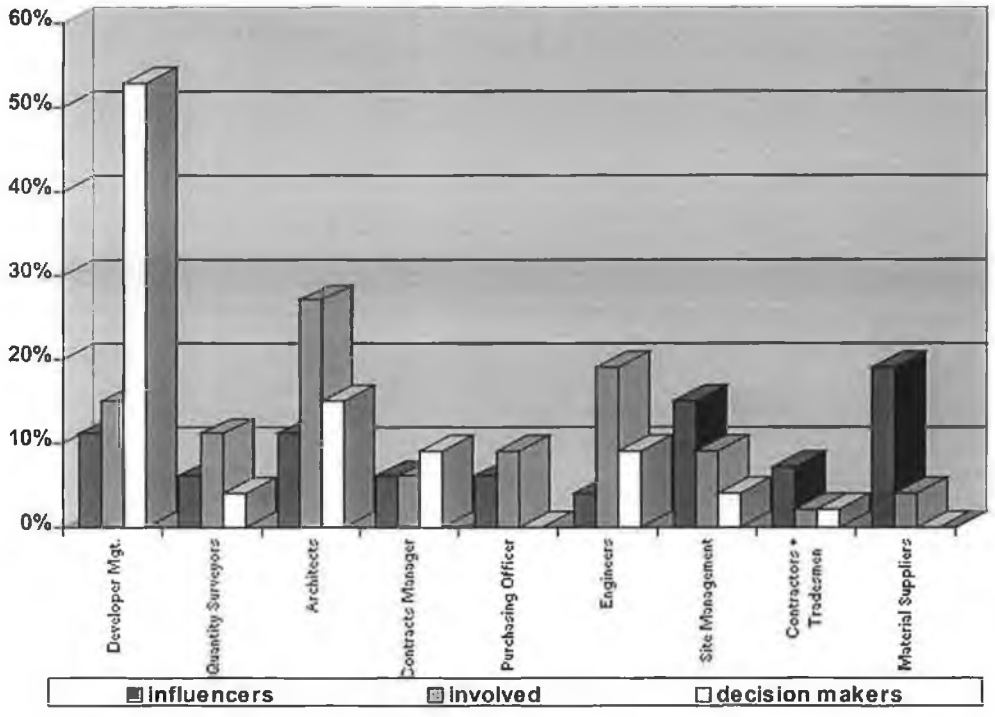


Table 7.3: Statistical Breakdown of Participation in Soft/Hardwood Specification

PARTIES	No Part	Influencer	Involved	Decider
Development Firm Mgt.	10 21%	5 11%	7 15%	25 53%
Quantity Surveyors	37 78%	3 6%	5 11%	2 4%
Architects	14 30%	5 1%	13 27%	15 32%
Contracts Manager	37 79%	3 6%	3 6%	4 9%
Purchasing Officer	40 85%	3 6%	4 9%	0 0%
Engineers	32 68%	2 4%	9 19%	4 9%
Site Management	34 72%	7 15%	4 9%	2 4%
Contractors & Tradesmen	42 89%	3 7%	1 2%	1 2%
Material Suppliers	36 77%	9 19%	2 4%	0 0%

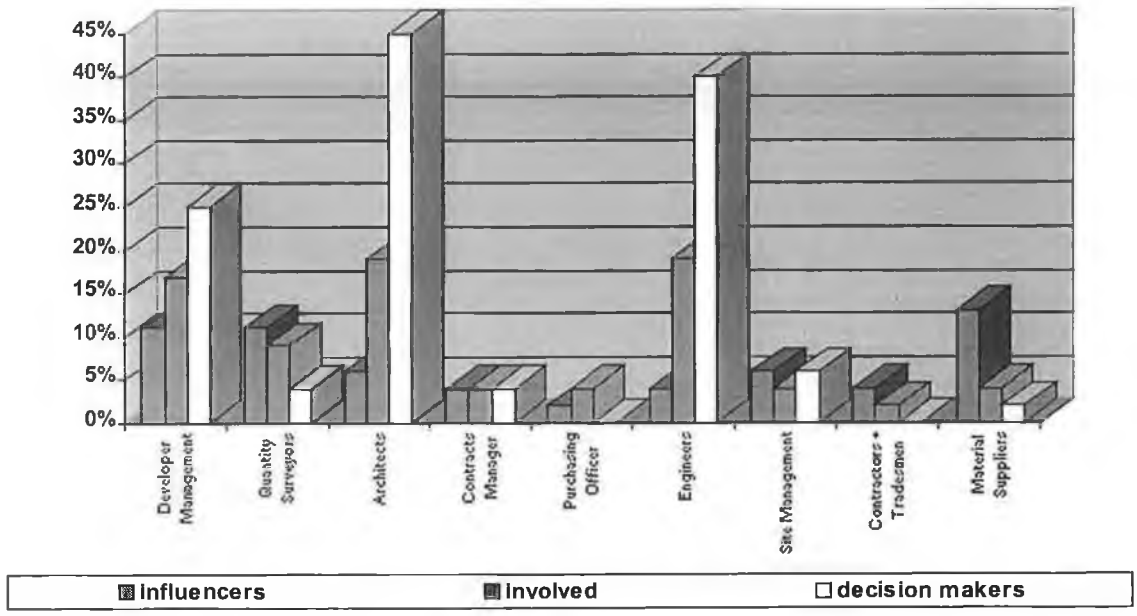
Structural Timber Standards and Dimensions Specification

This is the only specification step in which the respondents, who were all senior management of the development firms (developers), did not classify themselves as the dominant final decision-makers. Architects were identified by 45% (21) and engineers by 40% (19) of respondents as being decision-makers, while only 25% (12) identified themselves (developers). Involvement in the specification of standards and dimensions was attributed to architects and engineers in an equal number of responses (9/19%), while only 8 (17%) respondents identified developers as being involved. Material suppliers and development firm senior management were found to be the most commonly mentioned influencers, with 13% (6) and 11% (5) of respondents identifying them, respectively. Chart 7.3 and Table 7.4 display the complete results in this regard. The job title 'contracts manager', like 'purchasing officer' is unlikely to exist in many smaller firms, which helps to explain their relatively low levels of participation in the various stages discussed. So the 'no part' category in the various tables includes values for parties which may not exist in the context of the individual respondent firms.

Table 7.4: Statistical Breakdown of Participation in Timber Standards and Dimensions Specification

PARTIES	No Part	Influencer	Involved	Decider
Development Firm Mgt.	22 47%	5 11%	8 17%	12 25%
Quantity Surveyors	38 81%	3 6%	4 9%	2 4%
Architects	15 32%	2 4%	9 19%	21 45%
Contracts Manager	42 90%	1 2%	2 4%	2 4%
Purchasing Officer	43 92%	2 4%	2 4%	0 0%
Engineers	17 36%	2 4%	9 19%	19 40%
Site Management	39 83%	3 6%	2 4%	3 6%
Contractors & Tradesmen	44 94%	2 4%	1 2%	0 0%
Material Suppliers	38 81%	6 13%	2 4%	1 2%

Chart 7.3: Percentage of respondents who identified each party in each of the three participatory roles in the specification of structural timber standards and dimensions.



Structural Timber Type / Species Specification

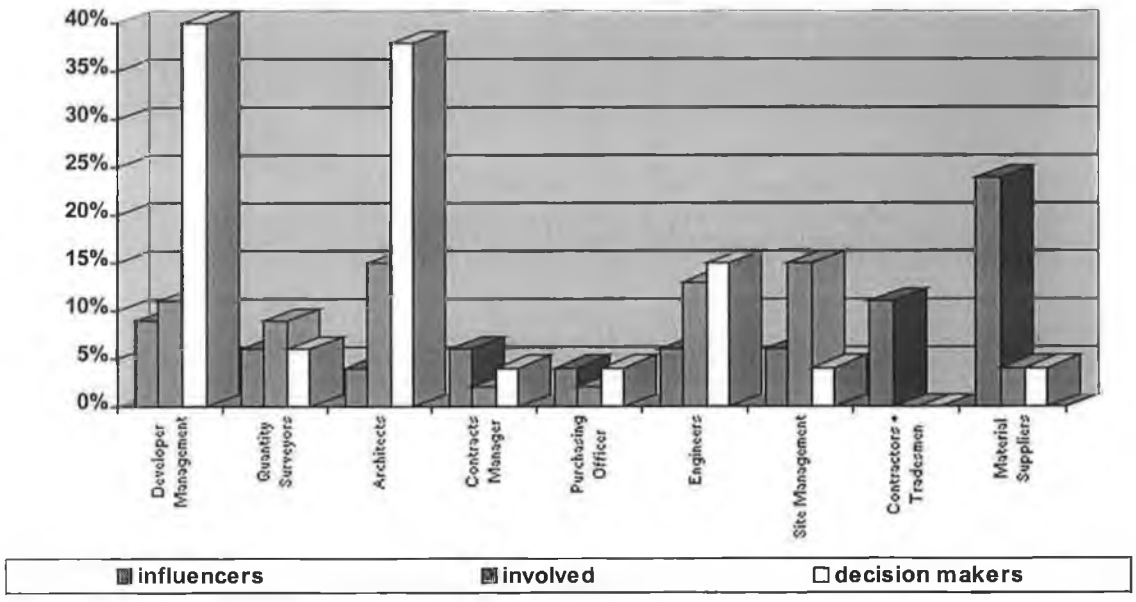
This step relates to the choice between different types or species of structural softwood, such as Red Deal or White Deal and Spruce or Pine. The developers re-emerged as the party with

the largest attributed decision making role in this step, with 40% (19) of respondents identifying themselves in this role. However, this is only marginally greater than the 38% (18) of respondents who identified architects as deciders. Those most commonly identified as being involved in this decision process were site management and architects with 15% (7) each. Material suppliers emerged most often as influencers, as they were identified by 24% (11) of respondents. Contractors and tradesmen were the second most common influencers at 11% (5). Chart 7.4 and Table 7.5 fully illustrate the survey results for this section.

Table 7.5: Statistical Breakdown of Participation Timber Species / Type Selection

PARTIES	No Part	Influencer	Involved	Decider
Development Firm Mgt.	19 40%	4 9%	5 11%	19 40%
Quantity Surveyors	37 79%	3 6%	4 9%	3 6%
Architects	20 43%	2 4%	7 15%	18 38%
Contracts Manager	41 87%	3 6%	1 2%	2 4%
Purchasing Officer	42 90%	2 4%	1 2%	2 4%
Engineers	31 66%	3 6%	6 13%	7 15%
Site Management	35 75%	3 6%	7 15%	2 4%
Contractors & Tradesmen	42 90%	5 11%	2 4%	0 0%
Material Suppliers	32 68%	11 24%	2 4%	2 4%

Chart 7.4: Percentage of respondents who identified each party in each of the three participatory roles in the specification of structural timber type and species.



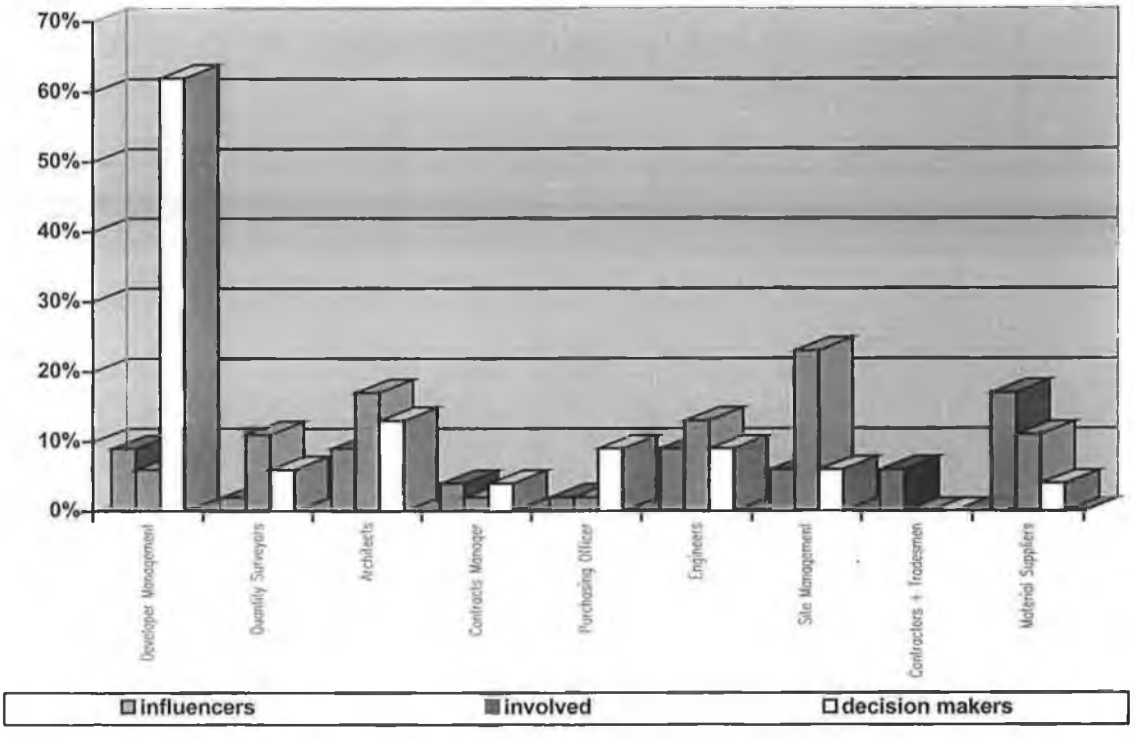
Irish or Imported Timber

Probably the least likely of the four specification steps to be explicitly undertaken during the building design stage is whether Irish or imported timber will be used, which can be witnessed by the low level of designer (architects and engineers) participation in this step. The decision to use Irish or imported timber is made by the developers in the majority of cases (29/62%). Site management were identified by 23% (11), architects 17% (8) and engineers 13% (6), of the respondents as being involved in this decision. Again material suppliers featured as the most common influencers, being identified by 17% (8) of respondents. Chart 7.5 and Table 7.6 present the full details of participation in this step.

Table 7.6: Statistical Breakdown of Participation in Irish/Imported Timber Choice

PARTIES	No Part	Influencer	Involved	Decider
Development Firm Mgt.	11 23%	4 9%	3 6%	29 62%
Quantity Surveyors	38 81%	1 2%	5 11%	3 6%
Architects	29 61%	4 9%	8 17%	6 13%
Contracts Manager	42 90%	2 4%	1 2%	2 4%
Purchasing Officer	41 87%	1 2%	1 2%	4 9%
Engineers	33 69%	4 9%	6 13%	4 9%
Site Management	30 64%	3 6%	11 23%	3 6%
Contractors & Tradesmen	44 94%	3 6%	0 0%	0 0%
Material Suppliers	32 68%	8 17%	2 4%	2 4%

Chart 7.5: Percentage of respondents who identified each party in each of the three participatory roles in the specification of Irish or imported structural timber.



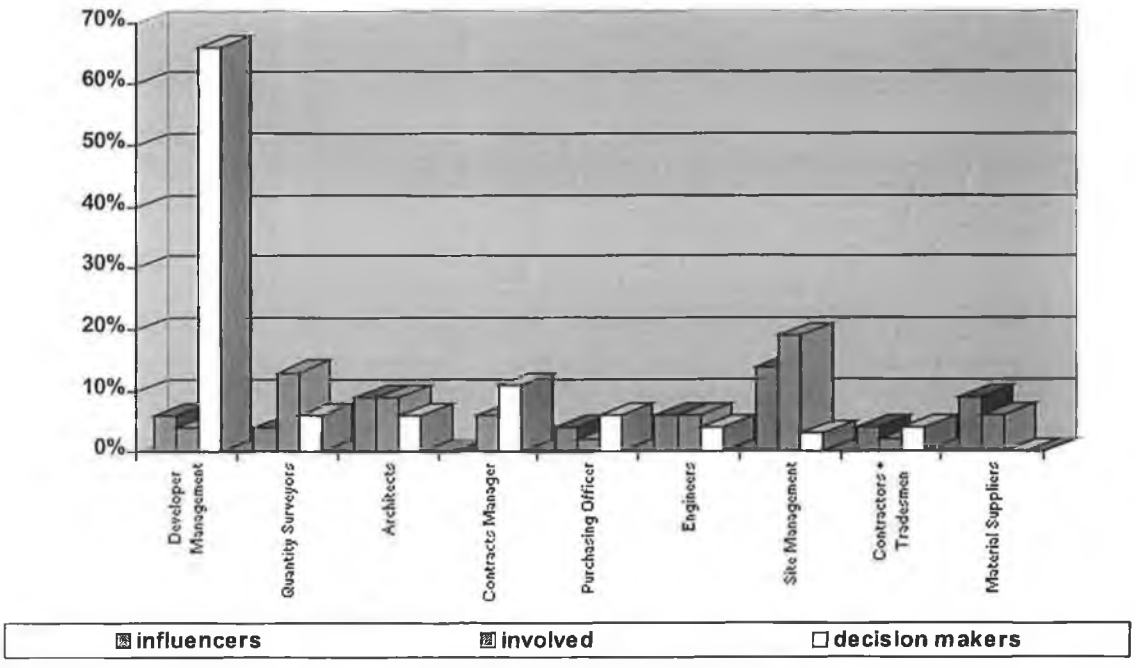
7.3.3 Structural Timber Supplier Selection

Timber supplier selection is the final stage of material choice processes examined in this survey. It concerns the identification of participants in the selection of structural timber suppliers in Irish speculative residential construction. Developers emerged as the decision makers in 66% (31) of the responses, while contracts managers were identified in 11% (5) of responses and quantity surveyors, architects and site management were each mentioned by a mere 3 (6.4%) respondents. Site management marginally led the field in involvement (9/19%) and influencing (6/13%) of structural timber supplier selection. In common with the Irish or imported timber decision, designers were attributed with relatively little participation at this stage. Chart 7.6 and Table 7.7 display the results relating to timber supplier selection participation. Interestingly contractors and tradesmen were identified as participants in this stage in only 10% (5) of responses, while they were identified in 17% (8) of responses as participating in material selection. This appears to be rather strange, considering their involvement in the development process should be increasing as supplier related decisions are made, as these are likely to occur later in the development process, as was indicated by the interview findings. In retrospect the combination of contractors and tradesmen in the one category may have been unwise, as some tradesmen are employed on an in-house basis (Table 7.1) and as such are more likely to have an early input into material selection. The assumption that most contractors in the construction industry are trades based is still reasonable, however, the assumption that tradesmen can all be categorised as contractors is not.

Table 7.7: Statistical Breakdown of Participation in Timber Supplier Selection

PARTIES	No Part	Influencer	Involved	Decider
Development Firm Mgt.	11 23%	3 6%	2 4%	31 66%
Quantity Surveyors	36 77%	2 4%	6 13%	3 6%
Architects	36 77%	4 9%	4 9%	3 6%
Contracts Manager	39 83%	0 0%	3 6%	5 11%
Purchasing Officer	41 87%	2 4%	1 2%	3 6%
Engineers	39 83%	3 6%	3 6%	2 4%
Site Management	29 62%	6 13%	9 19%	3 6%
Contractors & Tradesmen	42 90%	2 4%	1 2%	2 4%
Material Suppliers	40 85%	4 9%	3 6%	0 0%

Chart 7.6: Percentage of respondents who identified each party in each of the three participatory roles in the structural timber supplier selection stage.

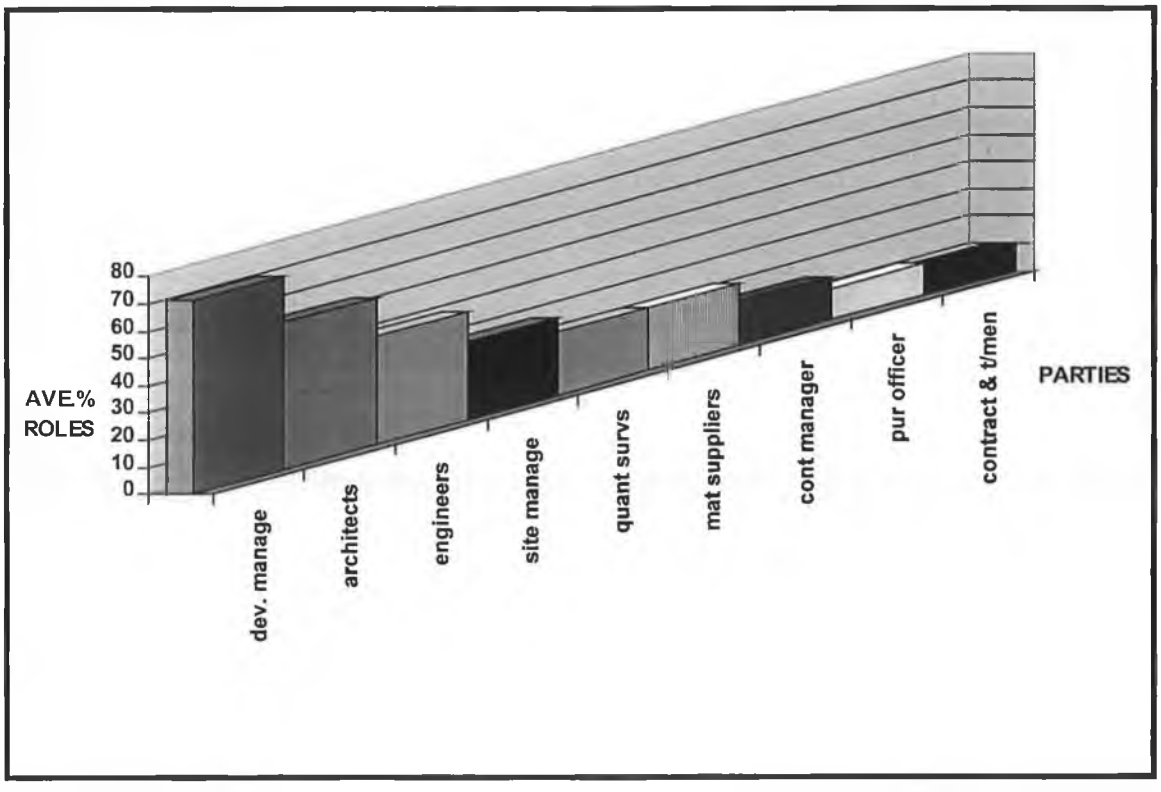


7.3.4 Party Participation

Despite the clear domination of material choice processes attributed by development firm senior management to themselves, in most of the material selection stages investigated a wide range of parties were identified as participating at some level in these processes. None of the stages examined yielded in a total non-participation role for any party listed, as all emerged in at least 6% (3) of the responses, which would indicate that at least some minor role was assumed. From the data displayed in Table 7.8, it is possible to derive a ranking of the frequency of identification of participation of the various parties in the average structural timber choice process, according to the mean number of roles which they were attributed in the survey. Average number of roles attributed to each party across all the decisions were calculated by finding the sum of the number of respondents who identified a given party in each role of each stage. This was divided by the total maximum number of possible identifications (i.e. 18 - three possible levels of involvement in six stages/steps of timber

choice). The average number of roles per decision stage for each of the parties is as follows - development firm senior management 0.715 (or a role in 71.5 % of decisions), architects 0.543, engineers 0.4, site management 0.287, quantity surveyors 0.233, material suppliers 0.227, contracts managers 0.16, purchasing officers 0.117 and contractors and tradesmen 0.102 (or 10.2% of decisions). Chart 7.7 represents the percentage of choice process stages which each party had some participatory role in, be it as decider, involved, or as influencer.

Chart 7.7: Average Participation (Combined Influence, Involvement and Deciding) for Each Party Across all Stages in Structural Timber Choice Processes (%)



7.3.5 Number of Parties Participating In Structural Timber Choice Processes

From the analysis of the data gathered in Section 2 of the questionnaire, it was possible to derive average party participation figures for each stage and step of the processes investigated and to break these into influencers, those involved and deciders. Table 7.8 displays the full data in this regard. It should be noted that this data relates to the number of parties rather than individuals identified.

A number of general observations can be made in regard to the numbers of parties participating at the three different levels. Firstly, the category of influencers yielded the lowest average number of parties in each of the six decision stages and steps examined. Secondly, with the exception of the material selection stage, the average number of deciders outweighed the average number of non-decision making parties involved in the individual decision stages. Thirdly, the initial material selection stage showed the highest average number of participants overall (3.42) and more specifically in relation to influencers (0.91) and those involved (1.32). Overall average participation levels were equally low in relation to the timber supplier selection and the selection of timber type and species (2.49 parties). It is possible that these results may in some part be due to respondent fatigue as they progressed through the questionnaire. However, it is also possible that that the decisions relating to the stages to which the respondents attributed the higher participation averages are the ones they more readily associated with and felt explicitly arose in structural timber choice processes.

Table 7.8: Number of Parties Influencing, Involved and Deciding in Each Choice Stage

Number of Parties	0	1	2	3	4	5	6	7	8	Mean
INFLUENCE MATERIAL SELECTION	21 44.7%	19 40.4%	3 6.4%	1 2.1%	1 2.1%	1 2.1 %	1 2.1%	0 0%	0 0%	0.91
INVOLVEMENT MATERIAL SELECTION	10 21.3%	23 48.9%	6 12.8%	6 12.8%	1 2.1%	0 0%	0 0%	0 0%	1 2.1%	1.32
DECIDER MATERIAL SELECTION	0 0%	39 83%	7 14.9%	1 2.1%	0 0%	0 0%	0 0%	0 0%	0 0%	1.19
										3.42
INFLUENCE SOFTWOOD/HARDWOOD	23 48.9%	17 36.2%	4 8.5%	0 0%	1 2.1%	1 2.1 %	1 2.1%	0 0%	0 0%	0.85
INVOLVEMENT SOFTWOOD/HARDWOOD	13 27.7%	25 53.2%	5 10.6%	4 8.5%	0 0%	0 0%	0 0%	0 0%	0 0%	1.00
DECIDER SOFTWOOD/HARDWOOD	0 0%	40 85.1%	6 12.8%	1 2.1%	0 0%	0 0%	0 0%	0 0%	0 0%	1.17
										3.02
INFLUENCE DIMENSION/STANDARD	29 61.7%	13 27.7%	2 4.3%	2 4.3%	0 0%	0 0%	1 2.1%	0 0%	0 0%	0.62
INVOLVEMENT DIMENSION/STANDARD	23 48.9%	15 31.9%	8 17%	0 0%	0 0%	0 0%	1 2.1%	0 0%	0 0%	0.70
DECIDER DIMENSION/STANDARD	0 0%	38 80.9%	6 12.8%	2 4.3	1 2.1%	0 0%	0 0%	0 0%	0 0%	1.28
										2.6
INFLUENCE TYPE/SPECIES	27 57.4%	13 27.7%	4 8.5%	0 0%	1 2.1%	0 0%	2 4.3%	0 0%	0 0%	0.49
INVOLVEMENT TYPE/SPECIES	23 48.9%	16 34%	5 10.6%	3 6.4%	0 0%	0 0%	0 0%	0 0%	0 0%	0.74
DECIDER TYPE/SPECIES	0 0%	38 80.9%	6 12.8%	3 6.4%	0 0%	0 0%	0 0%	0 0%	0 0%	1.26
										2.49
INFLUENCE IRISH/IMPORTED	29 61.7%	13 27.7%	2 4.3%	0 0%	2 4.3%	1 2.1 %	0 0%	0 0%	0 0%	0.63
INVOLVEMENT IRISH/IMPORT	19 40.4%	22 46.8%	2 4.3%	3 6.4%	1 2.1%	0 0%	0 0%	0 0%	0 0%	0.83
DECIDER IRISH/IMPORTED	0 0%	42 89.4%	4 8.5%	0 0%	1 2.1%	0 0%	0 0%	0 0%	0 0%	1.15
										2.61
INFLUENCE SUPPLIER SELECTION	31 66%	12 25.5%	2 4.3%	0 0%	2 4.3%	0 0%	0 0%	0 0%	0 0%	0.51
INVOLVEMENT SUPPLIER SELECTION	20 42.6%	18 38.3%	6 12.8%	2 4.3%	1 2.1%	0 0%	0 0%	0 0%	0 0%	0.85
DECIDER SUPPLIER SELECTION	0 0%	42 89.4%	4 8.5%	1 2.1%	0 0%	0 0%	0 0%	0 0%	0 0%	1.13
										2.49

MEAN - REFERS TO THE AVERAGE NUMBER OF PARTIES IDENTIFIED IN EACH ROLE IN EACH CHOICE PROCESS STAGE. (COMBINED AVERAGE FOR EACH STAGE IN BOLD TYPE).

Table 7.9: Importance-Rating of Structural Timber Choice Process Criteria

Importance Rating / Criteria / Factors	Very Important +2	Important +1	Neither 0	Unim-portant -1	V.Unim -portant -2	Average Rating (+2to-2)	Ranking Based on AR
Structural Material Selection Criteria							
Standardised Design / Familiarity With Use	25(53.2%)	19(40.4%)	3 (6.4%)	0	0	1.47	5
Building Cost / Return Relationship	34(72.3%)	13(27.7%)	0	0	0	1.72	1
Reliability of Material Availability	32(68.1%)	15(31.9%)	0	0	0	1.68	2
Availability of Tradesmen	29(61.7%)	17(36.2%)	1 (2.1%)	0	0	1.60	3
Appearance / Aesthetic Differentiation	17(36.2%)	21(44.7%)	8 (17%)	1 (2.1%)	0	1.15	8
Energy Efficiency	17(36.2%)	18(38.3%)	11(23.4%)	1 (2.1%)	0	1.09	9
Robustness (Building Life / Maintenance)	21(44.7%)	25(53.2%)	1 (2.1%)	0	0	1.43	6
Environment Friendly (Greenness)	5 (10.6%)	19(40.4%)	17(36.2%)	6 (12.8%)	0	0.49	10
Speed of Construction	27(57.4%)	19(40.4%)	1 (2.1%)	0	0	1.55	4
Buildability / Builder Friendliness	19(40.4%)	25(53.2%)	3 (6.4%)	0	0	1.34	7
Structural Timber Specification Criteria							
Fire and Sound Insulation	27(57.4%)	17(36.2%)	3 (6.4%)	0	0	1.51	3
Strength Class / Stress Grading	23(48.9%)	22(46.8%)	2 (4.3%)	0	0	1.45	5
Timber Standards (e.g. SR 11)	23(48.9%)	24(51.1%)	0	0	0	1.49	4
Building Regulations Compliance	37(78.7%)	9 (19.1%)	1 (2.1%)	0	0	1.77	1
Kiln Drying and Pressure Treatment	16(34%)	29(61.7%)	1 (2.1%)	1 (2.1%)	0	1.28	7
Moisture Content	19(40.4%)	27(57.4%)	0	1(2.1%)	0	1.36	6
Cost	32(68.1%)	14(29.8%)	1 (2.1%)	0	0	1.66	2
Structural Timber Supplier Selection							
Competitive Pricing	37(78.7%)	10(21.3%)	0	0	0	1.79	1
Relationship / Past Performance	19(40.4%)	26(55.3%)	1 (2.1%)	1 (2.1%)	0	1.34	4
Service Quality (delivery, order processing)	27(57.4%)	20(42.6%)	0	0	0	1.57	2
Reliability / Consistency of Product Quality	25(53.2%)	22(46.8%)	0	0	0	1.53	3
Credit Terms	16 (34%)	26(55.3%)	5 (10.6%)	0	0	1.23	5
Trust	15(31.9%)	29(61.7%)	2 (4.3%)	1 (2.1%)	0	1.23	6
Proximity to Site	3 (6.4%)	21(44.7%)	18 (38.3%)	5 (10.6%)	0	0.47	7

7.4 Structural Material Choice Criteria

The second survey objective aims to establish the relative importance of various criteria in the selection, specification and supplier selection stages of structural timber choice processes from the viewpoint of Dublin based speculative residential developers. The third section of the questionnaire presented the respondents with a list of criteria under the three material choice stages, which they were asked to rate on a 5 point Likert type scale of importance. Each of the five options on this scale is assigned a value from -2 to +2 (very important +2, important +1, neither important nor unimportant 0, unimportant –1, and very unimportant -2).

The factors listed under each of the three stages were derived from the preliminary interview findings, an examination of other related material selection studies and the suggestions of those who completed the survey pre-test questionnaires. At the end of each section the respondents were given the opportunity to add their own "other" criteria, however none were forthcoming in any of the responses. The full results of this section of the survey are illustrated in Table 7.9, showing both the number and percentage of respondents who rated each criteria from very unimportant to very important. An average rating per criteria, which could range from +2 to –2 is calculated but all criteria remained in the positive range (0 to +2). So for example 25 respondents indicated that standardised design constitutes a very important factor (+2) in material selection. The total of the 'very important' ratings thus totals 50. Nineteen indicated that this was an important consideration, which leads to a weighted total of 19, on the basis of a 1 point scoring for important. Three respondents rated this criterion as neither important nor unimportant, giving a 0 weighted total. As there were no respondents who rated standardised design as unimportant (-1) or very unimportant (-2), the total weighted score was 69. When this score is divided by the number of respondents (47), we arrive at the average rating of 1.47. The final two columns of Table 7.9 display the average ratings and rankings of each criterion. Kozak and Cohen (1996) also used the weighted average measure in their study of the timber specification process.

These results pertain to the senior management of residential development firms in the Dublin area, as they formed the target population of this study due to the dominant role they appear to assume in material choice processes as emerged from the interview findings. So it

is considered reasonable to assume that of any of the individual groups who could have been surveyed in this study, the group with the highest levels of participation in material choice processes has been targeted.

7.4.1 Structural Material Selection Criteria

The questionnaire presented ten individual criteria to be rated in relation to respondents' perceived importance in structural material selection. The *building cost / return relationship* was rated on average as the most important criteria in material selection (1.72). Almost three-quarters of respondents felt that it was a very important consideration (34/72%) and the rest rated it as important. This facet of speculative development was highlighted in the interview findings and the survey confirms its importance.

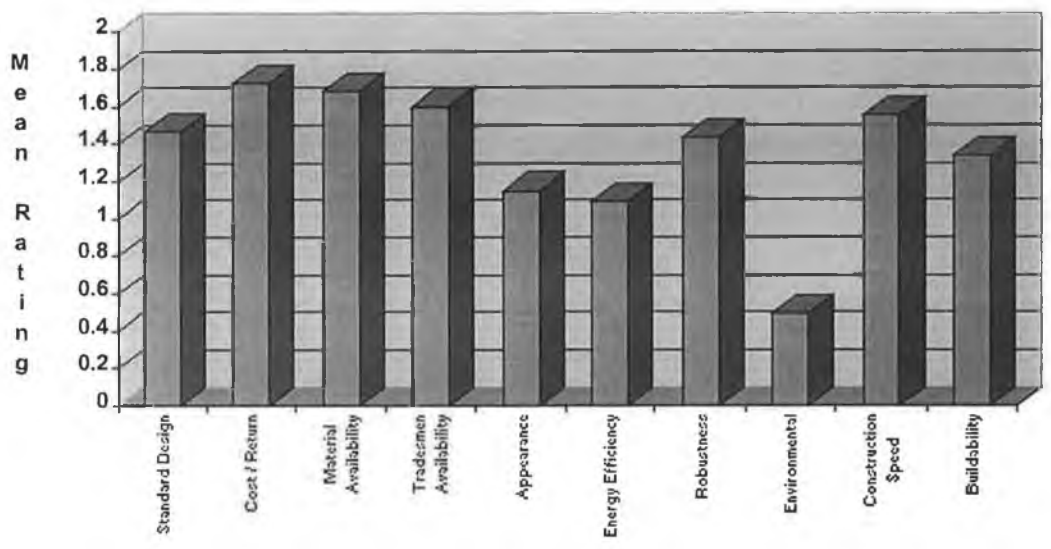
Reliability of material availability, emerged as a close second in terms of average importance, by achieved a rating of 1.68. Again all the respondents rated it as either important (15/32%) or very important. *Availability of tradesmen* received the third highest average rating at 1.60, with 62% (29) rating it as very important, 36% (17) important and one feeling that it was neither important nor unimportant. The relatively high level of importance attributed to this factor maybe a reflection of the industry concerns over the current short fall in numbers of brick-layers and the resultant spiralling in the costs of this element of construction. Another factor in favour of the use of timber frame construction is *speed of construction*, which received an average importance rating of 1.55, the fourth most important. A consideration that featured very highly in the interviews was *familiarity* with the use of a given material and its fit with the *standardised designs*. However, it was rated on average as only the fifth most important in this survey (1.47).

Robustness which refers to building life and maintenance, was ranked as the sixth most important, with an average rating of 1.34. *Buildability*, or the degree of difficulty experienced in the construction of a particular element, received an average rating of 1.34, or the seventh of the ten criteria. The criteria which received the eight highest average rating was *appearance / aesthetic differentiation*, at 1.15. From the evidence of the interviews it is likely

that architects would have rated aesthetics considerably higher than was the case with developers.

Energy efficiency received the second lowest average rating at 1.09, with only just over a third of respondents rating it as very important (17/36). The least important criteria, by a considerable margin, according to the rankings, was *environmental friendliness (greenness),* which scored a mere 0.49. Almost half of the respondents viewed this criteria as either 'unimportant' (6/13%), or 'neither important nor unimportant' (17/36%). It received both the lowest 'very important' rating and the highest 'unimportant' and 'neither important nor unimportant' rating of any of the ten criteria. The Construction Marketing Network (1996) of building product buyers and specifiers also highlighted the low level of importance attributed to energy efficiency. Contractors rated it as least important of eleven criteria while specifiers rated it as the second least important. The full details of the criteria ratings and rankings for material selection are displayed in the top section of Table 7.9 and Chart 7.8.

Chart 7.8 Mean Importance Ratings of Structural Material Selection Criteria



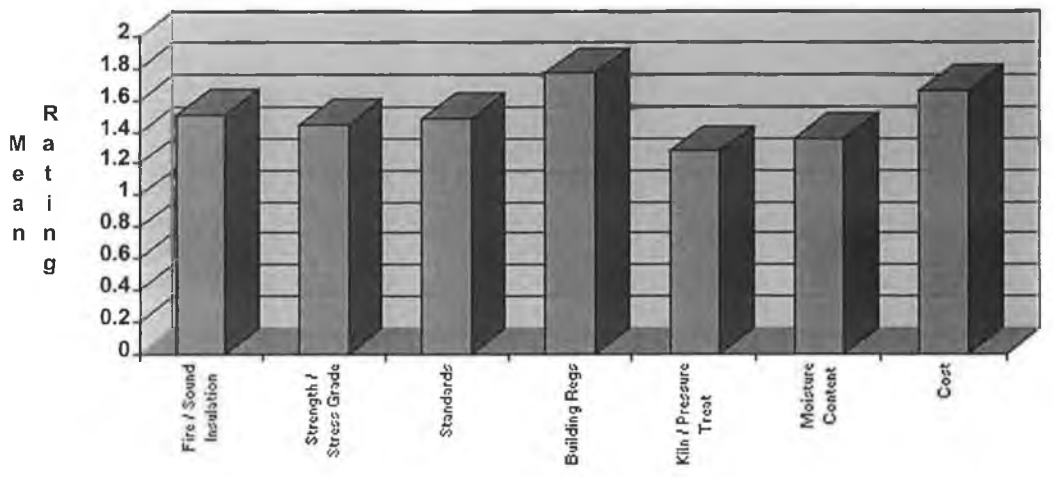
7.4.2 Structural Timber Specification Criteria

The second part of the criteria importance-rating section of the questionnaire presented the respondents with seven criteria relating to structural timber specification, which emerged from the interview findings and from the literature.

Compliance with the Building Regulations, which are mandatory building performance related standards, received the highest average rating at 1.77, as over three quarters (37/79%) of the respondents considered it as very important, 19% (9) rated it as important and rather strangely one (2%) felt that it was neither important nor unimportant. *Cost* emerged as the second most important criteria in material specification, with an average rating of 1.66. Kozak and Cohen (1996) included three material cost related criteria in their survey of North American specifiers (engineers and architects) of structural materials in non-residential construction:- material is inexpensive; material has good value for the money; and material is competitively priced. Their comparison of timber, steel, concrete, and masonry resulted in these three cost related criteria achieving eleventh, twelfth, and thirteenth highest rankings respectively amongst the twenty seven criteria proposed in relation to the choice of structural timber. The third most important criteria, with an average rating of 1.51, was *fire and sound insulation*. These factors are particularly important in high-density development such as apartments and terraced housing.

The four timber specific criteria, as opposed to the three foregoing general material specification considerations, received the lower ratings in this section, which may be due to their technical nature. A possible explanation could be found in the tendency for developers to leave the technical and standards related specifications to the designers. *Timber Standards,* such as SR11, scored an average importance rating of 1.49. S*tress grading and strength class* of timber emerged as the fifth most highly rated specification criteria, at 1.45. *Moisture content* yielded an average rating to 1.36, whilst the timber specification criteria to receive the lowest average rating in this survey was *kiln drying and pressure treatment* (1.28). An interesting aspect of the specification criteria ratings is that the lowest rating was 1.28 (kiln drying), which is higher than the three lowest rated selection criteria (0.49 - environmental, 1.09 - energy efficiency and 1.15 - appearance) and the three lowest supplier selection criteria (0.47- proximity to site, 1.23 - trust and 1.23 - credit terms). The full results of the timber specification criteria ratings are illustrated in the mid section of Table 7.9 and in Chart 7.9.

Chart 7.9 Mean Importance Rating of Structural Timber Specification Criteria



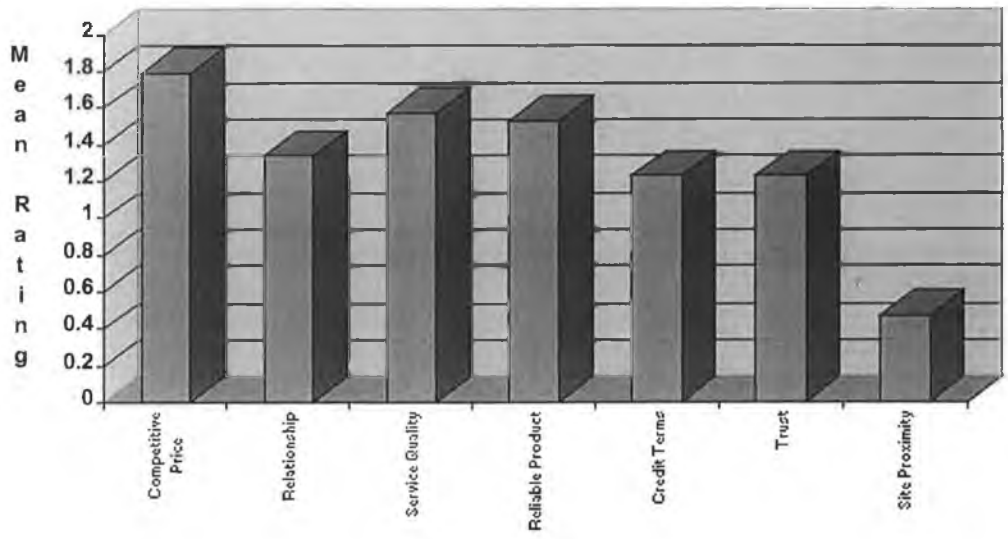
7.4.3 Structural Timber Supplier Selection Criteria

Seven criteria were again presented in the supplier selection section of the questionnaire, the most highly ranked, on the basis of average ratings, was competitive pricing at 1.79, which in fact makes it the most highly rated of any of the criteria in any of the three stages of choice processes examined. An interesting observation at this stage is that three of the five top ranked criteria relate to the financial aspects of material choice processes. Firstly, competitive pricing in supplier selection (1.79). Secondly, in third position behind compliance with Building Regulations was the cost / return relationship in material selection (1.72) and the fifth highest average was achieved by material cost in specification, behind reliability of material availability.

The second most highly rated supplier selection criteria was *service quality* with an average rating of 1.57. *Consistency and reliability of product quality* was rated as either important (22/47%) or very important (25/53%) by all the respondents, equating to an average rating of 1.53. The *past performance and relationship* with timber suppliers ranked as fourth at 1.34. Both *credit terms* and *trust* achieved 1.23 as their average rating. The least important criteria in structural timber supplier selection and indeed in overall choice processes, was supplier *proximity to the site*, at 0.47. It may be noted that this criteria is likely to be considerably

more important in the case of 'wet' concrete products, such as readymix, as the time restrictions for delivery effectively limits the potential distance which suppliers can be from the site. But with timber products this situation does not really arise. The bottom section of Table 7.9 and Chart 7.10 present the full findings of the importance rating of timber supplier selection.

Chart 7.10 Mean Importance Rating of Structural Timber Supplier Selection Criteria



7.5 Study Model Application to Speculative Home-Builders

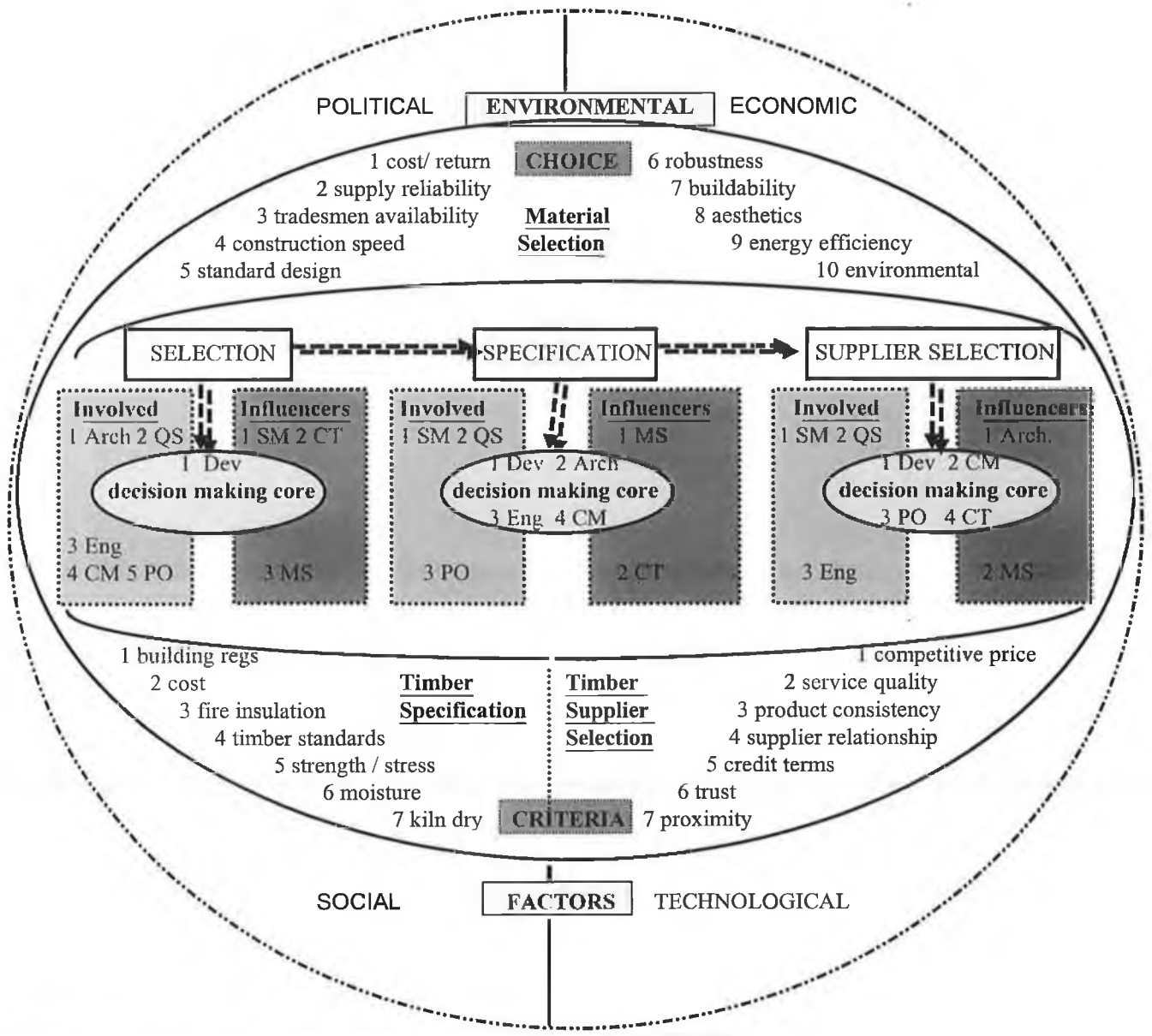
The survey findings in relation to participation and structural timber choice criteria present an opportunity to illustrate the application of study model to a wider population, as opposed to a development specific basis, as was the case in Chapter 5. While the core concerns of the study framework developed in Chapter 3 remain intact, a number of differences from the model's presentation in Chapter 5 are inherent in this presentation. Firstly, the model incorporates the aggregate responses of 47 speculative residential developers, who are all members of the Dublin branch of the Irish Home Builders Association. Secondly, it incorporates the views of senior management of speculative residential developments firms only and not those of designers and developers as was the case previous presentation. Thirdly, the survey findings on participation facilitate the ranking of party participation in each of the three levels of participation in the three stages of structural timber choice

processes. In each stage the parties are presented at the participation level in which they were identified most often. For example, the senior management of development firms received their highest number of identifications at the level of deciders in the structural material selection stage, whilst architects, quantity surveyors, engineers, contracts managers, and purchasing offices were most commonly identified as being involved. Site management, contractors and tradesmen, and material suppliers were most commonly identified in the role of influencers.

Fourthly, the survey findings also facilitated the development of the model to include relative importance ranked timber choice criteria on a stage specific basis. The development specific interviews enabled the presentation of material choice criteria as mentioned by both developers and designers, however they were not ranked in terms of importance or divided into selection, specification and supplier selection related criteria.

So, the model presented in Figure 7.1 is adapted to display the results of the participatory and criteria dimensions of the home-builder survey. This presentation of the model opens the doors to further development and extension of the study framework and model to illustrate buying processes in other sectors of the construction industry, and possibly beyond.

Figure 7.1: Structural Material Choice Model - Home-builder Survey



Participant Codes
Dev - Development Firm Senior Management
QS - Quantity Surveyor
Arch - Architects
Eng - Engineer
CM - Contracts Manager
SM - Site Management
MS - Material Suppliers
CT - Contractors and Tradesmen
PO- Purchasing Officer

7.6 Views on Timber Frame Construction

Survey Objective 3 aims to measure the views of Dublin based speculative residential developers on the relative merits of timber frame construction compared to the traditional 'blocks and mortar' system. Only one fifth (9/19%) of the respondents indicated that they had used timber frame construction, while two thirds (31/66%) have considered using the system. The respondents were asked to rate timber frame as better than (+1), the same as (0), or worse than (-1), traditional on four different factors - cost, speed, saleability and buildability. This is similar to the weighted average based scoring system used in the previous section.

Views on the construction *costs* of timber frame compared to traditional construction were very mixed (Table 7.10). 60% (28) of the respondents rated timber frame as better or the same as traditional construction on a cost basis. However, it may be noted that the mean rating was marginally negative (-0.05). The *speed* of construction was strongly rated as being favourable in the case of timber frame construction, as 37 (79%) of the respondents felt that it represented a faster form of construction and only 1 respondent (2%) rated it as worse than traditional construction, giving a very positive mean rating of 0.86.

A positive average rating was also recorded in relation to the relative *buildability* of timber frame of 0.29, as over three quarters of the respondents expressing the view that it was either better than, or the same as, traditional construction. In relation to each of the first three factors there were 5 respondents (11%) who failed to offer any opinion. Seven (15%) of the respondents did not express any view on the comparative *saleability* of timber frame. None of them felt that timber frame was more saleable, 49% (23) indicated that it was less saleable than traditional construction, leading to a mean negative rating of -0.58.

Finally, respondents were asked for their opinion as to whether timber frame's share of the construction market would - vastly increase, increase, stagnate, decline or vastly decline. Four (8%) respondents expressed no opinion, 7 (15%) felt that it will vastly increase, 29 (62%) felt that it will increase, 4 (8%) felt that it will remain stagnant, while only 3 (6%) expressed the view that it will decline and none foresaw it vastly decreasing. Twenty six of the 47 respondents gave reasons for their views on future timber frame market share. 15% (7) cited construction speed as the main force driving future increases. 13% (6) felt that the

increasing importance of energy efficiency in residential construction would help to increase its share. A further 13% (6) felt that as the market becomes more familiar with this method of construction it will become more acceptable and thus grow. Two of these respondents also warned of the potential damage which a recurrence of the timber frame quality scare of the 1980's, in England, could do to this form of construction. Three (6%) felt that the shortage of block-layers will result in increased market share and 1 (2%) respondent felt that consumer demand would increase timber frame's share. The full results of this section of the research are illustrated in Figure 7.10.

Table 7.10: Views on Timber Frame Compared to Traditional Construction.

	Better (1)	Same (0)	Worse (-1)	No Response /Opinion	Average Rating (1 to - 1)
Construction Costs	12 (25.5%)	16 (34%)	14 (29.8%)	5 (10.6%)	- 0.05
Speed of Construction	37 (78.7%)	4 (8.5%)	1 (2.1%)	5 (10.6%)	0.86
Saleability	0 (0%)	17 (36.2%)	23 (48.9%)	7 (14.9%)	- 0.58
Buildability	18 (38.3%)	18 (38.3%)	6 (12.8%)	5 (10.6%)	0.29

7.7 Views on Irish Vs Imported Timber

Section 5 of the questionnaire investigates the views of Dublin based speculative residential developers on the relative merits of Irish structural timber compared to imported, as envisaged in Survey Objective 4. In common with the previous section, dealing with views on timber frame construction, a weighted average calculation was undertaken. The vast majority (34/72%) of respondents professed to using Irish structural timber, however, a quarter (12/25%) indicated that they do not use Irish timber at all in their developments, and one did not respond. The eight (17%) respondents who stated a reason for not using Irish timber, all felt that the quality was poor.

In relation to the perceived difference in quality between Irish and imported timber, two thirds (31/66%) felt that imported was superior, while 28% (13) felt that there was no difference, 3 did not respond. There were 16 respondents who gave reasons for their perceptions of Irish timber as being of inferior quality. 17% (8) felt that the quality was unreliable, 8.5% (4) felt that Irish timber was more inclined to warp and bend, 6% (3) felt

that the kiln drying was not as good with Irish timber and 1 (2.1%) stated that Irish timber is not as well seasoned as imported. Table7.11 below, presents the views of respondents in relation to Irish structural timber compared to imported across seven parameters. Average ratings for each are calculated on the basis of the better than (+1), same as (0) and worse than (-1) scale. One respondent failed to complete this section of the questionnaire.

Table 7.11: Views on Irish Compared to Imported Timber

	Better (1)	Same (0)	Worse (-1)	No Response /Opinion	Average Rating (1 to - 1)
Kiln Drying	0 (0%)	27 (57.4%)	19 (40.4%)	1 (2.1%)	- 0.41
Structural Integrity	0 (0%)	17 (36.2%)	29 (61.7%)	1 (2.1%)	- 0.63
Consistency of Quality	0 (0%)	14 (29.8%)	32 (68.1%)	1 (2.1%)	- 0.70
Price	19 (40.4%)	24 (51.1%)	3 (6.4%)	1 (2.1%)	0.35
Availability	8 (17%)	34 (72.3%)	4 (8.5%)	1 (2.1%)	0.09
Load Bearing Capacity	1 (2.1%)	27 (57.4%)	18 (38.3%)	1 (2.1%)	- 0.37
Appearance	1 (2.1%)	24 (51.1%)	21 (44.7%)	1 (2.1%)	- 0.43

The survey confirms a number of the problems that were highlighted in the interviews relating to the perceived quality of Irish timber. The only two characteristics, which yielded a mean positive response for Irish timber, were *price* at +0.35, which 91% (43) of respondents felt was better or the same as imported and *availability* (+0.09) which 72% (34) of respondents felt was the same. 17% (8) expressed the view that Irish timber was more readily availability.

Irish timber has a serious problem in terms of both perceived *consistency of quality* with an average rating of -0.70 and perceived *structural integrity* (-0.63), as none of the respondents rated it better than imported in either regard. While no respondents rated the *kiln drying* (-0.41) of Irish timber as better than imported, there were a significant proportion who felt that there was no difference (27/57%). Only one (2%) respondent rated *load bearing capacity* (-0.37) and *appearance* (-0.43) as better, However again over half the respondents rated Irish timber as the same on both of these parameters.

Despite the fact that over 50% of respondents felt that Irish timber was worse in terms of quality consistency and structural integrity, only a quarter (12/25%) stated that they did not use Irish timber. This would indicate that at least a further quarter of respondents were willing to use what they perceive to be a lower standard product. Furthermore, 18 of the 29 (62%) respondents who felt that the structural integrity of Irish timber was worse still used it, while only 11 did not. Again only 11 of 32 (68%) respondents who felt that the consistency of quality of Irish timber was worse than imported, indicated that they do not use it. These are interesting findings as it highlights the point made by certain interviewees, that speculative developers are more concerned with improving the aesthetics in order to attract purchasers, while not overly worrying about maximising the quality of non-visible structural elements and materials.

7.8 Conclusions

The home-builder survey forms the less-dominant phase of the primary research in this study as discussed in Chapters 4 and 6. Its purpose largely relates to the extension and development of the interview findings in a complimentary manner. Whilst the focus narrowed considerably to speculative residential developers in the Dublin area it is felt that it offers a number of useful insights into structural timber choice processes amongst this important group within the construction industry. It is interesting to note the dominance that the senior management of the development firm attributed to themselves, in all aspects of material choice processes. Whilst, there may be some degree of over reporting of their own roles, the interview findings would appear to support their dominance in material choice processes. The emphasis which respondents placed on financial criteria in the three stages of material choice was evident. It would be interesting to investigate whether designers, particularly architects, would rate these criteria differently. The extension of the model through the presentation of survey findings may open the door to developing of its application to buying processes within other sectors of the construction industry, and perhaps beyond.

The mixed views gathered on the timber frame system makes it difficult to predict its future. However, the majority view predicted an increase in timber frame's market share. Irish

timber still faces considerable problems in terms of its perceived quality and standards relative to imported.

It was not possible within the restraints of the questionnaire to investigate various aspects of material choice processes such as the timing at which individual decisions were reached. The number of individuals as opposed to number of parties (each party could comprise a number of individuals), was not investigated, as this would have entailed an extensive series of additional questions in an already expansive and complicated questionnaire.

The conclusions and recommendations chapter (Chapter 8) which follows further discusses the links between the survey findings and the interview findings, in the context of the overall study.

CHAPTER 8

INTEGRATION OF INTERVIEW AND SURVEY FINDINGS – CONCLUSIONS AND RECOMMENDATIONS

Chapter 8: Integration of Interview and Survey Findings – Conclusions and Recommendations.

8.0 Introduction

This chapter brings together for final analysis and interpretation the overall findings of both the interview and survey research, discusses the limitations of the research and presents the conclusions and recommendations of the various strands of research presented in the previous chapters. This chapter commences with a brief overview of structural material choice framework, which is followed by an overview of the finding regarding participation in the three study generated stages of material choice processes. Next structural material choice criteria are examined, which constitute the second dimension of the study framework. A brief consideration of the study model which integrates the participatory and criteria dimensions of the study is followed by the overall findings and conclusions regarding structural material changes, with particular emphasis on timber frame and Irish timber.

In the next section some limitations of the research are reflected upon in order to highlight the methodological and coverage boundaries of the study in advance of the recommendations.

The recommendations section draws not only on the findings and interpretation from the primary research but also it incorporates views of both the researcher and the various industry sources consulted during the secondary research and encompasses various issues concerning the timber industry, the construction industry, policy-makers and subsequent researchers in this area. The recommendations sections broadly follows the same format as the overall findings and conclusions, concentrating on participation in material choice processes, followed by material choice criteria, and finally structural material changes.

8.1 Overall Analysis and Research Conclusions

This section is an opportunity to draw together the various strands of the study in a manner which is only possible in the wake of reporting of both the interview and mail survey findings. The layout of this section largely follows the sequence of findings presentation in the previous chapters.

8.1.1 Material Choice Framework

From the organisational buying behaviour literature and early consideration of material choice in construction, it became apparent that there was little existing knowledge of material choice processes in construction. It was recognised that participation and influence are core concepts of organisational buying behaviour theory, and that buying processes differ in terms of composition, duration, and numerous other aspects across individual buying situations (Johnston and Lewin, 1996). In common with previous researchers this realisation led to the development of a framework within which to explore various aspects of buying processes. The study framework envisages organisational buying processes as differing in each buying situation. In order to reflect this diversity the framework commences from the assumption that structural material choice comprises of processes rather than a singular process. Again, in common with many other researchers the desirability of breaking down buying processes into stages or steps was recognised (e.g. Banting et al., 1985). It is not claimed that these three stages are purely sequential, as it is recognised that buying processes are iterative in nature (Spekman and Gronhaug, 1986). This minimal use of stages - compared to previous studies (Johnston, 1981) - retained flexibility in the exploration of material choice processes, with the minimum necessary restraints set by stages, yet ensuring that a wide breath of these processes were be explored.

These stages are envisioned as comprising of a number of related decisions, rather than themselves constituting individual decisions. It is difficult to identify all decisions undertaken in the course of a given buying process. It becomes extremely difficult, if not impossible, to develop a preset group of decisions for exploration in the context of multiple buying processes across multiple organisations (Kauffmann, 1996). For this reason, it is concluded that the strategy adopted in this study, as in many other organisational buying behaviour studies (Banting et al., 1991; Ghingold, 1986 and Woodside &Vyas, 1987), of adopting stages rather than decisions in the study framework was a desirable theoretical device for conducting the study.

The second element of the study framework deals with levels of participation in organisational buying processes. Again, many authors in the area have distinguished

between different forms and levels of participation in decisions and stages of organisational buying. Rather than rating influence, participation, or involvement on a scale as has been done in various other studies - particularly large scale survey based studies such as Mattson and Esmail (1993) and Banting et al. (1985) - it was decided to use three levels of participation as the system for exploring participation. The three levels adopted were decision-makers (deciders), those involved, and influencers. A discussion of the appropriateness of these levels of participation is included in the limitations section of this chapter.

8.1.2 Participation in Structural Material Choice Processes

a) Structural Material Selection

The structural material selection stage refers to the group of decisions relating to the type of materials to be used in each structural element (i.e. will steel, timber, concrete, masonry, or plastic be used in the walls, floors and roof structures). An important finding to emerge from the interviews was the predominance of construction 'systems' or 'formulae' in determining the designs and materials used in residential construction. Material selection decisions may be implicitly made in the choice of a development system. The primary systems of house and apartment development largely define the structural materials to be used in each element of the structure. For example, the decision to use the 'traditional' system will result in the construction of brick/blockwork walling beneath a pitched tiled roof covering on prefabricated timber roof trusses and concrete ground floor slab with suspended timber upper floors. Deviations from these materials largely arise out the decision to use a timber, steel or concrete framed system. The later two are unusual in house construction, but are relatively common in apartment and non-residential construction.

The interview findings would indicate that any decision to change the development system would be dominated by the senior management of the development firm, with considerable involvement from design consultants. It is interesting to note that the respondents to the survey only gave a fifth highest average rating to standardised designs and familiarity of use in the material selection criteria section. This may indicate that developers are somewhat reticent about readily identifying with the importance of the standard designs in determining material choice. This highlights a weakness of the survey approach and helps

to justify the decision to conduct the dominant interview phase as it demonstrates how the interviews facilitated the emergence of an important dimension of material choice processes. It also strengthens Cherns and Bryant's claim, which was already noted in Chapter 4:- *"Construction industry researchers tend to oversimplify the role of the client in the construction management process. This partly results from the propensity of researchers to use 'broadcast' survey method approaches which typically achieve shallow penetration of the client's world."* (Cherns and Bryant, 1984:177).

The interview showed that structural material selection can be restrained by local authority planning provisions, both in terms of compliance with Development Plan provisions and through the direct input of planning officers in the area of the subject development. This is particularly the case when infill developments are undertaken in an area where the existing architectural style must be preserved and largely relate to aesthetic considerations in material selection. So the planning system can act as a restraint or individual planners can have an influencing role in material selection.

Local authorities are constrained by standard approved designs to a greater degree that the private sector, which reinforces Berkowitz's (1986) that formal procedures appear to be more pervasive in the public sector. The degree of bureaucracy involved through the various departments of the local authority including; architecture, quantity surveying, housing, and engineering; tends to decrease the flexibility in structural material selection. Local authorities normally appoint a head contracting firm, by tender, to undertake all construction works. These contractors have no direct input into the design stage, during which structural materials normally are selected. Local authorities monitor various aspects of the construction phase through site inspections and the use of a local authority site clerk in many large-scale developments, as highlighted in the interview findings. However, this form of construction procurement differs significantly from the other developments explored in its degree of separation of the design and construction phases, and the low level of interaction between the different parties in the stages of material choice processes, as discussed in Chapter 1 (Emmerson, 1962).

The two single house developments featured in the interview phase underlined the lack of input which end users have in the design, construction and material choice processes in

speculative developments. Perhaps the two selected single house developments featured a slightly higher than normal level of participation from the future owner-occupiers, in so far as both parties had considerable experience of working in the construction industry. However, they illustrate a crucial difference from speculative or local authority developments where the end users have little or not active role in material selection processes. The impact of end user participation in two single house developments was relatively large, with specifications being increased, material quality being seen as crucial and individual design features being incorporated. However, this input is not generally possible in speculative or local authority developments. Again this richness obtained from the qualitative interviews would have missed if only a survey had been used.

The survey strengthened the interview findings in relation to speculative developers in that developers and designers were identified as the parties most likely to be deciders or be involved in decisions relating to the material selection stage. The pool of contractors and material suppliers that developers use appear to influence the decisions in this stage. It is interesting to note that the Bellizzi (1979) study found that development firm senior management were ranked as number one in the recognition of a problem and a general solution in the buying process for major materials in commercial construction. However, architects and consulting engineers were found to be only the fifth most involved of six groups. Regional differences in construction industry practice may explain the divergence between the two studies to some degree. However, the researcher feels that the key change over the 20 years since Bellizzi's study has been the increased use of external consultants and contractors in the development process (Yisa et al., 1995). This has necessitated a greater integration of in-house and out-sourced expertise in decision-making processes.

b) Structural Timber Specification

The structural timber specification stage refers to the definition of characteristics such as dimensions, standards, moisture content, type/species of timber, strength class, stress grading and the use of imported or Irish timber.

The degree of detail to which characteristics are specified during design appears to differ considerably across individual developments and organisations. For this reason, the various timber specification decisions can be very difficult to pinpoint within the development

team, in terms of both timing and participation. The interview findings would indicate that architects and engineers appear to dominate in specification of the standards to which timber must adhere, such as strength class, moisture content, SR11, and dimensions. However, various other characteristics appear to be specified by the developer or his site management, such as type of timber and whether Irish or imported timber is used. The survey confirmed the dominance of development firm senior management and considerable involvement from site management in these decisions. In some cases these characteristics may not be formally defined until the timber is actually ordered, or may even be left to the discretion of the timber provider, once it meets the regulatory and designer specified requirements.

In relation to local authority development it would appear that a more substantial and detailed specification document is produced as part of the tendering procedure, than would normally be the case in private sector developments. This is necessary as head contractors must have a precise specification of all materials needed in order to price a job and the local authority must have a clear specification to ascertain if the contractor has complied with construction agreement. The added onus of public accountability must be foremost in the minds of local authority designers and city / county managers, which strengthens Berkowitz's (1988:45) claim:- *"In public and nonprofit settings formal buying procedures appeared to be more pervasive, probably for reasons of accountability"*. In the case of the local authority development examined in this study a local authority architect, engineer, and quantity surveyor all participated in the specification stage however, they were all bound by standard approved designs. Whilst the contractor is bound by the specification of standards and dimensions, etc. as laid out in the specification documentation, some discretion remains in the later specification decisions, such as whether Irish or imported timber is used.

There are variations in the extent to which engineers, architects and quantity surveyors are used in each development, and thus participation in the specification decisions differs from development to development. The complexity and scale of the development and the client or development organisation may influence this. Each of the multi-dwelling developments examined in the interview phase involved considerable input from structural engineers, in addition to the architects and in-house quantity surveyors. The strong input from structural

engineers may have been due to unusual topographical and site related conditions experienced in each case. While some of the interviewees indicated that site related conditions increased the need for engineering expertise and expressed the view that in more straight forward developments engineering inputs might not be required, the survey findings indicated that the vast majority of speculative developers surveyed use the services of engineers. Furthermore, they received the third highest average overall participation rating in material choice processes, which would indicate that they play an important part in material choice processes. Therefore despite the initial indications of the interview findings, which appeared to downplay the role of engineers, it would appear from the findings of both the interviews and survey that engineers play a significant role in a large proportion of residential developments.

Similar to the selection stage, the owner-developers in the two single house developments took a significant role in the specification decisions. The client in the single dormer development dominated the timber specification decisions, as he altered many of the specifications laid down by the draftsman. In relation to the timber frame development, again the client increased a number of the specifications. However, once the client, in consultation with the architect, decided to use timber frame construction, a number of the timber specification decisions were handled by the timber frame manufacturer. So the decision to use timber frame, or indeed steel or concrete frame construction systems, can lead to a significant shift in the locus of control regarding specification decisions as the frame manufacturers have standard specifications for the construction of different types of houses.

c) Structural Timber Supplier Selection

The timber supplier selection stage refers to the group of decisions relating to the choice of structural timber suppliers. The crucial finding in relation to the supplier selection stage is the diminishing involvement of the design consultants and the increased involvement of site management allied to the growing influence of tradesmen and material suppliers / distributors. However, the core decision making function appears to remain with the senior management of the development firm in speculative developments. The survey reinforces this finding and strengthens the conclusion that designers take a lesser role and site management take a slightly greater role in the supplier selection stage.

The mix of labour-and-materials and labour-only contractors emerged from the interviews as a crucial factor in determining participation in the supplier selection stage. When material supply is included in the contractors' responsibilities the development firm surrenders the balance of control in supplier selection decisions to the contractors. Whilst materials-and-labour contracting is commonplace in electrical and plumbing works, it is relatively unusual in structural works contracting, such as block-laying and carpentry. This may be illustrated by the results of the homebuilder survey where fewer than 5% of respondents indicated that they used material-and-labour contractors for carpentry. Whereas the use of head-contractors is more common in non-residential development, the local authority development was unique amongst the subject developments as it was the only one where the construction works as a whole were contracted out, which minimised the developers' (local authority) involvement in material supplier selection. This effect of contracting systems on the supplier selection stage provides a useful insight for material suppliers.

In the interview findings pertaining to the single timber frame house, it was seen that the developer and designers relinquished control over the selection of most of the structural material suppliers once the decision was made to use the timber frame system. Timber frame house manufacturers supply the structural materials used in the construction of most structural elements, with the exception of the base (ground floor and foundations). Similarly to the specification stage this shift in participation away from the developers and the designers to the frame manufacturers is also likely to be a factor in steel and concrete frame construction systems. This shift in material choice process participation highlights the potential for stronger relationship based strategic partnering between developers, designers and frame manufacturers, as discussed by Tanner (1999) and Gopalkrishnan (1996).

The supplier selection stage is a difficult stage in which to unearth the key participants, due to the complications associated with identifying the various contractors, subcontractors, site personnel, and head office management who may be involved. A further complication arises by virtue of the fact that the three stages may not be entirely sequential, which would support Speckman and Gronhaugs' (1986) supposition that stages are iterative (See

Chapter 3). For a number of reasons, material suppliers may be selected at an early stage in the development process, perhaps before specifications are finalised. Firstly, the developer may wish to enter into advance supply arrangements at the start of a development in order to fix material costs so he can have reasonably accurate advance budgeting. Secondly, in the case of custom-made structural units such as precast concrete floors or timber frame housing it is necessary to pre-order well in advance to allow for manufacturing. Thirdly, large developments need considerable quantities of materials arriving on site at the time required and as such it is important that the material suppliers have advance notice in order to guarantee meeting these needs. This is less so the case where the developer is building a single house, as most suppliers can with relative ease and little advance notice, supply the materials for such small scale orders.

An interesting finding to emerge from the study is the low recognition of the role of purchasing managers in the residential construction industry. As is the case in many small companies in other industries the purchasing function is carried out by an individual, or group of individuals, as part of their overall jobs, rather than constituting an individual job in itself. This was noted by Banting et al. (1991), who found that the purchasing departments' influence in buying processes was far less dominant in Hungary (socialist country) than in Canada (capitalist country). The proliferation of small-scale residential development firms in Ireland militates against the widespread use of purchasing professionals. Typically this function seems to be undertaken by senior management or quantity surveying / construction technician personnel on an inhouse basis, with the ordering function often undertaken by site management or site clerks, as highlighted by the interview and survey findings.

It has been suggested by various organisational commentators that purchasing will move from an administrative function to a core strategic management function and that cross functional supplier teams dedicated to building relationships with key suppliers will replace buying centre structure and process as the primary elements in organisational buying (e.g. Sheth 1996:13 and Tanner, 1999). Certain potential avenues for increased penetration of the construction process by materials suppliers were noted in this research, such as the timber frame example. Nevertheless the large number and small scale of most residential developers in the Irish market makes it unlikely that either developers or

material suppliers are going to dedicate significant resources to the development of strategic partnerships. Sheth (1996) suggests that size is going be a prohibitive factor in the development of such partnerships:- *"My a priori hypothesis is that similar to smaller market share brand names whose cost of maintenance is more than its value, supplier partnering with smaller share suppliers will not be economical"* (Sheth, 1999:13). The relationship between the speculative developers in the subject-developments and their supplier would seem to more closely resemble a functional relationship that a long term strategic one, as suppliers appear to be selected on a development specific basis. Tanner (1999) describes functional relationships as *"repeated transactions with salesperson-centred relationships"* and strategic partnerships *as "organisational relationships with both parties committed to long term profitability"* (Tanner, 1999:246). The interview findings would suggest that the same suppliers may be used on a roll-on basis, however this would not appear to be formalised in the form of strategic partnership, but rather based on functional relationships. It is, therefore, suggested that the decision to examine processes rather than relationships in this study was a valid one, although it would also be interesting to discover the degree to which mutual dependency and benefits could accrue from long term developer – supplier relationships.

8.1.3 Structural Material Choice Criteria

The interview phase of the primary research explored the main criteria considered by participants in material choice processes. Figure 5.7 presents the criteria mentioned by each of the interviewees. Differences between developers and designers across the different types of residential developments are highlighted. The homebuilder survey extended the investigation of Dublin based speculative residential developers' structural material choice criteria, as respondents were requested to rate the importance of 24 criteria, from very important to very unimportant. One of the primary strengths of the survey was the opportunity it presented to investigate the relative importance of criteria in each of the three material choice stages: material selection criteria(10), structural timber specification criteria (7) and structural timber supplier selection criteria (7).

A recurrent theme throughout the interviews was the importance attributed by speculative developers to both individual material cost and the effect of materials and development

systems on the overall return. This was borne out by the survey in which the cost-based criteria received the highest average importance rating in both material selection and supplier selection stages and second only to compliance with Building Regulations in the specification stage. Whilst material cost was seen as being of paramount importance, certain overriding considerations must be borne in mind. These include the effect of individual materials on the overall development system in terms of cost, speed of construction, saleability and development team constitution. Apartment development is subject to more onerous regulatory standards of construction than is the case with house construction, which tends to restrict the choice of structural materials used in various elements, such as the need to use concrete floors for fire and sound insulation. Similarly, the location of many apartment developments on infill sites, tends to restrict the choice of materials used in the external leaf of external walls and in regard to roof coverings, as construction must be in sympathy with existing streetscapes.

Material quality and robustness / durability of the housing units, which form part of the long term estate of the local authority, emerged as the vital criteria in structural material choice to the local authority. Higher and more rigid standards appear to apply in both the design and the construction supervision of local authority housing than is the case with private speculative development. The differences in criteria between local authority and speculative developers would appear to support Spekman's (1981) findings that purchasing related factors (criteria) differ amongst commercial, not for profit, and governmental organisations, as discussed in Chapter 3.

In a similar vein to the local authority, both the single house developers emphasised the importance of their long-term interest in the property and its durability in their choice of materials. Both highlighted instances where they decided to increase the specification of structural timber elements in order to improve structural integrity and sound insulation of the houses and prolong the building life. The need for the building project to fit in with the overall budget rather than an emphasis on the cost of individual materials was highlighted by the two single house developers and by the local authority. Both owner developers in contrast to the local authority displayed flexibility regarding their budgets in order to incorporate particular design features. The fundamental difference between the two speculative developers and the two owner developers relates to emphasis on overall

building quality as highlighted by the later and on the cost / return relationship with the former.

The high thermal insulation value which can be achieved throughthe use of the timber frame system was stressed by the interviewees involved in the timber frame house development. In contrast, the survey highlighted the relatively low emphasis which speculative residential developers place on energy efficiency and environmental friendliness as they achieved the second lowest and lowest average importance rating respectively. In the context of these findings of this study it is interesting to note that Drumwright (1994) found that non-economic criteria such as environmental factors are becoming increasingly important in organisational buying processes.

The timber specification criteria section of the survey underlines one of the limitations of the study, in so far as only the views of senior management of speculative developer companies were gathered. The four timber specific criteria included in the timber specification section of the questionnaire received the lowest average rating (4^{th}-timber standards, 5^{th}-strength class/stress grading, 6^{th}-moisture content and 7^{th}-kiln drying/pressure treatment). These criteria are primarily performance and standards related factors, which are likely to be of greater concern to engineers and architects. Tradesmen who work with the materials supplied would also be likely to rate these performance criteria more highly than senior development firm management who appear to be more concerned that the completed building meets the performance based Building Regulations, which apply to the overall structure, rather than to individual materials. An interesting anomaly in the construction quality policing system was highlighted by two of the architects interviewed, whereby normally the architects who design a given development ultimately certify that the completed structure complies substantively with current Building Regulations. This system would appear to be open to abuse in view of the natural desire of architecture practices to endeavour to retain an ongoing relationship with their speculative developer clientele. In view of the situation described by another architect interviewee where the architecture practice had no ongoing inspection role during the construction phase, it would appear rather a weak safeguard to breaches of the Building Regulations that this architecture practice should ultimately certify compliance with same, even though much of the structural framework of the houses is concealed from view once finishes are applied.

As supplier selection appears to be dominated by developers and contractors with considerably less input from designers than is the case in specification and material selection stages and that the interview findings indicated that developers and contractors were highly concerned with costs (see above), it was not surprising to find that competitive pricing emerged as the criteria to achieve the highest average importance rating, in the speculative developer survey. However, what the survey results hide, by virtue of the lesser average rating attributed to service quality and reliability, is a point highlighted by a number of the interviewees, that price often only becomes an issue once the credentials of a given supplier are proven in terms of service and material quality. Developers can not afford to sacrifice service quality to any significant degree, particularly in area of delivery of materials, in order to achieve material price savings, in view of the growing importance of construction speed and the elimination of unnecessary time delays. Indeed, the Banville and Dornoff (1973) study of the relative importance of patronage motives to US residential builders indicated that service and product quality outranked low price in the selection of lumber suppliers. Proximity of the supplier to the site achieved the lowest average rating in the supplier selection criteria section of this study's home-builder survey. This would be likely to be far more important in the case of wet concrete products, such as readymix, which have a limited distribution radius from the producer, due to the short timescale involved in hydration (setting of concrete).

8.1.4 Model of Structural Material Choice Processes

A model of material choice processes in construction was presented in Chapter 5, with its roots firmly laid in the organisational buying behaviour literature review and the study framework developed at the end of Chapter 3. The model reflects the core concerns of this research by displaying the levels of participation in the three stages of material choice processes and facilitates the presentation of the different criteria emphasised by various participants. Factors external to the individual development projects which impact upon the material choice processes are also featured in the model. These factors were briefly discussed in the construction industry review in the form of a residential construction industry PEST analysis (political, economic, social and technological factors).

In addition to displaying a summarised version of the study framework and findings, the study model provides a basis for further research. It could be extended in its application to both the social housing and single house sectors in a similar fashion to the speculative home builder survey, and developed within other areas of the construction industry, such as the commercial and civil construction sectors. The general framework in terms of stages and participation could be developed and tested in the context of other industries in order to ascertain its applicability to general organisational buying behaviour theory.

The model may have uses in practical terms by illustrating the importance of considering development projects as a key concept in the materials market, rather than concentrating marketing efforts on development firms or design practices. This allows marketers to focus on the needs of an individual project and to identify the key participants in each stage of the material choice process. Important progress could be made through the development of mechanisms to gain access to the entire team involved in a given project, possibly through presentations to the assembled development team during design or construction stage meetings.

Whilst it may be impractical to tailor marketing efforts to every individual project, particularly the single house developments, the research findings as displayed in the model, illustrate the diversity of participation patterns in different types of residential construction projects. With the aid of further research, it should be possible to develop a more complete picture of the criteria considered by the various parties involved in single house construction.

8.1.5 Structural Material Changes

The literature review highlighted divergent views on the effect of changes in the products purchased on organisational buying processes. Whilst this study does not endeavour to provide a definitive answer to the extent, if any, of the effect of such changes, some interesting insights were gained into the area in the course of the research.

Risk aversion and conservatism both from within the industry and amongst the general public appear to act as barriers to significant material usage changes in the residential

construction industry, as discussed in the interview findings. Whilst a number of interviewees identified conservatism on their own behalf or that of their organisations, most expressed the view that conservatism was more prevalent amongst other parties in the construction industry. A number of the architects pointed to the lack of willingness of developers to experiment with new materials and development systems on the grounds that the traditional materials and systems have worked effectively to date, and as such there is little need to alter them. Some of the interviewees suggested that this is particularly the case with the older more conservative generation of developers and that certain younger developers are more open to innovation in design and materials. On the other hand it was also suggested that architects are averse to change due to the perceived long term risks associated with material or system failure in relation to housing they designed and certified. A further suggested impediment to material change is that the general public are very conservative in their vision of housing. Thus, it is suggested that the risks associated with altering materials are not on technical grounds but rather stem from the concerns regarding saleability. This is particularly the case where structural materials are visible and thus have an aesthetic effect on the finished property.

The developments examined in the interview phase of this study support a view expressed by some of the interviewees that one-off or owner developed houses offer the greatest scope for changes in materials and the adoption of innovative design and construction systems. This may be due to the greater scope given to architects in these circumstances, allied to the desire of such developers to produce a unique or custom built house. As suggested in the interview findings, buildability and cost and time restraints are often not as important in these circumstances, as owner developers often lack the experience to spot design items which will create cost and time difficulties during construction.

Material changes appear to be more driven by regulatory and cost criteria rather than by design innovation in the speculative sector. This can be witnessed by the fundamental lack of variation in the form of house construction over the last 60 years. The main changes to occur relate to the increased thermal insulation requirements, which have led to the introduction of double glazing and the addition of a layer of insulation in the walls and ceiling, however few fundamental material changes have occurred. Concrete and brick continue to form the primary external wall materials. Timber trusses and concrete tiles or

asbestos slates are almost universally used in the roof structure. While insitu concrete ground floor and suspended timber upper floors remain the predominant flooring systems (Dunne, 1991).

A further disincentive to material changes arises out of the increased supervisory workload associated with the adoption of a new material or system, as was indicated by a number of the interviewees. The site management and designers often have to expend considerable time ensuring that a new material is installed properly and ensuring that the subcontractors understand the repercussions of the new material. New materials can have an effect on the development programme as a whole, which may mean delays or adjustments in the established order of works, or may even mean the elimination of a given trade within the development process. Thus the need for labour and tradesmen may alter or even be eliminated, which can cause labour relations difficulties. The widespread adoption of a new material may result in the need to develop a pool of new tradesmen. As such any new material or system should endeavour to feed with relative ease into the existing skill base of tradesmen, with the minimum of disruption to the established development programme. A new system which requires significant new skills for erection on site will generally be very difficult to establish, and needs to be introduced slowly, with strict supervision, so as to ensure that quality workmanship is assured. The long term reputation of a system or building product is dependant upon its durability and if installed incorrectly even the best products may end up failing. This is a difficulty many new building products face, as once the product arrives on site, under the current system, generally the manufacturer cedes control over installation to the developer or his subcontractors.

Bounded rationality and incrementalism are features of buying processes according to the satisficing model (Robbins, 1988 &1996) as discussed in Chapter 3. The very limited amount of change in structural materials and adherence to the traditional development system in recent years as highlighted in the interview findings would appear to correlate with this theory. Buyers rarely seek and evaluate all possible alternatives in any given purchasing situation, but rather seek solutions that lie close to the tried and tested methods.

Two timber specific material changes were explored in the study. The first relates to industry opinions on Irish timber compared to imported timber. This is important in view

of the growing substitution of imported structural timber with Irish, as noted in Chapter 2. The second relates to industry views on the timber frame development system, which is slowly gaining market share in the Irish market.

8.1.5a) Irish Timber

Evidence from the interview analysis would indicate that while many participants in the industry view Irish timber as acceptable once it meets the relevant standards such as SR11 and strength class, there remains a hardcore who still refuse to use Irish timber. Most interviewees felt that imported timber remains superior to Irish timber and the survey findings would appear to support this view.

Whilst no comparison of relative pricing on the ground was undertaken in the course of this study, it would appear from the survey results that in Ireland the main advantage Irish timber holds is its price. There are a considerable number of developers who feel that once timber meets the minimum standards necessary, price becomes the defining factor. This can be seen from the survey results, in which 40% (19) of respondents felt that the price of Irish timber was better than imported, while no respondents felt that structural integrity, consistency of quality or kiln drying was better. In fact the majority of respondents felt that Irish timber was worse on the former two bases, yet over seven out of ten respondents professed to using Irish timber for structural purposes. It should again be noted that the respondents to this survey were senior management of residential development firms, who indicated in 62% of cases that the role of decider in terms of the choice between imported and Irish timber was undertaken by themselves.

Structural timber usage in new Irish residential construction was estimated in Chapter 2 of this study at approximately 290,000 cubic metres (m^3) for 1995. This estimate was based on the researcher's calculations of total structural timber usage in a standard Irish house as 10.5 m^3 and the housing construction statistics for 1995 (DOE, 1996). The sample bill of quantities for a 'typical Irish house' was provided by Dunne (1991), in his study of the economics of constructing energy efficient housing. It is acknowledged that this estimate is approximate, and that no specific allowance has been made for the unknown number of timber frame houses, and that an estimated fraction was applied to apartments.

Nonetheless, the estimate provided in Chapter 2 of this study is the first end-user-based estimate of timber usage in any sector in Ireland, which had been recognised by Murphy (1996) as a major gap in the information available on the Irish timber market.

Builders' providers form a vital link in the structural material supply chain, particularly in the supply of timber products. Their role is to supply a range of different products, both imported and domestic, and advise on the quality and suitability of given products. For this reason, they have a degree of influence in the decision to use Irish or imported timber products. Some builders' providers are now developing additional services to developers in an attempt to improve their integration into development programmes. For instance one such provider now takes a copy of the specifications for each house type a developer includes in his developments, as indicated by the quantity surveyor interviewed in regard to the speculative housing development. This allows the site management to order materials for a given number of a given type of house, to be delivered in accordance with the development programme. So instead of the site manager needing to order a certain number of roof trusses and floor joists, for instance, the provider will automatically know the quantities of each element required, once he is informed of the construction stage that each house is at. This form of value added service is important in terms of maintaining their role in the supply chain, as other materials are primarily supplied directly from manufacturers, such as concrete blocks and readymix concrete. As the Irish market becomes more accepting of the improved quality of Irish timber products, it is possible that some of the larger sawmills will attempt to provide a complete production and distribution system. This could reduce or even eliminate the need for builders providers in the structural softwood market. Indeed the supply chain management literature cites the importance of developing additional services to customers in order to move towards stronger relationships, which is of importance to both manufacturers and builders providers if such a battle for dominance in the supply chain begins (Stuart, 1997 and Martin & Horne, 1992).

8.1.5b) Timber Frame Construction

Timber frame construction is a minority residential development system in Ireland and has been struggling to gain market share from the traditional blocks and mortar system for a

number of years, as indicated in the interview findings. Timber frame manufacturers have estimated that it now accounts for around 10% of new residential construction although this estimate is far from definitive, as discussed in Chapter 2. This estimate represents a substantial increase in usage since 1993 when the last official survey of material usage in residential construction indicated that 3% of new houses used timber frame (Ryan and Leahy – DOE, 1995).

The views expressed by interviewees varied widely in relation to timber frame construction. Most were reluctant to use this system in favour of traditional blocks and mortar for a variety of reasons including:- the perception of inferior fire resistance and quality standards, higher cost, and the traditional preference for more 'solid' blocks and mortar construction. The main factors mentioned as driving the current increases in timber frame usage were: the shortage of bricklayers, greater energy efficiency, and speed of construction. The homebuilder survey highlighted speed of construction as a major perceived advantage of timber frame, as considerable time savings can be achieved through the use of this system: The load bearing timber frame of the structure can be erected in a mater of hours on site, which allows the internal works and roofing to commence in parallel with the construction of the outer leaf of the external walls, which would not be possible with the traditional blockwork load bearing system. However, a considerable impediment to the widespread adoption of timber frame was noted in the interview findings and reinforced by the survey results, which showed that around half the respondents rated the saleability of timber frame houses as being worse than traditional construction. The most important aspects for speculative developers to emerge from the interviews, in relation to new materials and systems, relate to the creation of savings in cost or time to the developer, while not adversely effecting saleability. As already stated, a number of the interviewees could not think of any changes in materials or development systems in recent years. This might be explained to some degree by the fact that the various innovations in materials and development systems, which have occurred in recent years, appear to have endeavoured to fit in with the conventional housing appearance. For example timber frame housing is increasing in market share, yet it has little or no distinct image of its own. It appears that the timber frame industry has endeavoured to hide the fact that it does not incorporate conventional concrete blockwork inner leaf wall construction. If timber frame is to gain a sustainable share of the market, it is recommended that ways of

building its own aesthetic image are examined.It has been suggested by Smyth et al. (1997) that house buyers in the UK are interested in increased energy efficiency in residential construction, however any additional capital costs must be offset by energy savings within a 3 year payback period. Any campaign to significantly increase timber frame's share of the speculative housing market will need to highlight the speed of construction to the developers, while highlighting the energy efficiency advantages to consumers. In the short term the current shortage of bricklayers is an important driver, as highlighed in the interviews. However it is dangerous to rely heavily on this factor as it is unlikely that the current shortage will last in the long-term. In the short to medium term FAS and the CIF are attempting to address the issue through training programmes, and recruiting abroad.

Some of the less conservative development firms have shown a willingness to test and ultimately construct developments using the timber frame system in recent years. However, other systems such as the concrete 'eco-house' system as developed by CRH and Bretan and constructed on a trial basis by Manor Park Homes, have thus far been unsuccessful in gaining market share. In fact, both precast concrete and steel frame housing systems appear to be making little or no impact on the market to date, on the basis of the interviews and general market information. There are signs of moves afoot in both areas to attempt an assault on the housing market. Both systems are likely to experience considerable barriers due to conservatism and cost, be it driven by builders, developers, designers or end-users as already discussed.

8.2 Limitations of the Study

Like all research work this work has its limitations based on such issues as the time and resources available, the methodology chosen and the experience and expertise of the researcher. Many of these issues have been discussed at various points throughout the study, however, it is important to reiterate these points in advance of making recommendations. Firstly, the primary aim and objectives of the study are exploratory in nature, although the less-dominant survey objectives are descriptive in nature. For this reason the emphasis must be on the drawing of tentative conclusions, some of which have been strengthened through the survey findings. The selection of developments in the dominant interview phase was not by random sampling, but rather by a process of

purposive and snowball sampling. This facilitated the inclusion of a wide range of targeted conditions or development types in the research, and allowed the researcher to provide a context rich description of the environment within which organisational buying processes occurred. Describing the context of each the five subject developments in terms of organisational and constructional factors, facilitates the reader in judging how applicable or transferable the research is to a given situation.

The researcher's own involvement is an intrinsic part of qualitative research methods. For this reason, it is important to acknowledge the inseparability of the researcher and the completed research document. It is therefore beneficial to remind the readers of the researcher's background and potential biases, in order to aid an assessment of the worth of the study findings and to assist future researchers who may wish to replicate any part of the study. The researcher initiated this study with some knowledge of both the timber and construction industries, having studied at undergraduate level in the Department of Surveying, DIT Bolton Street, and having undertaken an undergraduate thesis on the viability of forestry as a land use. From this background, the study had a strong industry orientation. While perhaps not without its disadvantages (for the example, the need for the researcher to change theoretical orientation in pursuit of a relevant research problem) this industry orientation was considered beneficial. It assisted in gaining a strong knowledge of both the timber and construction industries needed to establish and maintain credibility with industry respondents during primary research. This facilitated the emergence of various new perspectives, which may not have been forthcoming if the researcher had been unable to sustain reasonably technically based interviews.

The less dominant mail survey phase of the study concentrates on a small sector of the parties involved in the residential construction industry, in order to extend various aspects of the topics explored in the interview phase. The homebuilder survey relates specifically to speculative residential developers, who were registered members of the Irish Home Builders Association in the Dublin area, in July 1997. The survey does not purport to represent the views of a broad spectrum of those involved in the construction industry but rather it serves as an illustration of the potential avenues of extension emanating from this study. It also demonstrates the difficulties involved in conducting a quantitatively based

study in the construction industry, as it illustrates the problems associated with accessing suitable respondents.

The use of three participation levels (involvement, decision makers, influencers) was considered to be more flexible and appropriate in the interview environment than attempting to introduce a rating system. In retrospect for ease of analysis and comparability with previous organisational buying studies it may have been more prudent to use a two dimensional differentiation of participation levels, such as indirect and direct involvement, or involvement and influence. This is qualification relates specifically to the less dominant survey phase, as the presentation of three levels of participation in the questionnaire may have been confusing and overly complicated for respondents. As noted in the survey findings (Chapter 7) some degree of tailing off in the average number of parties identified as participants in each of the selected stages and steps of material choice processes was found. This may have indicated some level of fatigue on behalf of the respondents as they progressed through the questionnaire.

As discussed in Chapter 4, combining of research methods can be viewed as an undesirable or even inappropriate endeavour in research studies on the grounds that some qualitative and quantitative purists express the view that the assumptions underlying each are incommensurable (e.g. Guba, 1987). Perhaps more relevantly the methodological discussion revealed that there can also be significant difficulties in analysing and drawing together conclusions from a combination of methods. In this study, the combination of a dominant interview phase and a lesser dominant mail survey was undertaken on pragmatic grounds. As argued in Chapter 4, it was considered as an appropriate mode of exploring and extending various aspects of the study. The survey builds on specific elements of the data gathered in the interview phase in a complimentary manner.

Some consideration of the decision to concentrate on processes rather than relationships in organisational buying has already been mentioned, however, it is important to reiterate the rational underlying this decision. It was felt that the construction industry was not the most advanced industry in the drive towards the development of strategic partnering or in championing relationships with suppliers. The residential construction industry in Ireland comprises of many small scale developers (the average number of individuals per firm in

the survey respondent firms was under 12), which are generally run by builders with limited knowledge of strategic management or relationship marketing. The interview finding appear to justify the concentration on processes as little evidence of strong relationships between developers and material suppliers emerged.

Whilst some discussion of the effect of risk associated with material changes was undertaken in this study, little was done to explore the various types of risk and their effect on participation. Equally, conflict and power received little attention in this study, although they are acknowledged as fundamental constituents of organisational buying behaviour (Sheth, 1996 & Johnston and Lewin, 1996), as briefly discussed in Chapters 3 and 5. The motivational factors involved in participation or non-participation in material choice processes has not received any attention in the context of material choice processes within this study, however Chapter 3 briefly addresses individual motivational factors.

While many of the limitations of the research have been reviewed in this sections some limitations will again be revisited implicitly in the suggestions for further research offered in the next section of this chapter.

8.3 Recommendations and Suggestions for Further Research

The need to develop a firm understanding of organisational buying behaviour is well established in most industrial markets, yet there has been a dearth of research undertaken, and information available on the nature of buying behaviour in the construction industry, as discussed in Chapter 3. This study aimed to address this problem by exploring structural material choice in Irish residential construction. Various aspects were explored and insights produced, however, the research highlighted the need for considerable further research. The following recommendations sections outlines a broad array of such research opportunities.

8.3.1 Participation

Participation in material choice processes needs to be understood by those wishing to provide goods and services to the construction industry. It is crucial to recognise that

participation differs across a myriad of parameters including:- development projects; type, importance and newness of product; and stage of buying process (Johnston and Lewin, 1996). From the research findings a number of recommendations can be made regarding participation in structural material choice processes.

As the research would suggest that type, scale and location of developments along with type of developer influenced buying behaviour, material suppliers might consider segmenting the market in various ways. It is suggested that segmentation of the residential construction industry could be undertaken on a number of dimensions such as:- apartments or houses; speculative, social or owner-developed; urban or rural; and small, medium or large scale developments. While it is felt that this form of segmentation would be relatively effective in targeting the residential materials market, it is suggested that where possible material suppliers should endeavour to understand the market on a development specific basis. The diversity in participatory patterns and organisational structures highlighted in each of the developments featured in the interview phase would indicate that each development project should ideally be treated on a stand alone basis. This ties back to the organisational perspective of Thompson (1996) and others who proposed the concept of temporary project based networks as the foundation of modern construction organisational structure, as discussed in Chapter 3. The recent upsurge in research activity in the U.K. relating to organisational structure in the construction industry opens a number of avenues for comparative studies to be undertaken in the Irish context, which would assist aid material suppliers' understanding of their target market. The interview findings would suggest that suppliers wishing to introduce a new material or development system, or increase the usage of their material, should concentrate specifically on identifying and influencing participants in the material selection stage.

The Irish timber industry is relatively fragmented when compared to the steel and concrete industries, in so far as there are a very large number of groups involved in the supply chain - from foresters to builders providers (See Chapter 2). Whilst Coillte currently produces the vast majority of roundwood in Ireland, there are now thousands of private forestry owners in the country, who will change the landscape of the roundwood supply chain considerably in the next 20 years. There are between seventy and one hundred sawmills and four boardmills in Ireland. It is in the interest of all these parties to influence the material

selection stage in order to maximise timber use in construction. For this reason, it is recommended that a combined effort be made by the various representative bodies, including the Irish Timber Growers' Association, Coillte, and the Irish Timber Council, with the co-operation of builders providers, to market the use of timber in construction. From the analysis of this research the most important stage to target in such a campaign would appear to be the material selection stage and the participants therein.

Indications from the interview and survey findings would suggest that development firm senior management dominate the material selection stage, with variable levels of input from designers, such as architects, engineers and quantity surveyors. However, specification stage decisions appear to involve designers to a greater degree. For this reason, it would appear to be particularly important for material suppliers to influence the key participants in both the development firms and the design consultancies in these stages. Some evidence arose from the interviews that the specification decisions may involve lower ranking personnel within the development and design firms, as these details could be considered as relatively routine. For instance in the case of the speculative apartment development it was indicated that initial development concepts and sketches were developed by the senior management of the development firm and a partner in the architecture practice. These sketches would largely determine the materials used. However, the planning and working drawings and the bill of quantities were developed by the in-house development firm quantity surveyor in conjunction with architectural technicians, draftsmen and structural engineers, under the supervision of the more senior management. It is therefore, recommended that attempts by material suppliers to influence material specification stage decisions be targeted in such a way as to reach not only the senior management, but all those involved in the design and specification stages of individual development projects. From this perspective it is recommended that consideration should be given to attempting to targeting marketing activities at design stage meetings, where the development firm management and design team members are all present.

The interviews highlighted the impact of the use of labour and materials contracting in terms of removing significant parts of the material choice process from the direct control of the developer. This leads the researcher to recommend that further research be undertaken to discover the extent of outsourcing of both design and construction works within the

construction industry. Whilst the home-builder survey in this study illustrated this point, considerably more research is required. It is important to discover the impact of outsourcing of both construction and design functions on the participatory aspects of organisational buying behaviour. The degree to which labour-and-materials contracting is used in construction should be monitored closely by material suppliers, as any changes in this regard could result in a significant change in the composition of the decision-making unit in supplier selection decisions.

Ongoing relationships between developers, designers, contractors and material suppliers were highlighted by a number of interviewees as being of particular importance in the development process. It is therefore recommended that relationships between developers and both design consultants and subcontractors should be explored in terms of duration and strength, in order to assess the degree to which such relationships follow through from one development to the next. An interesting contrast could be drawn between local authority developments, where there is limited scope for ongoing relationships due to the tendering process, and speculative developments, where developers are free to select the desired development team. Such comparison may lead to interesting insights into the effect of ongoing relationships in terms of the participation of non-development firm parties in material choice processes.

As discussed in the interview analysis (Chapter 5) it would appear that the move (see for example Tanner, 1999) towards examining relationships rather than processes or buying centres in organisational buying theory is not easily applied to the Irish residential construction industry at this stage. The primary reason, in the view of the researcher, is the continued emphasis on the internal organisation - albeit a dynamic or temporary project based organisation (as for example described by Thompson, 1996) - rather than on alliances with suppliers or formalised cross-functional supplier teams (see Sheth, 1996). This may largely be due to the small-scale nature of most of the residential development organisations involved in Irish residential construction. Whereas a lot of the organisational buying research is based on large scale corporate style organisations, who are likely to be at the forefront of strategic restructuring of the nature discussed. However, as is indicated above there may be considerable scope for integration and greater mutually beneficial communication channels to be developed between development team members and

material suppliers. The area that offers particular leeway for the development of such relationships is the timber frame sector. As speculative developers become accustomed to using this system there may be considerable benefits for all parties involved to improve the level of integration. The frame manufacturers need the co-operation of all development team parties in order to initially design the structures in the most efficient manner possible, and then to erect the structures on site. As timber frame gains share in the speculative development sector there is a very rich vein of research opportunity opening for organisational buying / relationship marketing / supply chain management researchers to tap into.

As already mentioned in the limitations, little was done to explore the various types of risk, conflict and power and their effect on participation, or indeed on the motivational factors involved in participation or non-participation in material choice processes. While the relational based stream of research down-plays the importance of individuals in organisational buying, Tanner (1999) argues that sight should not be lost of the impact of individuals and groups in organisational buying. These are particularly interesting areas for further research within the construction industry, particularly in view of degree of reliance on outsourced labour and consultancy, which can lead to heightened conflict within the development team. As noted in the analysis of the interviews such heightened conflict was alluded to by one of the interviewees in his description of the distinctions between developer led and contractor led developments.

The level of end user input into material choice processes was shown to vary widely in the developments examined in the interview stage of the research. In particular the speculative development sector appears to offer little scope for involvement from their customers, the end users. The opportunity for developers to accommodate such input has increased significantly in recent years due to the prevalence of off-the-plans sales of residential units, in advance of actual commencement of construction. There is little information or research available on consumers' knowledge of, or attitudes towards, structural materials or development systems. Recent studies (Shinnick, 1997 and Conniffe & Duffy, 1999) of the factors affecting the price of Irish housing found some variance due to the use of different finishes, sizes, number of rooms and density of houses. However, no effects of variations in structural materials were investigated in these studies. It is recommended that research

be conducted in order to ascertain the importance of structural materials to consumers, and to assess the feasibility of tailoring speculative housing design and construction to the desires and requirements of individual end users.

The UK house building industry has become far more customer orientated in recent years and a number of building firms are now actively researching their markets (Smyth, 1996). Evidence of this increased awareness of customer needs and marketing generally within the industry can be witnessed by success of the annual National and International Construction Marketing Conferences in Oxford and Leeds respectively. Similar research, where it exists in Ireland is generally haphazard, informal and unpublished. The interviews would suggest that in many cases builders rely on feedback from estate agents rather than directly from their customers. This is insufficient, as estate agents are often only involved in developments for the final completion and disposal stage and are primarily concerned with selling the individual dwellings not ensuring the sustainable future of the development organisation. In a time when customer service and the development of ongoing customer relationships is considered as crucial by most industries, the construction industry remains relatively unconcerned about long-term customer care. The number of times individuals change houses over the course of their lives is increasing rapidly (Finnegan, 1997 and Smyth, 1997), which increases the importance of developers attempting to establish and maintain long term links with their customers. The current buoyant market is unlikely to last for ever and when recession hits builders' reputation will be a crucial factor in deciding which firms survive and which perish. For this reason it is recommended that the residential construction industry adopts a stronger marketing focus, and attempt to develop understanding and ongoing relationships with its customers.

Allied to the various research opportunities already mentioned, it is suggested that a longitudinal case study methodology could be adopted in order to provide a more comprehensive and context based report of the nature of decision making in material choice processes. This study examined material choice processes on the basis of participant accounts in single sitting interviews, at a specific point in time, after the completion of the subject developments. It is suggested that a case study approach could afford the opportunity for a researcher to explore and observe the unfolding of material choice processes and thus reduce the potential biases which may arise from participant accounts.

Such an approach has long been recommended by organisational buying researchers, however access to suitable organisations can prove a large impediment to the use of longitudinal case studies (Tanner, 1999). The researcher experienced considerable difficulty in locating and achieving agreement from parties involved in suitable developments for single sitting interviews. It is therefore suggested that considerably greater difficulty would be experienced in attempting to gain ongoing access to suitable organisations. For this reason it is recommended that such research should be undertaken by a researcher with excellent contacts in the construction industry.

There are an array of potential survey based extensions of the current research. In particular the survey could be extended to speculative developers outside the Dublin area and to other groups in the residential and commercial construction industries, such as architects, engineers, quantity surveyors, subcontractors, and site management. This would facilitate the broadening of the picture of both participation and criteria in material choice processes, as the results of the survey incorporated in this study are limited due to the restrictions associated with the use of respondents from one particular background.

8.3.2 Structural Material Choice Criteria

The material choice criteria to emerge from the interviews and their subsequent rating by speculative residential developers in the Dublin area, provide interesting insights into the different perspectives of those involved in material choice processes. Some tentative recommendations are forwarded based upon the criteria related findings.

It is recommended that further research be undertaken to collate a broader picture of material choice criteria, through the execution of surveys of other construction industry participants, such as local authorities, single house developers, and design consultants. This would assist material suppliers to develop marketing strategies targeted at different groups or segments of the construction industry.

The survey findings highlighted the dominance of the cost / return based criteria over the quality based criteria such as robustness and building life in material selection which

would appear to confirm a suspicion highlighted in the interviews that speculative developers are primarily concerned with profit maximisation. This points to the necessity of maintaining and continuously monitoring material and construction quality on development sites.

Similarly, the low average rating attributed to environmental friendliness and energy efficiency, by speculative developers, points to the need introduce either incentives or improved regulations in order to develop better standards on these fronts. The Department of Environment will need to take the lead in pushing up thermal and acoustic insulation and material recycling standards in order to meet the growing awareness of the need for sustainable development.

The interviews indicated that architects put a heavy weighting on Building Regulation compliance in material choice, whilst only one of the developers interviewed mentioned it. Although it did receive the highest average rating in the timber specification criteria section of the survey. Remaining with the changes needed in the regulatory structure governing construction, it is recommended that the onus to certify Building Regulation compliance be removed from architects involved in the design of a given development. Whilst the onus should remain with designers to ensure that their designs comply with Building Regulations, there is a potential conflict of interest in architects or engineers certifying compliance of building works. This is due to the pressure which designers may feel they are under to certify substandard construction, in view of the natural desire to avoid undermining an ongoing relationship with developers. Perhaps regular spot checks undertaken by an independent body or local authority inspectors could be introduced to ensure and certify compliance. Such a system could be used to police material and constructional quality in addition to monitoring improved insulation standards as already recommended.

The differences in criteria between speculative developers, the local authority, and single house owner-developers, as highlighted in the interview findings, offers a wide range of

opportunities for further research. It is imperative that material marketers are aware of the differing criteria that may concern each individual actively participating in material choice process decisions.

8.3.3 Structural Material Changes

Any change in development system, such as a move to timber or steel frame construction, could result in significant changes in the composition of the building team and material suppliers, and may result in the appointment of specialist design consultants. This area requires further research, as it has been suggested in buying behaviour literature that the newness of a purchase situation (Robinson, Farris and Wind, 1967), its complexity (Lemann and O'Shaughnessy, 1974) and its strategic importance (Gopalkrishnan, 1996 & Bunn, 1993), all effect the nature of buying processes (Dholakia et al., 1993). Further research could explore the effect of a material system change on organisational buying behaviour, from the perspective that it represents an instance of 'newbuy' in the Robinson Farris & Wind's 'buyclass' classification. It is suggested that a case study methodology undertaken in the context of a development organisation embarking on such a change would yield rich and insightful information on the participatory, power and conflict dimensions of organisational buying behaviour, as already suggested in regard to timber frame. Lesser changes such as the adoption of pre-insulated concrete blocks, or the change from imported timber to Irish timber could be viewed as 'modified rebuy', as they represent a variation on the existing norms in material choice. Again, some interesting research could be generated from the study of such material changes. While Dholakia et al. (1993) found that the 'buyclass' variable remains valid, such research could add to the unresolved issues regarding the effect of 'buyclass' on organisational buying behaviour and would also be useful to marketers involved in the structural materials market.

This study did not examine at the comparative costs of different structural materials, so it is difficult to assess the effects that volatility in timber prices have on its use. In the US the high price of timber (lumber) in recent years led to a search for alternative materials (Spelter, 1996), resulting in significant increases in use of steel frame housing (Pieters, 1996). There is scope for further research into the effect of price volatility both directly and indirectly attached to the use of given materials in the Irish context. This is particularly

pertinent given the degree to which labour shortages appear to be inflating the costs associated with the use of certain materials, such as concrete blocks, as highlighted in the interview and survey findings.

8.3.4 Timber Frame Construction

Timber frame construction appears to be growing in acceptability in certain areas of the country. Initially, it appears that single house owner-developers were the main sector driving the adoption of the system, largely due to speed of construction and thermal efficiency. The shortage of tradesmen in many areas is also likely to have been a significant factor in its growth. Its more recent adoption by speculative developers in specific areas of the country, such as Kildare and Portlaoise, again appears to be driven by shortages of certain tradesmen. The research contained in this study has a strong weighting towards the Dublin area, due to the concentration of the interviews and the survey predominantly in Dublin, where the adoption of the timber frame system is very slow. However, a number of interesting observations and views on the system leads the researcher to make a number of recommendations.

From the viewpoint of those advocating timber frame there is a need to improve the image of timber frame, which suffers from some negative perceptions amongst a number of the parties interviewed. The survey highlighted a significant problem for the system amongst Dublin based speculative developers, who largely feel that the system adversely affects the saleability of houses. Research is required into the perceptions amongst the general public of the system in order to address this concern held by developers. Firstly, the perceptions of structural quality need to be discovered and secondly the perceived effects on resale of houses constructed using this system should be explored. Another interesting research opportunity lies in the exploration of attitudes of valuation and structural surveyors regarding timber frame construction. They hold a significant degree of influence in relation to lending institutions' policy on the suitability of property as security for mortgage lending purposes.

A further avenue of market research which could benefit the timber frame industry is in regard to the views of existing occupiers of timber frame houses to explore the primary

reasons for their decision to purchase or build timber frame houses and to discover their current views on the system. Existing occupiers are likely to form a significant source of influence for others considering building or purchasing timber frame houses and as such they are an important reference group whose views should be monitored.

The timber frame industry needs to develop both public and construction industry awareness of the major advantages of the system, rather than relying on the shortage of tradesmen as a driving force to the adoption of the system. A downturn in construction industry activity would be likely to result in the reversal of such shortages and could lead to a reversion to the traditional blocks and mortar system of construction. In order to maintain and increase its share of the construction market it may be necessary for timber frame to develop a distinct image of its own, as suggested in the interview findings. Current developments using the timber frame system appear to endeavour to conceal the use of the system by maintaining the traditional brick/blockwork outer leaf in external wall construction and generally leaving little or no evidence internally of the system. The risk involved in this strategy is that it can be interpreted as an attempt to conceal the fact that timber frame was used, and thus raise questions as to its desirability if it needs to be disguised. This can be contrasted to timber frame construction in many other parts of the world, where timber is used extensively in the construction of the outer facade.

The interviews highlighted some fears expressed by industry participants about the lack of expertise amongst developers, contractors and designers in the use of timber frame. Timber frame manufacturers need to ensure that their systems are erected properly by builders, and that the vapour barrier remains intact throughout construction. The system is particularly susceptible to damage by the various tradesmen involved in its construction and unless there is sufficient training of tradesmen involved, there is a clear danger of damage being caused to the frame. Such damage can cause significant structural difficulties down the line. This was highlighted by a 'Panorama' documentary in the 1980's in the U.K., which pinpointed a number of such problems, and resulted in considerable damage to the timber frame industry for a number of years.

In view of the likely future emphasis on sustainable development and a move away from the use of our finite resources, such as iron, and concrete products, timber based

construction systems are in a strong position to capitalise. Timber is the only major renewable resource available in the structural materials market. The thermal insulation qualities of timber are undoubtedly a considerable strength in its future marketability. Despite the low average rating of environmental friendliness and energy efficiency amongst speculative developers surveyed, timber frame manufacturers should continue to market their products on these strengths as they are likely to prove to be fundamentally important in the medium to long term.

While the main timber frame manufacturers, the Timber Research Centre and DIT are examining and researching the possibility of using Irish timber in timber frame structures, it is still predominantly imported softwood that is used. In view of the survey results, which indicate that the majority of Dublin based speculative developers feel that timber frame will increase or vastly increase in market share, it is crucial that the Irish timber industry continue to push for market presence in this area. The current situation where the vast majority of structural timber used by timber frame manufacturers is imported must not continue, if Irish timber is to maintain its share of the market.

8.3.5 Irish Timber

Irish timber has gained considerable ground in the battle for share of the Irish structural timber market, as discussed in Chapter 2. However, a number of issues arose in the course of the research, which lead to the following recommendations.

Despite the perception of Irish timber as being of lesser quality than imported timber on a number of fronts, as highlighted in the interviews and underlined by the speculative developer survey, most developers interviewed/surveyed professed to using Irish structural timber. It would appear that the primary perceived advantage of Irish timber is its price. From this basis it is recommended that Irish timber processors ensure that they maintain their price competitiveness. The development of SR11, the Irish structural timber standard, has been an important element in the growth of Irish timber's share of the structural timber market. This has provided specifiers with a quality standard to which structural timber must comply. The introduction of Common European Standards (CEN) will present a new challenge for the timber industry. Early compliance and adoption of these standards will be

of benefit to the Irish timber industry both domestically and in the U.K. and European export markets.

The Irish timber quality image problem might be addressed at a central level by Coillte, the Irish Timber Growers Association, and the Irish Timber Council in order to develop a co-ordinated approach to quality management, while maintaining their cost competitiveness. Such an approach should attempt to address the primary concerns of interviewees and respondents as outlined in Chapters 5 and 7 while retaining the all important cost advantage. Improvements in quality should assist in displacing the remaining imported structural softwood in the Irish market. The role of builders providers should be carefully assessed by timber industry participants in order to ensure that any benefits which may accrue to them through the sale of imported softwood are matched or bettered by the Irish industry and their products. They emerged as influencers in various stages of material choice processes in some a couple of the subject developments, and their influencing role was reaffirmed by the survey findings.

As already mentioned there have been no end-user-based estimates of timber consumption undertaken in Ireland. All existing consumption estimates have been generated from Coillte's estimates of domestic production and imports. This study has provided an approximate estimate of timber consumption in the Irish residential construction sector. Non-residential development is more diverse in terms of material use, scale and design, which makes the estimation of timber consumption more difficult. Nonetheless, it would be beneficial to the timber industry to initially develop a more comprehensive picture of end user based consumption in the residential construction sector and then to endeavour to extend this investigation into the non-residential, fencing, packaging and joinery sectors.

8.4 Conclusions

This chapter integrates the dominant interview findings and the less-dominant survey findings while drawing conclusions and recommendations from the overall study. The conclusions highlight the importance of understanding material choice processes as a primary concern for materials marketers. It is argued that process based exploration remains the most appropriate basis for examining the Irish residential construction industry

buying, despite the recent shift towards relationship and strategic partnership based studies by many organisational researchers. As recommended by Kauffman (1996:103) the study and this final chapter in particular integrates the study of more than one dimension of organisational buying behaviour through the exploration of participation, criteria and material change related dimensions. The survey helps to extend the investigation material choice processes from the viewpoint of speculative residential developer, which is often considered useful in this type of study (see for example Brannick, 1997 and Greene et al., 1989). It is suggested in the recommendations that the move towards timber frame construction and moves towards greater use of the labour-and-materials contracting system offers immense opportunities for further research into the construction industry.

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APPENDIX A

INTERVIEW INTRODUCTORY LETTER

Post Graduate Research Dept.,
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Dublin 1.
Phone 855 8445 / 2
E-mail monel@dit.ie
20th April 1997

Mr. {X},
{Y} Construction Ltd.,
{Address 1},
{Address 2}.

Dear Mr. {X},

I am writing to request your assistance in a research Masters, which I am currently undertaking, in the Dublin Institute of Technology, under the Strategic Research and Development Programme. {Mr. S. of S. and S.} recommended that I contact you.

The aim of this research is to provide an insight into the material specification process in the residential construction industry. A number of residential developments will be examined in order to represent different sectors of the industry. It is proposed to conduct interviews with various members of the development team, (i.e. the architect, the developer and the quantity surveyor) in order to assess the level of involvement or influence which each individual or organisation has in the material selection process. This information will be used in the development of decision making models for different residential development situations. The primary material selection criteria adopted by the various interviewees will be sought, particularly as they affect the use of structural timber in construction.

It is hoped that you would be willing to provide the time and information required for one of these studies, I am particularly interested in a speculative apartment development, which has recently been completed. {Mr. S.} informed me that your company is very involved in inner city apartment development, and I was hoping you would agree to discuss such a project with me. The duration of the interviews would be between half an hour and an hour, and will commence in June 1997. The timing and location of the interviews will be at the convenience of the interviewees.

The research is for academic purposes and the results will be included in a Masters thesis. None of the individuals or organisations involved in the research will be identified in the thesis, and only the general location of the subject developments will be provided. The co-operation of both yourself and other development team members in this study will be very much appreciated.

Yours sincerely,

Maurice O'Neill

APPENDIX B

SAMPLE INTERVIEW THEME SHEET

Sample Interview Theme Sheet.

1. Development Details

- **What were the main structural materials used in the construction of the following elements:**
  - **a)** External Walls
  - **b)** Internal Walls
  - **c)** Ground Floor
  - **d)** Upper Floors
  - **e)** Roof
- **What type and how many dwellings were involved in the development.**

2. Participation in Development Process Stages

- **What were the main stages in this development, and which organisations and individuals were involved at each of these stages.**

  Probes- 1) development initiation
  2) design
  3) planning
  4) construction
  5) sale/disposal of development units

3. Participation in Material Choice

- **Which parties were involved in:**

a) Structural material selection (choice between steel, timber and concrete in structural elements)

b) Structural timber specification (standards, dimensions etc.)

c) Structural timber supplier selection

- **Who/which parties were the ultimate decision makers in these stages.**

- **What individuals or groups would have influenced the decisions in these stages without having any direct involvement in them.**

4. Structural Material Selection Criteria

- **What do you consider as the primary criteria or factors influencing material selection.**
- **Do you feel that there are different emphasis on material choice criteria across:**
  - **a)** different professions and trades (architect, quantity surveyor, developer, contractor, etc.)
  - **b)** developer type (speculative, local authority, owner developer)
  - **c)** development type (apartment or houses)

5. Structural Material Changes

- **What are the main changes in structural material usage to emerge in recent years.**
- **How adaptive do you feel the industry is to new materials and methods.**
- **What are the primary constraints in regard to structural material changes.**
- **What are your views on timber frame development**
- **What are your views on Irish structural timber as compared to imported.**

APPENDIX C

SURVEY COVER LETTER

Post-Graduate Research Office
Dublin Institute of Technology

Maurice O'Neill
23 Mountjoy Square
Dublin 1.
Ph: 855 8442
August 1997

{Company Name}
Dear Managing Director,

I am a Research Masters student at DIT Mountjoy Square carrying out research on *"Structural Material Selection and Decision Making in the Irish Residential Construction Industry"*. I am writing to invite you to participate in this survey by completing the questionnaire provided.

The proposed research aims to develop a greater understanding of the decision making process and criteria involved in the various stages of structural material choice. It also aims to provide a general picture of structural timber usage trends.

Please be assured that all information received will be treated with the utmost confidentiality and any results will be stated generally and will not incorporate any company-specific information. A summary of the survey results will be available to you on request.

I am aware how valuable your time is, but by participating in the research you will provide a valuable contribution to the development of construction industry theory. Should you have any reservations or questions regarding the questionnaire, please do not hesitate in contacting me.

Yours sincerely,

_____
Maurice O'Neill

APPENDIX D

MAIL SURVEY QUESTIONNAIRE

Home Builder Survey

Maurice O'Neill
Post Graduate Research Department
DIT Mountjoy Square
23 Mountjoy Square
Dublin 1
Phone (01)855 8445
e-mail MONEL@DIT.IE

Home Builder Survey

1 Which of the following services and trades are undertaken on an in-house basis by your firm, and which are sourced externally. In relation to the trades please indicate (✓) whether labour only or labour and materials contracting is used in each case.

	In-House	Sourced Externally	Labour Only Contractor	Labour and Materials Contractor
Carpentry				
Blocklaying				
Roofing				
Ground Work				
Site Labour				
Plumbing				
Plastering				
Electrical				
Quantity Surveying				
Architectural				
Engineering				
Site Management				
Other (please specify)				

Notes and Definitions (Refering to subsequent questions)

Structural Materials refer to the materials used in the main load bearing elements of the structure (i.e. external and internal walls, ground and upper floors, roof and foundations).

Structural Timber refers to the timber used in these structural elements, most commonly being softwood joists, rafters, batons, purlins, and studs.

Material Selection refers to the stage where a choice between steel, timber, concrete, and masonry is made for the main structural elements.

Material (Timber) Specification refers to the specification of material characteristics such as dimensions, and standards.

Material (Timber) Supplier Selection refers to the search and selection process involved in procuring the specified materials.

2) Please rate (on a scale of 1-3) the involvement, if any, of the individuals or groups listed across the top, in the various material choice decisions listed down the left hand column.

Rating; 1 being an informal advisory role (influence);
2 being formally involved in the decision;
3 being the final decision maker/ratifier;
- please ignore if not involved

Decision Makers / Stages in Decision Making	Development Firm Senior Management	Quantity Surveyor	Architect	Contracts Manager	Purchasing Officer	Engineer	Site Management	Contractors and Tradesmen	Material Suppliers	Others (please specify)
Structural Material Selection										
choice between concrete, timber, and steel in structural elements										
Structural Timber Specification										
a) softwood or hardwood										
b) dimensions & standards (stress, strength, and moisture)										
c) type/species (pine or spruce)										
d) Irish or Imported										
Structural Timber Supplier Selection										
timber supplier selection										

3 The Matrix below lists a number of factors or criteria which may feature in the three main decision stages; the selection of structural materials; the specification of structural timber; and the procurement of structural timber. Please rate these factors in terms of importance (very important to very unimportant), as they feature in these decisions. (✓)

Importance Rating / Criteria / Factors	Very Important	Important	Neither Important nor Unimportant	Unimportant	Very Unimportant
Structural Material Selection Criteria					
Standardised Design / Familiarity With Use					
Building Cost / Return Relationship					
Reliability of Material Availability					
Availability of Tradesmen					
Appearance / Aesthetic Differentiation					
Energy Efficiency					
Robustness (Building Life / Maintenance)					
Environment Friendly (Green)					
Speed of Construction					
Buildability / Builder Friendliness					
Other (Please Specify)					
Structural Timber Specification Criteria					
Fire and Sound Insulation					
Strength Class / Stress Grading					
Timber Standards (e.g. SR 11)					
Building Regulations Compliance					
Kiln Drying and Pressure Treatment					
Moisture Content					
Cost					
Other (Please Specify)					
Structural Timber Supplier Selection					
Competitive Pricing					
Relationship / Past Performance					
Service Quality (delivery, order processing..)					
Reliability / Consistency of Product Quality					
Credit Terms					
Trust					
Proximity to Site					
Other (Please Specify)					

4 Timber Frame

a) Has your firm used timber frame construction yes ❑ no ❑

b) Has your firm considered using timber frame yes ❑ no ❑

c) How would you rate timber frame compared to traditional 'bricks and mortar' construction on the following parameters (i.e. timber frame is.....)

Construction Costs	better ❑	same ❑	worse ❑
Speed of Construction	better ❑	same ❑	worse ❑
Saleability	better ❑	same ❑	worse ❑
Buildability	better ❑	same ❑	worse ❑

d) Do you think timber frames' share of the residential construction market will

vastly increase ❑ increase ❑ stagnate ❑ decline ❑ vastly decline ❑

Why .....

5) Irish Timber

a) Do you use Irish timber for structural purposes in your developments yes ❑ no ❑

If no, please give reason .....

b) Would you feel that there is any difference between the quality of Irish and Imported structural softwood yes ❑ no ❑

If yes please specify .....

c) How does Irish structural softwood compare to imported on the following parameters

	Better	Same	Worse
Kiln Drying	❑	❑	❑
Structural Integrity (warping, bending, shrinking)	❑	❑	❑
Consistency of Quality	❑	❑	❑
Price	❑	❑	❑
Availability	❑	❑	❑
Load Bearing Capacity	❑	❑	❑
Product Appearance	❑	❑	❑

6) Organisation Details

Is your Firm primarily involved in

a) Developing ❑ Contracting ❑

b) House Building ❑ Apartment Building ❑ Apartment and House Building ❑

Non Residential Construction ❑

c) Private Housing ❑ Social Housing ❑

d) Large Scale Developments (over 50 dwellings) ❑ Medium Scale (11-50 dwellings) ❑

Small Scale Developments (1 to 10 dwellings) ❑

e) Upper End of Market (prices over £150,000) ❑ Mid-market (£80,000-£150,000) ❑

Lower Market (under £80,000) ❑

f) Dublin and Surrounding Counties ❑ Nation-wide ❑ International ❑

g) What is your Position within the firm _____

h) How many People are directly employed in the firm _____