# An evaluation of how VfM can be achieved from a government's perspective in relation to school building projects in Ireland.

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**An evaluation of how VfM can be achieved from a government's perspective in relation to school building projects in Ireland.**

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# List of Abbreviations

BBC       -       Basic Building Cost

BSF       -       Building Schools Future

CSF       -       Critical Success Factors

CSO       -       Central Statistics Office

D&B       -       Design and Build

DART       -       Design Awareness Research and Technology

DoE       -       Department of Education and Skills

EIB       -       European Investment Bank

EWA       -       External Works Allowance

GCCC       -       Government Contract Committee Contract

GIS       -       Geographic Information Systems

GRD       -       Generic Repeat Design

INTO       -       Irish National Teachers' Organisation

NDP       -       National Development Plan

OECD       -       Organisation for Economic Co-operation and Development

PMBOK       -       Project Management Body of Knowledge

POE         -         Post Occupancy Evaluation

PPP         -         Public Private Partnership

RIAI        -         Royal Institute of the Architects of Ireland

RM          -         Risk Management

SCSi        -         Society of Chartered Surveyors Ireland

SSIs        -         Semi-structured interviews

TGD         -         Technical Guidance Document

UK          -         United Kingdom

VE          -         Value Engineering

VfM         -         VfM

VM          -         Value Management

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# Dedication

I dedicate this thesis to my family – Tim, Oran and Liam McNamara.

# Declaration

This is to certify that the work presented in this thesis is original, except as acknowledged in the text, and that the material has not been submitted previously for a degree at any other university.

Print Name: .......................................................................................

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Date: .......................................................................................

# Abstract

Children of primary school age in Ireland are expected to increase in number by at least 10 per cent, and possibly even higher, by 2025. This means that new schools will have to be built rapidly to keep up with the demand for school places. The Department of Education and Skills (DoE) has decided to use a generic repeat design (GRD) and design and build (D&B) procurement route for school building projects where appropriate to satisfy this rapid need for new schools. This GRD option aim is for the DoE to produce standard designs which design consultants, then use to design and construct a school building. The D&B option involves bundling a number of schools together and bringing a contractor in to design and manage the project. As the design and the cost limits are set by the DoE this means that other areas need to be investigated to ensure VfM is achieved. These areas include the construction and post occupancy stage of each of these procurement options. In order to achieve this a review of the literature is presented which begins with a definition of what value means and goes on to investigate how VfM can be achieved at the construction stage and post occupancy stage of a school project. This is followed by the constraints and procedures that need to be adhered to in the delivery of school accommodation which has been set out by the DoE. The fieldwork involved undertaking semi-structured interviews with key stakeholders at both stages on GRD projects and D&B projects to explore whether a more holistic interpretation of VfM can be achieved. From this the emerging themes are identified at construction stage, which include the area of stakeholder satisfaction and sustainability. At the post occupancy stage the themes that have emerged following the literature review and the data collection and analysis include the design, user requirements and any additional issues. The overarching finding implies that it is crucial to consult all stakeholders at the construction and post occupancy stage to ensure that VfM is achieved.

**Keywords** VfM, Generic Repeat Design, Construction Stage, Post Occupancy Stage, School, Ireland.

# Chapter 1 Introduction

*'… education at every level is both the cause and the consequence of national renewal… it is down to a test of national will to invest in the future; to rediscover those things for which this country has been rightly celebrated.'*
*Lord David Puttman (2010, p. 4)*

## 1.1 Introduction

This chapter introduces the background and motivation for the research, the research statement of the problem and the research aim and objectives. This is followed by a summary of the research methodology to be adopted. After which it outlines the overall structure of the thesis and concludes with a summary of the chapters.

## 1.2 Background

The construction industry is vital for economic growth as it delivers the building and infrastructural needs of the rest of the economy and society (O'Murchadha and Murphy, 2016). In Ireland, the importance of the construction industry to the national economy cannot be overstated, due in no small part to it being a major provider of employment and a key generator of wealth (Forfás, 2013). In the mid-2000s, the Irish economy had become increasingly over-reliant on construction. By 2007 the sector had completely exceeded a normal level of output and employment for an economy the size of Ireland's (O'Murchadha and Murphy, 2016). This over-reliance on construction was unsustainable and contributed to the much documented, unprecedented collapse of the Irish economy in 2008 (Gerlach, 2013). Six years of contraction followed, with output reducing year on year before bottoming out in 2013 resulting in a severe contraction in construction employment (Central Statistics Office, 2016). This has a detrimental effect on tender prices for construction work. Figure 1.1 displays the change in average tender prices from 1998 to 2015, according to SCSi (Society of Chartered Surveyors Ireland) data. Over the four year period 2003-2007 average tender prices increased by 19%. However, that trend was quickly reversed in the second half of 2007 as the construction sector began to slow down. As a result, by the end of 2008, tender prices had fallen by 15% since they peaked in the second half of 2007. Tender prices continued to remain stagnant between the period 2009-2012 where tender prices were back to where they were in 1999 ten year earlier.

Tender prices from 2013 to 2015 showed a slow but steady increase and this trend is likely to continue to increase as activity in the industry picks up and major projects and new commercial projects come on-stream (Society of Chartered Surveyors Ireland, 2016a). During this cycle of boom and dramatic bust in the construction industry changes have taken place in the volume and availability of work. With the contraction of construction work comes a reliance on government work to sustain companies during recessionary times. This meant that from a government perspective they considered that increased value for money (VfM) was being achieved as there was increased competition from contractors and consultants for work. Going forward, as construction tender prices are beginning to accelerate with the rate of increase at 6.2% in the last twelve months this now has implications on the availability and willingness of contractors and consultants to undertaken government construction projects. It also means that the government notion of how to achieve VfM is being eroded as both consultants and contractors are unwilling to compete purely on a cost basis for construction work.
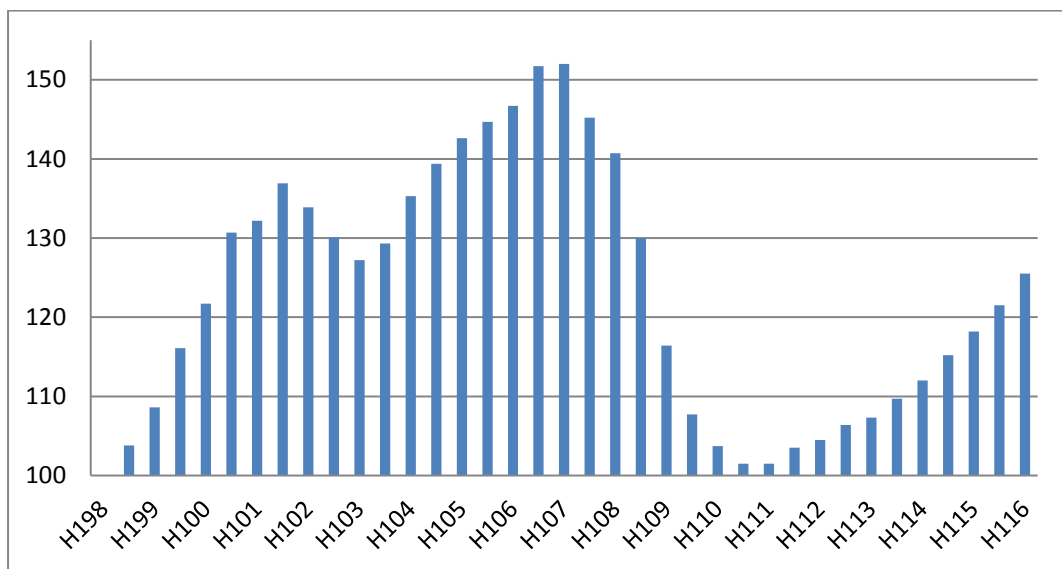


**Figure 1.1** Construction tender price (Society of Chartered Surveyors Ireland, 2016a)

Ireland's economy today continues to recover and grow at an encouraging rate but it is not back up to the levels attained during the boom times. According to the Bruce Shaw Handbook (2016), construction output in 2015 was approximately €12.5 billion, or 7.6% of GNP, well below the recognised norm of 12% of GNP for developed countries. Using this metric, the sector's output should be between €20 and €24 billion in a properly functioning market. Some of the principal difficulties facing the construction sector to respond to current demand are lack of finance, planning delays and skills shortages (Society of Chartered Surveyors Ireland,

2016b). Whilst the wider macroeconomic figures for 2016 are mainly positive there is a degree of uncertainty on the horizon due to Brexit and the outcome of the US general election (Society of Chartered Surveyors Ireland, 2016b). Brexit has the potential to have a positive impact on Ireland as it could become the sole English language entry point (besides Malta) for international firms seeking to do business in the EU (de Mars et al., 2016). This would undoubtedly represent an advantage as English is one of the world's main business languages. However, as de Mars et al. (2016) also advocated, the actual trade "winners" of Brexit would in all likelihood be Ireland which should have a positive impact on the Irish construction industry which should see the reliance of government work to sustain the industry decrease. The result of the US general election may also have an impact on internationally businesses setting up in Ireland in order to access other EU countries. It is through this setting that the Irish government provides school accommodation. Different cycles of the market mean that the Department of Education and Skills (DoE) get either competitive tender prices or they pay a premium to maintain interest in tendering for school building work. This cycle of boom and bust is a trait of providing school accommodation in Ireland.

## 1.3 Providing schools

Ireland has experienced a population boom in recent years and this is expected to continue. Census 2011 showed a strong growth in population from the 2006 census. The most recent census, which was undertaken on 24th April 2016, should have preliminary results to follow later in 2016 and early 2017 should also show an increase in population. The first quarter of 2011 saw the highest quarterly birth rate since CSO (Central Statistics Office, 2011) records began in 1960. The commuter belt counties to the north and west of Dublin are the main areas of population growth which, along with Wexford and Cork, all grew by more than 10 per cent. With this population increase comes an increase in primary pupil enrolment. In the period 2000 to 2011, the primary school-going population increased steadily from 439,560 pupils to 516,460 pupils (Department of Education and Skills, 2016a). Based on birth data, this is continuing to increase with enrolment at 544,696 pupils for 2014/15 and 553,380 pupils 2015/16. This shows an increase of 24.9% in pupil numbers between 2000 and 2015. While pupil number are still not available for 2016/17, the most likely scenario is a continued increase in enrolments at primary level.

With this increase in population comes a pressing need for investment in school buildings. Indeed, in 2009, a total of €613.5 million was allocated for the primary and post-primary school building and modernisation programme (Department of Education and Skills, 2010). Werner Hoyer the President of the EIB (European Investment Bank) announced in July 2012 a deal that provided funding for a €100m school building programme over the next five years. This funding was provided at a time when the construction industry in Ireland was in the grips of a deep recession and the availability of construction work was in short supply.

Overall, children of primary school age are expected to increase in number by at least 10 per cent, and possibly even higher, by 2025 (Central Statistics Office 2008). Indeed, as of 2015/2016 there are 553,380 pupils enrolled in 3,277 primary schools in Ireland taught by 3,262 teachers (Department of Education and Skills, 2016a). These figures include an increase of 8,684 pupils from 2014/2015 and an increase in the number of teachers by 963, with unusually a decrease in the number of schools by 15. These national population projections indicate that new school buildings will be required. International research indicates that school building quality can have a direct impact on teacher morale, community satisfaction and educational outcomes (Wang and Degol, 2016; Barrett et. al., 2015) so it is timely to consider whether VfM is being achieved on these schools. However, Ireland's investment in education – currently 4.7% of GDP – compares poorly with the OECD average of 6.2%, and its expenditure on construction is also low, e.g. - €750m2 compared to €1,800m2 for typical government office buildings (Construction Industry Council, 2009). Ireland is facing a crisis in the school building programme as an urgent increase in public capital investment is required, not only for new construction, but also to bring the existing stock up to current educational and environmental standards.

While Ireland was grappling with the need to provide school places quickly, the UK in 2004 announced the Building Schools for the Future (BSF) programme with an investment of £45 billion over 15 years (Mahony et al., 2011) to rebuild every secondary school in England. BSF was to be the *'greatest school renewal programme in British history'* (Blair, 2004) and a commitment to investment in education not seen since the Victorian times (Hurst, 2008). It involved the refurbishment or rebuilding of 3,500 secondary schools in the country within a 15 year period (CABE, 2007). A new approach to learning was to be created centred around the four principles of BSF; improved educational results, a wider role for schools in the community, environmental and social sustainability and better VfM (CABE, 2007). By 2011,

£8.65 billion of the allocated funding had been spent on 310 schools (Vaughan, 2012), which was a huge overspend (Smithers and Hall, 2004), and the projected budget and timescale had risen to £55 billion and 18 years, respectively (Mahony et al., 2011). Thus, significant questions were raised as to whether the reality of BSF had lived up to expectations. It was recognised that architects with the experience to conceptualise effective school design did not match the capacity required. Local Authorities also lacked the expertise to support such an extensive commitment to designing and building. The involvement of governors, teachers and most crucially students was minimal and the opportunities to share good practice effectively were overlooked in the scramble to meet deadlines for funding (Mellor, 2016). However, following the 2007 election, which saw the Conservative Party in government, it was announced by Michael Gove the coalition government's Secretary of State for Education, that 700 BSF school projects would be cancelled. He also announced a review of capital spending and a move towards a more "building-based" orientation based on efficiency and VfM and the emphasis on educational and community transformation was removed (Mahony and Hextall, 2013).

While the UK were investing significant amounts of money in the upgrading and refurbishment of schools, the recessionary periods in Ireland meant that there were only limited funds available to invest in the provision of new school accommodation. This means that achieving VfM is even more imperative when providing these schools so that every cent can be accounted for and money is spent wisely. It can also be seen from BDF programme in the UK that providing funding does not necessarily mean that the appropriate school accommodation is provided and in order that VfM is achieved it is imperative that there is stakeholder involvement.

## 1.4 Statement of research problem

Schools need to be delivered in a timely and efficient manner so what the government is still requiring from their schools is VfM for every euro spent. The concept of VfM is one which received considerable attention by the government after the volume constrained period in the construction industry in the late 1990s, when construction inflation was running at 12% per annum on average. As a result, subsequent National Development Plans included VfM among their key programme objectives. Indeed, the NDP 2007-2013 specifically included VfM Management and Assessment Frameworks which provided for the appropriate appraisal and management of capital projects including cost benefit analysis for all projects over €30m. In

2009, the requirement was introduced that all capital projects worth more than €5m must be sanctioned by the Department of Finance. In order to achieve VfM, the government also introduced the VfM and Policy Review Initiative which is a systematic process of evaluation conducted by government departments and offices under the guidance of the Department of Public Expenditure and Reform. Its objectives are to analyse Exchequer spending in a systematic manner and to provide a basis on which more informed decisions can be made on priorities within and between programmes. In October 2011, as part of a number of expenditure reform initiatives, the government decided to transform the VfM framework in order to make it more effective in facilitating departments, ministers and government in allocating scarce resources across competing priorities. Included in this initiative as a general requirement is that all VfM and policy reviews be completed within 3-6 months on initiation and an ongoing parallel evaluation role for the central expenditure unit of the Department of Public Expenditure and Reform, and that VfM framework would be consolidated into a modern code reflecting best international practice (Department of Public Expenditure and Reform, 2012). The Department of Public Expenditure and Reform (2012) considers that VfM is achieved when you are:

- *doing the right thing* – that is, spending money to achieve the right objectives <u>and</u>

- *doing it right* – that is, spending money, as effectively as possible, avoiding waste.

Therefore, in order for VfM to be achieved, the government undertake appraisal and management of spend in government departments. The government is of the opinion that when trying to achieve VfM on projects, the spend needs to be kept to a minimum and each government department spend is reviewed at a broad level. When investigating school projects and achieving VfM it is clear that government is concentrating on the financial side where money is spent to achieve the objectives and is spent as effectively as possible. However, what is clear from this is that the government sees VfM carried out at a strategic level in relation to all projects undertaken in a government department but is not undertaken on a project by project level. On a project level, VfM for school projects is achieved according to the government by including cost limits (Department of Education and Skills, 0010/2016); but in order for a more holistic view of VfM other areas rather than finance need to be taken into consideration. Moreover, VfM also needs to be investigated on a school by school basis rather than all school projects at a strategic level.

It is clear that work needs to be conducted to investigate where VfM can be achieved in order that the contractor can gain (profit) and the client also gains (satisfaction), which is not currently being achieved by the government. Even as far back as 1944 the Simon Report (Simon Report, 1944) began investigating how the placing and management of contracts could improve the efficiency of the construction industry. The report criticised the practice of open tendering and suggested that the tendency of clients to simply accept the lowest price created a situation where tenderers would submit low bids and then make profit by reducing quality or making claims. However, the report had little impact as the demand for rapid reconstruction in post-war Britain became the overarching priority. Reports and recommendations followed which all had little impact on the operation of the construction industry as government support was not forthcoming, however, the Latham Report 1994 (Latham, 1994) did achieve government support. This report identified industry inefficiencies, condemning existing industry practices as adversarial, ineffective, fragmented, and incapable of delivering for its clients and lacking respect for its employees. The report advocated that teamwork and cooperation was the recommended route to achieve client satisfaction (Latham, 1994). This message was reinforced in the Sir John Egan's report (Egan, 1998, p. 23), which was again endorsed by the UK government, when he stated that *'a well-run process, stripping out waste and inefficiency is necessary to deliver the client's aspiration for a harmonious building project.'* Thus, the construction industry went from discussing client satisfaction to considering that in order to achieve client satisfaction value needed to be achieved in relation to construction projects and more importantly government support is required in order to implement any changes within the industry. Ashworth and Hogg (2000) reinforced this by indicating that reducing building costs, or adding value, is beneficial not only for clients of the construction industry but also for society as a whole. They went on to state that if more hospitals, schools and houses can be built for the same capital outlay, then the benefits to the government's financial strategy are obvious. What this is not about is cost cutting, instead a more holistic view of how value is achieved on a project by project basis. All of this is sufficient at a strategic level but at a construction project level it is more difficult to achieve VfM. As stated earlier what VfM should not be about is cost cutting so that a more holistic interpretation of VfM can be achieved.

In relation to this research as outlined in Figure 1.2 as the government in Ireland is the largest client in the construction industry, the aim of achieving VfM is narrowed down to focus on government projects. As discussed in section 1.3 new school buildings are required as a

consequence of the increase in the birth rate in Ireland, this necessitates narrowing the focus down further to concentrate on the provision of new school accommodation particularly at entry level (primary schools) where the need is currently the greatest. The boundary for all this research will be Ireland.
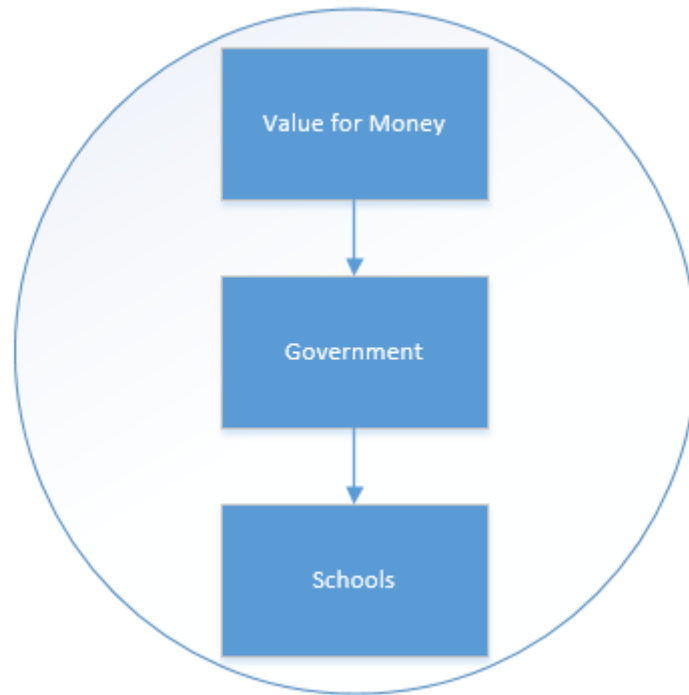


**Figure 1.2** Main aim

The dominant way of achieving VfM on construction projects has been to focus on the building and cutting costs within the building. This is the case as it is seen as the easy option. This can be referred to as the "hard" problem of value. What is equally important is focusing on the people and how the building is used by them. This can be referred to as the "soft" problem of value. As can be seen from Figure 1.3, the overall research is considering VfM on government project more specifically the school building programme. By focusing on the two different sides of achieving VfM there are hard areas and soft areas. Hard areas have clearly defined problem boundaries. In relation to the building itself this is where the government have been focusing in order for VfM to be achieved. In terms of the softer aspect of VfM this appears to consider more, unsure, less certain areas that concentrate on the people either constructing the school or working in the school. By addressing both these areas in relation to school building projects, then this facilitates for a more holistic and balanced outlook of achieving VfM.
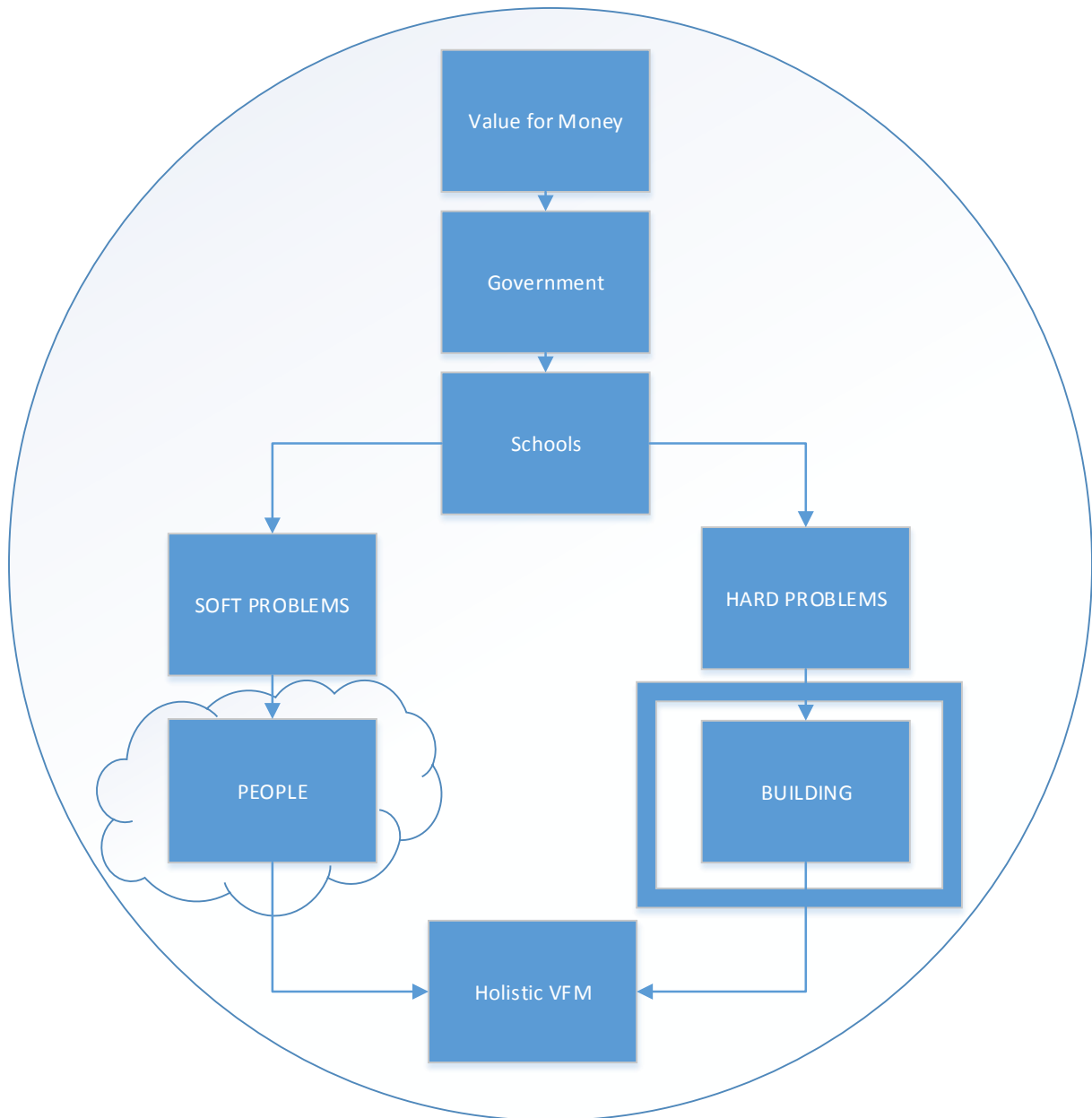
**Figure 1.3** Overall research

## 1.5 Overall aim

The aim of this research is to evaluate how VfM can be achieved from a government's perspective in relation to school building projects in Ireland.

## 1.6 Research objectives

The following objectives were established to achieve the research aim:

1. Ascertain how value generally, from both a government perspective and construction perspective is achieved at the present time in order to gain an understanding of how VfM can be attained.

2. Establish specifically how VfM is achieved on a construction project at the present time and propose steps that may be introduced in order to achieve VfM in the future.

3. Determine the government challenges in building schools in Ireland from a legislative background, to the design and the delivery background in order to explain the processes and procedures that influence the building of schools in Ireland and how VfM can be realised.

4. Establish how VfM can be achieved at the construction stage and post occupancy stage of the delivery of a primary school project in order to gain an understanding of how enhanced VfM can be attained on these projects.

5. Determine how a more holistic view of VfM can be achieved on school building projects by proposing a model of the processes and procedures that should be implemented in the future.

6. Formulate recommendations in relation to achieving better VfM on school projects, which can be fed back into the provision of future schools.

## 1.7 Research methodology

This research is largely exploratory in nature so will use qualitative research strategies to achieve the aim and objectives of the research. For the purpose of meeting the aim and objectives, the study will employ a thorough and comprehensive review of literature and semi-structured interviews. Initially, these interviews will be exploratory in nature and involved discussions with four key stakeholders involved in the construction of primary school accommodation in order to gain an understanding of how these projects are completed. Semi-structured interviews were then carried out at the construction stage with nine participants and the post occupancy stage with fifteen participants on the case study in order

to gain detailed information on how VfM can be realised on a school building projects. These interviews will collect both in-depth, contextually rich and generally applicable qualitative data and the data will be analysed using thematic analysis in order to to identify commonalities in experience and perceptions across participants in relation to achieving VfM on school building projects.

## 1.8 Structure of the thesis

The overall structure of the thesis is comprised of nine chapters in the following structure, presented together with supporting referencing, bibliography and appendices:

Chapter 1 Introduction
Chapter 1 has provided the background, the drivers for, and the wider scope of the research. More importantly the chapter sets out the focus, objectives and overall aim of the thesis along with an overview of the methodology adopted. Finally, a summary of each chapter is included.

Chapter 2 Value
This chapter commences with an overview of the nature of value, followed by an interpretation of value versus values. It goes on to investigate the nature of value from a government perspective and also from a construction perspective. Once this has been established, obtaining value in relation to construction activity is assessed, particularly in relation to providing school accommodation in Ireland.

Chapter 3 Processes and procedures that influence the building of schools in Ireland
This chapter begins with an overview of the education system in Ireland followed by an understanding of primary school design proposed by the DoE. It then investigates the construction and post occupancy stage of the construction of a school in Ireland and the justification as to why these two areas require further investigation in relation to achieving VfM.

Chapter 4 Research methodology
This chapter provides details of the research strategy adopted in this study. The chapter particularly focuses on the methods available for the collection and analysis of the data and justifies the methods adopted. It outlines the underpinning research methodology adopted for  this research along with the philosophical position adopted. The research design and strategy are also highlighted as well as the justification for choosing a case study strategy.

It also explains the reliability and validity of the research along with the ethical considerations.

## Chapter 5 Analysis and findings for achieving VfM on the school building programme in Ireland

The data analysis section begins in chapter five where information is analysed in regard to the school building programme and issues concerning the achievement of VfM are analysed. An interpretation of the findings concerning the school building programme are also included. This is followed by the data analysis and interpretation of the specific building programme that is being utilised which include the generic repeat design (GRD) and design and build (D&B) procurement route.

## Chapter 6: Analysis and findings of the construction stage

Continuing the data analysis, this chapter analyses the evidence that came from the case studies that were conducted on the construction stage of a GRD primary school and a D&B primary school. An interpretation of this data and how it affects obtaining VfM is also included.

## Chapter 7 Analysis and findings of the post occupancy stage

This chapter is also part of the data analysis section and examines the post occupancy stage of the case study GRD primary school and D&B primary school. An interpretation of the findings on how value is achieved is also provided.

## Chapter 8: Discussion

Chapter eight readdresses the findings obtained in chapters five, six and seven and presents a model of the recommendations for achieving VfM on school building projects. The data obtained in chapter 2 and 3 is also included so that a more holistic view of how VfM can be achieved on school building projects is formed.

## Chapter 9 Conclusions and recommendations

In the final chapter a reflection on the research aim and objectives are outlined. This is followed by a summary of the key findings and the research recommendations. The research contribution to knowledge is then outlined along with the limitations that were encountered while undertaking the research. Finally, recommendations are presented for future research.

## 1.9 Summary

This chapter has outlined the basis for the development of the study. It sets out the background and motivation for the research, research statement of the problem, the research aim and objectives. It also highlighted the scope of the research, the research methodology, and finally the structure of the thesis. The next chapter will review and examine the theory of VfM and how it can be achieved in relation to schools. In doing so, the theoretical background for this research will be presented.

# Chapter 2 Value

*'It is unwise to pay too much, but is worse to pay too little.*
*When you pay too much, you lose a little money - that is all.*
*When you pay too little, you sometimes lose everything, because the thing you*
*bought was incapable of doing the thing it was bought to do.*
*The common law of business balance prohibits paying a little and getting a lot - it*
*can't be done.'*
(Ruskin, 1849)

## 2.1 Introduction

Following on from the introduction chapter it is necessary initially to define value and the techniques used to achieve it, in order to obtain a better understanding of how value can be understood. This chapter commences with an overview of the nature of value, followed by an interpretation of value versus values. It goes on to consider the nature of value from a government perspective and also from a construction perspective. Once this has been established, obtaining value in relation to construction activity is assessed, particularly in regard to providing school accommodation in Ireland.

## 2.2 Value

Initially, when looking at value this necessitates the investigation of the terms value and values in order to contextualise the research that is being undertaken. The meanings of these terms are derived from first principles to establish a foundation for the development of value in the context of the study, i.e. a school setting. Next the nature of value is established as it has developed over time. The main characteristics of value are then recognised followed by an investigation of value from an Irish government and a construction perspective.

### 2.2.1 Value versus values

It is necessary, initially, to clearly state how the word value is understood in order to define it in relation to the context of this research. Cha and O'Connor (2005) stated that there is no single definition of value due to its abstract nature however, what is known is that value is what an individual places upon an object, often in relation to usability, technical quality, design, cost, etc. (Wandahl, 2005). For example "my mobile phone is of great value when I am away from

my desk". Hence, value always relates to something physically existing. An example of this view can be found in Lean Production, where Womack and Jones (1996, p. 311) state that value is *'a capability provided to a customer at the right time and at an appropriate price, as defined in each case by the customer.'*

Values, on the other hand, are the beliefs of individuals, i.e. perceptions of good/bad and right/wrong. For example "it is against my values to lie". As can be seen from this, value relates to a product and its assets, and it is often connected to monetary relations. Values, are the principles by which we live, or one might say that values are our individual bible or the paradigm through which we see the world (Covey, 2004). They are the core beliefs, morals and ideals of individuals and are reflected in attitudes and behaviours in society.

*2.2.2 Nature of value*

To fully explore the issue of VfM it is important to develop a good understanding of what is meant by the terms "value" and "adding value". This seemingly simple task is more difficult to address than it might first seem and has challenged a number of deep thinkers over the years (Morwood et al., 2008).

Irish writer and poet, Oscar Wilde (1854-1900) claimed that; *'Nowadays people know the price of everything and the value of nothing'.*

American businessman, investor and philanthropist Warren Buffett (*1930) stated that, *'Price is what you pay. Value is what you get.'*

Even these early writes saw that there was more to value than just about the monetary value of something. What was unclear though is what that other aspect to value was.

The publication of Adam Smith's (1723-1790) Wealth of Nations in 1776 heralded the rise of the classical school in relation to the theory of value. Smith (1776) argued that wealth was created by the act of producing goods and that the value of all commodities was proportional to the amount of labour applied to their manufacture. Other early thinkers on the subject of value include David Ricardo (1772-1823) who adopted Smith's labour hypothesis, but tried to avoid his circular reasoning of measuring labour with wages. Instead, he felt that value depended upon the quantity of labour necessary for production, which would be calculated by time (Ricardo, 1817). Despite these attempts, Ricardo in the end was forced

to accept that there were other forces affecting value which prevented a pure theoretical labour theory of value. Nevertheless, he still believed that it was the quantity of labour to produce goods that was the crucial element in his calculation. Karl Marx's (1818-1883) approach to value was essentially Ricardo's labour theory of value. According to Marx, the values of *'all commodities are only definite masses of congealed labour time'* (Marx, 1867). As an advocate of Ricardo's original theory, he also followed and built on his solutions to the labour value theory's inherent deficiencies.

Moving on to the twentieth century, Perry (1914) saw value as being present when a person is interested in an object and derives pleasure from it. Perry considered value to be divided into "intrinsic" value where something is perceived to have value by the individual and "extrinsic" value where the properties of an object create the value. What can be seen from this is that value has developed from being purely about labour and wages to being more a person's individual concept of what value means to them. Langford and Huynh (2007) reflect this when he stated that there are economic, cultural and social interpretations of what is meant by value.

*2.2.3 Main characteristics of value*

Daniels (2000) defined value as the relationship of market perceived price to market perceived quality. While Dumond (2000) stated that customers value is linked to the use of a product or service, thereby removing it from personal values. Value is thus perceived by the customer rather than objectively determined by the seller, and typically involves a trade-off between what the customer received (e. g. quality, benefits, worth) and values and comparing this with the market value assessment (typically expressed as a price). In this sense, the product is a commodity rather than a reflection of beliefs. As can be seen from Figure 2.1 value comprises of three connected issues: first, on what sort of property or characteristic having value or being of value is; second, on whether having value is an objective or subjective matter, whether value reposes in the object or is a matter of how we feel towards it; and thirdly; trying to say what has value.
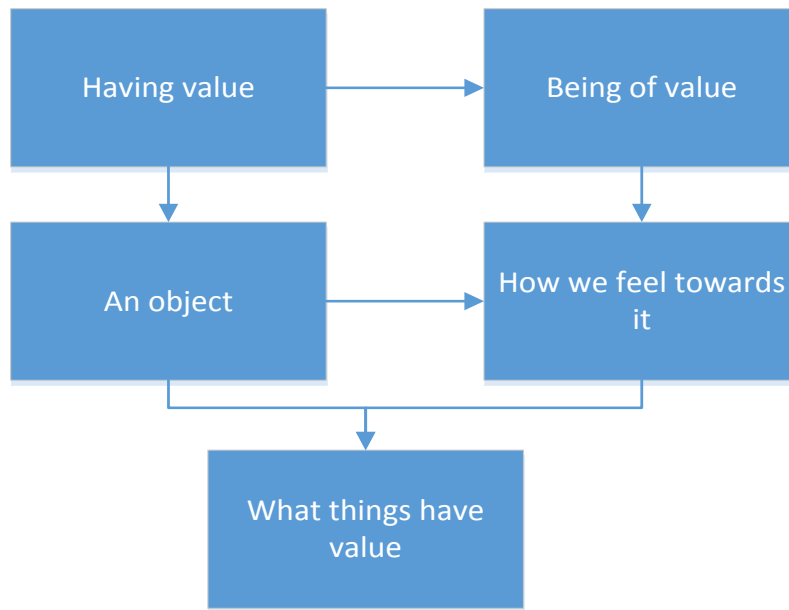
The objective nature of value was first discussed in Greek philosophy. Here, value was understood as a property of goods or services, a perspective which is still strongly associated with the concept of value today. It is argued that *'engineers and economists alike see value in terms of the features that a product or services has'* (Shillito and De Marle, 1992). Consequently, value has been linked to measurable attributes or physical product features and several authors have emphasised this vision (Green, 1997; Thomson et al., 2003). The manufacturing sector has adopted this objective view of value for many years. Value analysis, for example, involves the testing of functions required by customers as design objectives. This approach substitutes for the direct engagement of customers (to identify their values to which the design must respond) recognising that its success in doing so will be judged subjectively by these customers.

However, some discontent with the limitations of the objective view has existed for many years. As early as the 1960s Miles (1961) suggested that the definition of value should vary with the purpose, the viewpoint and the intent of the person defining it, given that value means a great many things to a great many people. MacDonald (2011) reinforced this by stating that there is also a need to understand the subjective nature of value in a social context. The subjective nature of value arises as one of the most complex features, to which everyone is able to contribute with an individual vision of the concept including product/individual interaction, emotion, feeling, personal judgements, etc. (Neap and Celik,

1999; Thomson et al., 2003; Emmitt et al., 2004; Wandahl, 2005). According to Thyssen et al. (2010, p. 3) *'The perception of value is individual and personal, and is therefore subjective'*. Indeed, agreement on an objective best value for a group will differ from the individuals' perception of value (Emmitt et al., 2004). Therefore, to create value is not to create products, but products with certain characteristics and qualities.

Despite the prevalence of subjective definitions of value, such a viewpoint is not reflected in the current British Standards BS EN 1325-1 (British Standards Institution, 2014), which instead adopts an objective stance by defining value as the relationship between the contribution of the function to the satisfaction of the need and the cost of the function implying that value can be measured. The objective value refers to all economic aspects and it is possible to quantify it accurately in theory by knowing the price and cost of every step – feasibility studies, procurement, construction phase and operational phase. The subjective value refers to social benefits and satisfaction. This value is difficult to define because it depends on individual perceptions so it seems even more difficult to measure and quantify.

To sum up, value is the relationship between positive and negative consequences. More specifically, value does not exist in its own right, but is an assessment of an object. This assessment occurs in a context and is framed by the characteristics of that context. Value assessment can be subjective when framed against an individual's values, or objective when the relationship between benefits and expenses are compared. Figure 2.2 represents value, for the context of this research, as the benefits you obtain from an object versus the sacrifices you put into obtaining that object. This is a broad definition which could include cost involved in obtaining a building but could equally include other items such as the social inclusion and satisfaction derived from using a building.
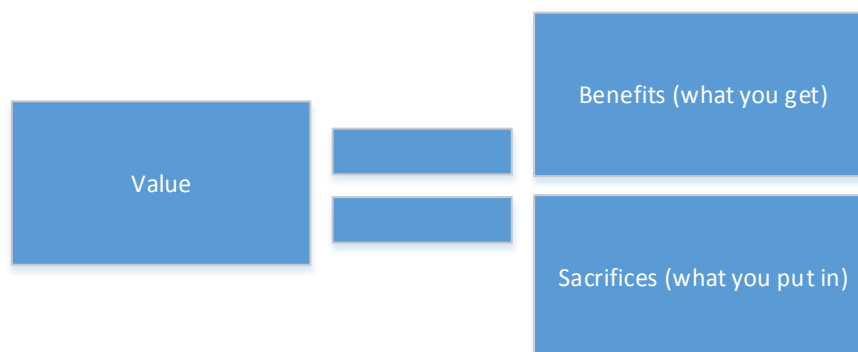


**Figure 2.2** Value in this thesis

This broad definition expresses provision of the right thing (product or service) at the right time for the right consideration, to the right customer. In relation to this study, this implies that the government "benefits" mean that a school building is produced with the "sacrifices" of what each stakeholder put in, in order to achieve that building. The greater the sacrifice, then ultimately the greater the benefit and ultimately greater value is achieved.

*2.2.4 Value from government's perspective*

Despite the importance of achieving VfM, a uniform definition of the concept is yet to be pronounced. In the development sector, there are competing interpretations of what value is, or should be, and who ought to define it (Emmi et al., 2011). So despite the pervasive use of VfM, the intrinsic meaning is usually synonymous with the "3Es" – efficiency, economy and effectiveness (Shaoul, 2011; Demirag and Khadaroo, 2010). If value is primarily to be seen on the levels of outcomes and impacts, measuring value requires measuring changes on these more complex dimensions (Emmi et al., 2011). However, there is a strong focus on the quantifiable outputs rather than outcomes, in many current measurement systems. As Emmi et al. (2011) asserts, progress from a government perspective is still focused on reporting the number of beds provided or children enrolled in school rather than reporting on how the health and education situation has improved. In describing public value, Alford and O'Flynn (2009) comment that it should focus on a wider range of value than public goods. It is about what has meaning for people, rather than what a public sector decision-maker might presume is best for them. According to Grimsey and Lewis (2005), the most critical accounting question from the public sector's point of view should be if the project represents good VfM.

There are several definitions of VfM from a government perspective. The Local Government Act 1999 introduced the concept of "Best Value" in England and Wales (McKevitt and Davis, 2016) Obtaining "Best Value" subsumed the "3Es" and included a duty to consult with stakeholders especially users of the service. This was followed by The UK HM Treasury (2008) who went on to define value as, *'securing the best mix of quality and effectiveness for the least outlay over the period of use of the goods or services bought. It is not about minimising upfront prices....'.* Unlike the private sector, non-profit organisations' produce value by defining and achieving social missions (McKevitt and Davis, 2016). The Public Service (Social Value) Act 2012 considers this social value by recognising that outcomes such as inclusion, wellbeing and happiness are difficult to measure but must be considered in the procurement process (McKevitt and Davis, 2016). As much as possible

the government it is not only about providing a service but also about obtaining value from the taxpayers investment.

In an Irish context, a strategic framework for public management effectiveness can be traced to a series of reforms referred to as the strategic management initiatives (SMI) (McKevitt and Davis, 2016). Key to this initiative is the concept of VfM which is defined in terms of economy, efficiency and effectiveness (O'Brien, 2007). The emphasis is about achieving more from any expenditure base. As far back as 2005 the Minister for Finance Brian Cowen believed that in order to achieve VfM on public expenditure it was not all about cost cutting but about doing more for less (Cowen, 2005):

> *"I want to turn now to the question of achieving VfM in public expenditure. As Minister for Finance I believe this issue needs to be tackled as an ongoing priority and one which I am determined to address. I would like to take this opportunity to announce and outline a series of two initiatives that I believe will be fundamental to ensuring enhanced efficiency, accountability and transparency in public expenditure projects. ... We will maximise benefits for the socioeconomic development of our country and to ensure taxpayers get value."* (Cowen, 20th October 2005)

In order to achieve better VfM the two initiatives that were introduced included, initially full acceptance of the need to improve VfM and to ensure that every euro is well spent. VfM should not simply be an item ticked in project appraisal, rather, it should be the outcome of a carefully considered appraisal system and culture that takes into account, as objectively as possible, the overall benefits and costs of a given project and seek to make sure that budget estimates are met. The other initiative introduced included fixed price lump sum contracts to become the norm. This development the government believed was fundamental to protecting taxpayers from cost over-runs. The aim was to ensure that there is a fair risk sharing and that contractor's only take on those risks that they are able to manage and control.

These two initiatives introduced in 2005 represented the beginning of a government strategy to achieve VfM in public expenditure. This was at a time when the economy was booming so the government were focused on putting cost processes in place to achieve VfM. This shows the Irish governments' traditional focus on financial resources. Over the last few years, the main focus of reform has been on construction procurement, with the introduction of new fixed price lump sum contracts and standard conditions for the engagement of construction consultants in order to achieve better VfM.

The General Secretary's circular letter of 25th January 2006 (General Secretary, 2006), which covers a number of VfM issues, reiterated the comments of the Minister for Finance in his speech of the 20th October 2005 regarding the achievement of improved cost certainty and VfM on projects. It indicated that:

> *"To achieve this, standardised contracts for use across relevant public sector bodies are being developed. In addition, comprehensive conditions for the engagement of construction-related consultants have also been developed to end the practice of fees escalating with project costs".* (General Secretary, 2006)

In 2008 at the height of the crash the Minister of State at the Department of Finance Dr Martin Mansergh speech (Mansergh, 2008) started to look at outputs and outcomes in order to achieve VfM rather than achieving cost certainty on projects:

> *"The VfM principle is vital at this time of scarcer resources. The approach to management of VfM in public expenditure is evolving in the direction recommended by the OECD from the traditional focus on financial inputs to include analysis of and reporting on performance in terms of outputs and outcomes. Central to this are the Annual Output Statements and the VfM and Policy Review initiative."* (Mansergh, 2008)

Moving on to 2010 when Dr Martin Mansergh, Minister of State at the Department of Finance, at the Infrastructure Ireland Conference (Mansergh, 2010) backtracks a bit as the downturn in the economy has led to a more competitive market and again placed the focus on achieving VfM on cost:

> *"Indeed, recent data show that tender prices are down by over 25% from their peak levels and this downward trend appears to be continuing. This offers us the opportunity to obtain greater VfM from our capital programme. Government Departments are accordingly reporting very significant savings in procurement – the Department of Education, for instance, has noted reductions of up to 30%. This means that we can now obtain more for less."* (Mansergh, 2010)

As can be seen from this the Irish government commenced by putting procedures in place in order to obtain better VfM. It commenced in 2005 where obtaining VfM by cutting costs it soon when on to 2008 where the downturn in the economy meant that the government felt that they needed to move away from the traditional focus on financial inputs to include analysis of and reporting on outputs and outcomes. In 2010 when the economy was still in recession the government went back to look at cost and reduced tender prices in order to achieve VfM. As

the economy is now growing other techniques of achieving value for the government now need to be investigated. As McKevitt (2015) asserts in public management VfM is an umbrella concept that attempts to capture all three dimensions of effectiveness, economy and efficiency simultaneously. It is the government that will judge the optimal combination of quantity, quality, features and price (Burger and Hawkesworth, 2011).

*2.2.5 Value from construction perspective*

Value delivery should be a fundamental objective for all construction projects (Thomson et al., 2003). The impact of design on the value of a construction project has been summarise by Lipton (2001) who stated that the design represents a minute proportion of the lifetime cost of a building – less than 1 per cent – but done well it has a disproportionate impact on how well the building and its surroundings perform.

One of the simplest definitions of VfM as applied to construction is illustrated by the time, cost and quality model in Figure 2.3 (PMBOK, 2008). The triangle illustrates the relationship between three primary forces in a construction project. Time is the available time to deliver the project, the cost represents the amount of money or resources available and quality represents the fitness-for-purpose that the project must achieve to be considered as a success. The normal situation is that one of these factors is fixed and the other two will vary in inverse proportion to each other. For example, time is often fixed and the quality of the end product will depend on the cost or resources available. Similarly, if you are working with a fixed level of quality then the cost of the project will largely be dependent upon the time available.
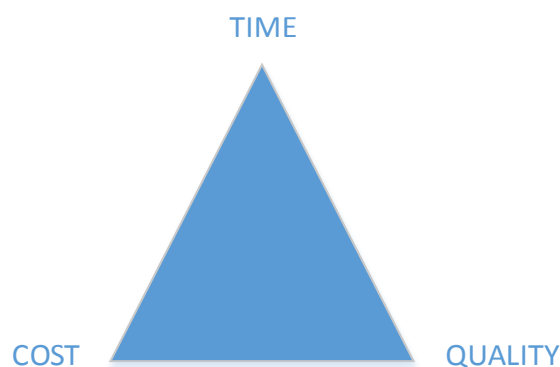


**Figure 2.3** Achieving VfM (PMBOK 4th Edition, 2008**)**

It is worth noting that in the latest version of the Project Management Book of Knowledge (PMBOK, 2013) that the Project Management Institute has excluded the project triangle as

they consider that a project has many more constraints to be observed than the time, cost and quality relationship. It is clear from this that in order to achieve VfM on construction projects there is a shift away from the time, cost and quality area as other elements also need to be taken into consideration. Salvatierra-Garrido (2011) reinforced this by advocating that there are several definitions of what value is from a construction industry perspective and that ongoing effort by researchers to define or develop a common understanding has not materialised.

In relation to the construction industry as far back as 1944 The Simon Report (The Simon Report, 1944) investigated how the placing and management of contractors could improve the efficiency of the construction industry. The report recommended the in order to improve the efficiency of the industry a pre-qualification process should be created of suitable companies who are then invited to tender for a project. The report suggested that the tendency of clients to simply accept the cheapest price created a situation where tenderers would submit low bids, and then make up their income by reducing quality by making claims. In this way as far back as the 1940s the suggestion was that the price of a construction project should not be the most important aspect. This suggestion was reinforced in 1988 with The Egan Report where it was indicated that clients in the future will require an increased VfM that is expended on their capital projects (Egan, 1998). The principle involves reducing the relative costs of construction by designing, procuring and constructing the work in a different way than at the present time. This involves doing more for less by removing unnecessary costs.  It has the aims to meet the perceived needs associated with efficiency, effectiveness and economy.  This is even more important for any government as they are concerned with the economic use of resources of the country as a whole. Until recently the cheapest method of construction was still in the majority of cases the one that was selected. Nowadays it is all about obtaining more from a given amount. More specifically, in the construction industry, as can be seen from Figure 2.4, the value achieved through the project is measured by the ratio of benefits delivered, from the owner's perspective, – to the resources used for the whole project (Dallas, 2008).
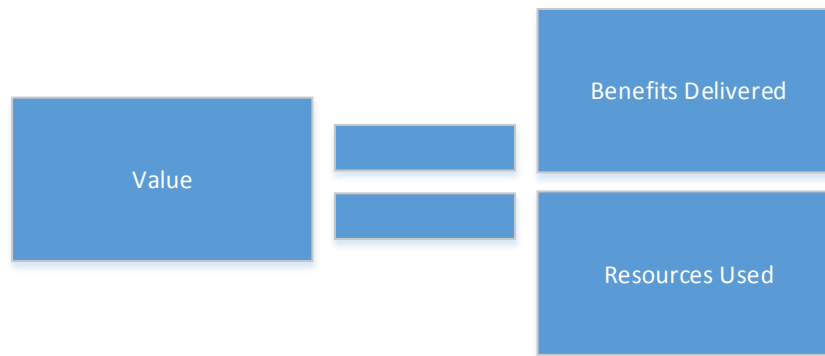
**Figure 2.4** Value (Dallas, 2008)

The term "Resources Used" can always be converted into money, whether it deals with raw material resources, technical resources or human resources. Therefore, this value ratio is often named as VfM. However, it is arguable that the term "Benefits Delivered" cannot be easily assessed since it consists of both objective and subjective components. Many organisations' or clients whose aim is to improve VfM might adopt a too narrow method. They are only focused on reducing the cost of a given service without trying to improve the quality or the economy, efficiency and effectiveness with which it is delivered. As stated earlier, the British Standards Institution BS EN 1325-1 (2014) describes value as the relationship between functionality, user satisfaction and cost. However, this is seen as presenting a somewhat narrow view and does not consider how value can be distributed between all parties in the construction process.

While Burt (1978) stated that maximum value is obtained either from a required level of quality at least cost, the highest level of quality for a given cost, or from an optimum compromise between the two suggesting that a more objective view may also be appropriate for construction. Furthermore, CABE (2007) integrated both subjective and objective views by defining value in a construction context as a measure of the worth of something to its owner or any other person who derives benefit from it.

From this it can be seen that the value delivery activities of the construction industry can be characterised by the prominence of an objective view of value. The industry's current understanding of value is such that it routinely fails to consider the relationships between built environment assets and the people who will provide, use and be influenced by them. As its understanding of value is currently biased towards an objective view. Evidence of the benefits of what built environment assets can do for their occupiers is beginning to

emerge. For example, Luxton (2002) found a 120% reduction in staff turnover in a call centre, occupying a building specifically designed to create a sense of community and place through informal meeting places and innovative building structure solutions. As can be seen from Table 2.1 Blockley and Godfrey (2000) argues that it is appropriate to define hard and soft value on a project, in order for VfM to be achieved. As can be seen from the table some values can be defined as being both hard and soft. These values include utility, health and safety, performance, operation and the environmental impact. The hard values include money, buildability and sustainability. While the softer values include customer satisfaction, shareholder value and ethics. The worth of hard values is more easily measured whilst the worth of soft values are often partly personal, partly shared and therefore can be difficult to measure dependably.

**Table 2.1** Values relevant to construction procurement (MacDonald, 2011)

| Values | Explanation | Hard or Soft |
|---|---|---|
| 1. Customer Satisfaction | Exceeding expectations, providing what soft is needed, fulfilling a desire. | Soft |
| 2. Shareholder value (non-financial) | Reputation, goodwill, customer loyalty, desire to own. | Soft |
| 3. Money | Profit, share price, financial measures (such as return on capital, dividend cover, etc.) initial costs, life cycle costs, opportunities, expectations, about future value. | Hard |
| 4. Utility | Usefulness utility as in utility theory. | Hard and Soft |
| 5. Health and Safety | Harm, human life, injury, quality of life. | Hard and Soft |
| 6. Performance | Functionality, reliability, damage, simplicity, complexity. | Hard and Soft |
| 7. Buildability | Constructability, level of standardisation, waste. | Hard |
| 8. Operations | Availability, efficiency ease, convenience' difficulty. | Hard and Soft |
| 9. Environmental Impact | Aesthetic, biological, loss of diversity, elegance, pollution, waste, efficiency. | Hard and Soft |
| 10. Sustainability | Natural resources, energy consumption. | Hard |
| 11. Ethics | Individuals, groups, professional standards, future generations. | Soft |

There is a danger that we avoid or ignore those values where the worth is not easily measured. Indeed, only a portion of development work and outcomes may be captured in quantitative terms. (Emmi et al., 2011) The issue of hard and soft values is taken further by Nogeste and Walker (2005) who draw a distinction between tangible and intangible outcomes of projects. They argue that there is growing unease with a sole reliance on the "iron triangle" hard measures of time, cost and quality. They suggest that there is a desire to identify more visionary measures of performance which may be intangible but do provide indicators of success. New interpretations of value are beginning to emerge in construction. Spencer and Winch (2002) commented that you should exploit the economic and social value of good design by improving both the functionality and enjoyment for its end users of the environments it creates. For example, hospitals where patients recover more quickly, schools and workplaces which are more productive and more enjoyable to work in and housing which raises the spirits and enhances the sense of self-worth.

*2.2.6 Emerging themes in relation to value*

Although the concept of value has been widely discussed the literature a review has revealed that for construction, this discussion has been mainly undertaken from an objective point of view. Indeed, MacDonald et al. (2012) define VfM in two different ways. Firstly, VfM is defined as the recognition of value that has various dimensions including the conventional perspective of economic which involves social and environmental objectives as well as intangible characteristics including quality of relationship, leadership, learning, reputation and trust. Subsequently, the more sophisticated approach of VfM focuses on the whole project life cycle and does not emphasise merely the benefits delivered during construction stages.

It can also be observed that customer-focused activities have been commonly addressed at the project level and therefore most of the effort to deliver value have been used to satisfy customer requirement within a specified period of time. No consideration has been given to value as a dynamic concept, varying according to the context within which value judgements are expressed. It is evident that environmental and social issues are included only if these problems are to be addressed from the project customer's perspective of value. In choosing to look at an objective viewpoint the industry fails to consider the relationships between buildings and the people who will provide, use and be influenced by them. In doing this the industry tends to fail to account for the subjective value judgments formed by individuals, organisations' and societies as they interact with the built environment. As a result, design decisions tend to be

made without considering their impact on the making of value judgements of the resulting product.

It is proposed that the construction industry could deliver value more effectively by improving its ability to address the subjective nature of value (MacDonald, 2011). To do this, it must understand the values of the individual, organisations and societies so that their subjective value judgements can be pre-empted in its design solutions. There is a need to have an understanding of value that is both subjective and objective views so that a more holistic view of achieving VfM on construction projects can be achieved. As can be seen from Figure 2.5 the "past" on construction projects saw a lack of added value as a result of the focus being placed on cost, where there was a lack of awareness of client's needs and values which was followed by a lack of status and profit, with feelings of lack of worth with ultimately client dissatisfaction and a culture of confrontation. The "future" should see adding value to the client which results in delighting the client, feelings of worth; leadings to status and profit are enhanced by focusing on the customer and focusing on values. All of this leads to a culture of cooperation, rather than a culture of confrontation which if achieved can lead to better value being realised.
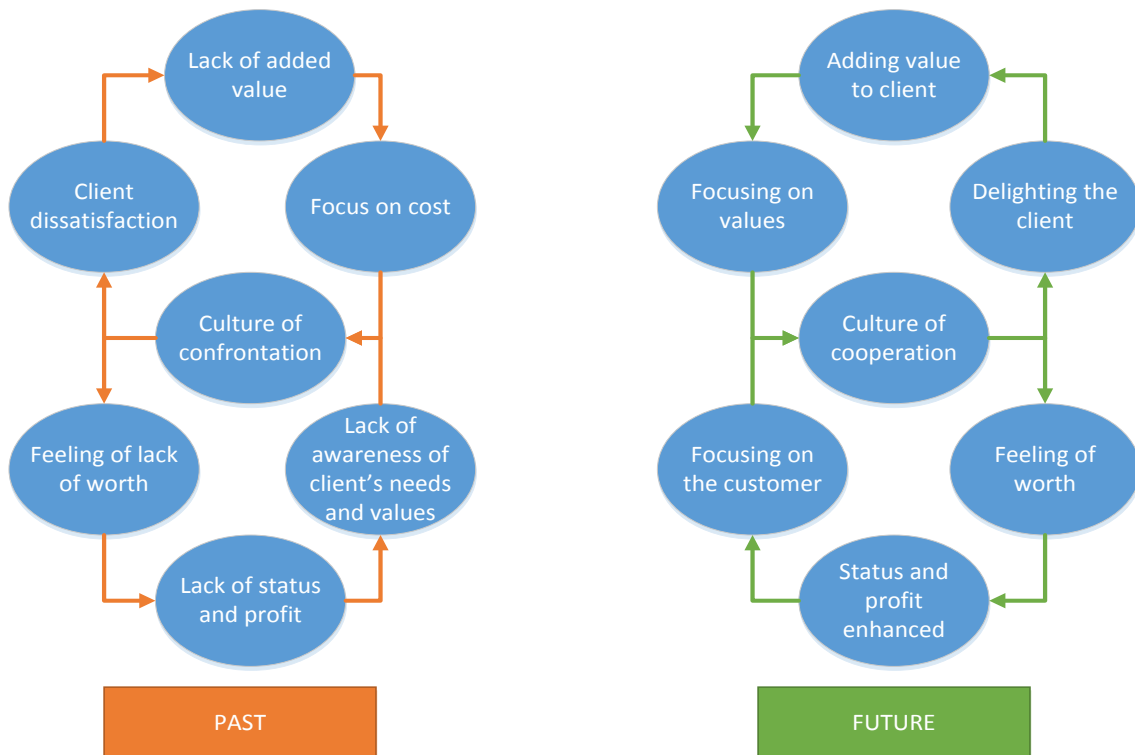


**Figure 2.5** The opportunities available in moving from a culture of confrontation to a culture of cooperation (MacDonald, 2011)

27

## 2.3 How do you obtain value in construction?

At present, in order to achieve VfM in construction three concepts are used which include value engineering, value management and risk management. It is necessary to investigate how each one of these concepts is used in the construction industry to understand how VfM is being achieved at the present time. It is also necessary to investigate benefits and shortcomings with each of these methods as applied to a construction project and whether these concepts focus on the objective (hard) or subjective (soft) view of value.

### 2.3.1 Value Engineering

Value Engineering (VE) originated in the United States General Electric Company where Lawrence D. Miles developed value analysis during the 1940's (Miles, 2015). Their VE method examined the function of product parts in the quest to identify alternatives which could decrease costs without removing the functions. VE was used to increase value by simplifying products and thereby reducing manufacturing costs and increasing profit margins. Numerous definitions of VE exist. All definitions agree that the essence of VE is the relationship between deliveries of product functions compared to the cost (Wandahl, 2005). Most of the definitions also agree that even though the client's requirements and needs are specified in the early project phases VE is often applied in later phases, often in the late design and at the beginning of the construction phase (Wandahl, 2005). Liu and Leung (2002, p. 341) observed that in relation to VE *'traditional value engineering is mostly based on the economic aspects emphasising techniques, such as brainstorming, functional analysis and weighted evaluation to solve hard technical problems.'*

VE is a discipline that has grown up around the notion that there is a need to identify explicitly the value of every function of each part of an engineering product. Every part is assessed for the value it brings to see how it might be improved. If parts are found to be redundant then they can be removed and if parts can be redesigned to be more efficient, savings will be made (Adam, 1993). Dallas (2008) proposed that the introduction of VE to the UK was in 1983 when VE was used for the first time by the American company Xerox in its new UK headquarters building. The North American VE process was adopted in the UK on a modified basis as there was the understanding in the industry that it was the quantity surveyor on a projects responsibility. As can be seen from Table 2.2  Kelly and Male (1993) who were one of the first researchers and authors on a UK VE process suggested the following four stages should be used. These stages include functional analysis where the project task is

defined along with the spaces, elements and components of the project. The second stage involves carrying out life cycle costing of the project to ensure that the initial investment options are compared and the least cost alternative over a period of time is identified. The third stage involves a multidisciplinary work group where, by utilising the job plan and creative techniques value is ensured on the project. The final stage is about establishing comparative costs of certain functions of the project to ensure that value is being achieved.

**Table 2.2** Stages in the value engineering process (Kelly and Male, 1993)

| Stages | Involves |
|---|---|
| 1. Functional Analysis | Project task<br>Spaces<br>Elements<br>Components |
| 2. Life Cycle Costing | |
| 3. Multidisciplinary Work group | Work groups utilising the job plan and creative techniques |
| 4. Establishing Comparative Costs | In relation to the function and hence overtly concerned with issues of value |

Specifically, from a construction perspective the Irish government, for the first time in 2007 and subsequently updated in 2014, introduced clauses in their public works construction contracts in relation to VE (Public Works Contract PW-CF1 V1.10, 2014; Public Works Contract PW-CF2 V1.10, 2014). The clauses in the contracts include for the following:

- PW-CF1 V1.10: Public Works Contract for Building Work Designed by the Employer – In clause 4.8.1 of this contract, the contractor may give to the employer's representative a written value engineering proposal that will, if adopted, either (1) reduce the contract sum or (2) accelerate the execution of the works, or otherwise be of benefit to the employer, with no increase to the contract sum. Clause 4.8.4 however, states that if the proposal includes a change in the design of the works, unless otherwise agreed, the contractor shall undertake and be liable to the employer for that design and any other consents.

- PW-CF2 V1.10: Public Works Contract for Building Work Designed by the Contractor - Clause 4.8.1 of this contract states that the contractor may give to the employer's representative a written value engineering proposal that will, if adopted, either (1) reduce the contract sum or (2) accelerate the design, execution of the Works, or otherwise be of benefit to the employer, with no increase to the contract sum.

As can be seen from this the Irish government has adopted a traditional VE approach which is mostly based on economic aspects emphasising techniques, such as brainstorming, functional analysis and weighted evaluation to solve hard technical problems. It also places the liability for any changes to the design with the contractor. In so doing, the contractor is loath to make any significant changes to the design as they become liable for those changes. Also, however, such mechanistic approach often fails to consider the management process holistically since both the technical tasks (as guided by processes and tools) and the human resource variables (as manifested in conflict and commitment) are equally important as suggested by Liu and Leung (2002). A total project orientation in a holistic perspective is more desirable than the fragmented approach in treating VE as a procedural subsystem. As Fulford and Standing (2014) advocate, these disparate project management processes and non-standardised information is impeding efficiency gains. Not contented with traditional hard VE practice as discussed above, some scholars (Green, 1994; Liu and Leung 2002) thought there was cause for improvement. They thought that the traditional VE was rooted in hard systems methodology which was consequently only effective in solving hard technical problems. Liu and Leung (2002) observed that such hard problems are always manifested as a pursuit for cost reduction or function related value. What they advocated was soft value management, which does not differentiate between soft and hard problems; it merely provides a different way of dealing with situations perceived as problematic. The "hardness" or the "softness" is not the intrinsic quality of the problem situation to be addressed, it is an aspect of the way those involved addresses the situation.

Not only does the Irish government prescribe in their forms of contract about how VE is to be achieved on a construction project they also in relation to school projects include cost limits for the construction of all primary schools. At present the cost limits for primary schools are €1,210 per m2 of gross internal floor area which is to include the building, the substructure, preliminaries, insurances' and value added tax (Department of Education and Skills 0010/2016). By only using cost as a method of VE schools there appears to be an unexploited opportunity in achieving VfM. What needs to be done is to also look at the softer side of achieving VfM if a more holistic view is to be achieved.

*2.3.2 Value Management*
In contrast to VE the idea of value management (VM) is to increase the VfM relationship from the client's perspective. This is also the goal of VE, but VM advocate that VE is insufficient for defining the client organisation's product values in the complex and dynamic environment

of the early phases of a building project. The history track of VM is equal to VE until the 1960's, where for the first time VM manifested itself as a value delivery concept different from VE. The differences are rooted in the focus on the briefing process. Often the briefing process has been characterised as being particularly problematic (Latham, 1994; Yu et al., 2005; Naaranoja et al., 2016), and many problems in the later build process can often be traced back to the briefing process.

When looking into definitions of VM, one of the most accepted definitions is by Green (1996, p. 320) *'Value management is concerned with defining what value means to a client within a particular content. Value for money is then achieved by ensuring that design solutions evolve in accordance with the agreed objectives'*. The underlying principle is to achieve the required functions at the lowest possible cost without sacrificing quality. The purpose is to stimulate the discovery and examination of high cost areas and encourage creativity, which should result in generating better alternatives that can maximise the value of the product or service (Fong et al., 2001). VM is used to achieve best VfM and to increase the investment of stakeholder expectations in projects (Thiry, 2001). Apart from saving in project costs, VM can also provide a forum for the contracting parties to review the whole project and improve communication and team spirit among, various construction professionals (Yu and Shen, 2010). An additional benefit is that during the study creativity is largely enhanced through the interaction of different professionals and external experts. It is vital to understand that VM is not a set of rules and procedures it is more a conceptual framework within which amendments can be made according to one's needs.

Again, by using soft value management with VM you can balance inadequacies associated with traditional VM thereby maximising the benefits of the service. The Institute of Value Management (Institute of Value Management, 2008) identifies a range of benefits associated with using VM and soft value management together which include, better business decisions by providing decision makers a sound basis for their choice; improved products and services to external customers by clearly understanding, and giving due priority to their real needs; enhanced competiveness by facilitating technical and organisational innovation, and a common value culture, thus enhancing every members understanding of the organisation goals and decisions which can be supported by stakeholders.

The value delivery activities of the construction industry can be characterised by the prominence of an objective view of value and the use of predominately quantitative methods, such as Value Management (Thomson et al., 2003). The shortcomings of VM are beginning to emerge as construction industry members', customers' and stakeholders' understanding of value is becoming more sophisticated. To date, VM has provided an effective way to deliver objective value, given its focus on quantitative definitions of required function of cost (Thompson et al., 2003). However, as the industry and its customers are broadening their interpretation of value, they are also beginning to appreciate its subjective nature. This is exposing shortcomings in the current approach to value delivery, and its reliance on value management in particular.

In being prescriptive in relation to the design on school building projects in Ireland the DoE has decided what value means to them as a client and are therefore ultimately value managing the design and construction stages of a building project. Again, what needs to be done is a more holistic approach to value management needs to be adopted in order for better VfM to be achieved. The ultimate aim of VM should be to deliver best value or ensure VfM for a project and it should not be a cost cutting exercise. (Leung et al., 2003). However, VM is sometimes regarded as being synonymous with cost reduction, this should not always be the case as explained by Leung et al. (2003) and Jessup and Mitchell (2013). In conclusion, Norton and McElligott (1995) states that although VM normally does result in the reduction of the cost, the aim should not be about reducing costs, but about improving the design without reducing quality. VM should never be seen as a quick fix or a cost cutting exercise for projects in trouble which sometimes it has become.

### 2.3.3 Risk Management

In order to obtain VfM, risk should be allocated to the party most adept at managing it (Department of the Environment, Heritage and Local Government, 2003; Department of Finance, 2006; Demirag et al., 2012). Therefore, it is important to understand how risk is allocated, transferred and managed in construction projects. Risk has been defined by the Association of Project Management (2006, p. 28) as *'an uncertain event or a set of characteristics that, should it occur, will have an effect on the achievement of one or more of the project objectives'*. As Latham (1994, p. 54) stated in relation to risk *'You can reduce it. You can prevent it. You can accept it or you can transfer it. You must not ignore it'*. Both, risk analysis and risk management originated in the United States insurance industry in the 1940's.

Risk management (RM) in relation to the construction industry has been defined by Chapman and Ward (2003) as *'lack of certainty and uncertainty which is especially prevalent in the early project phases.'* Table 2.3 establishes the perception of the risks involved in undertaking construction work and how the risk should be allocated. It commences with planning risk which is dependent on procurement route that is chosen. It then goes on to illustrate that construction and design risk should be the responsibility of the contracting authority. The other risks of operating, demand, residual value and legislative changes should be the obligation of the government. Finally, other financial risks are dependent on the procurement option that is chosen for the work.

**Table 2.3** Sample Risk Allocation Matrix (adapted from Department of Environment, Heritage and Local Government, 2003)

| Risk Category | Allocation |
|---|---|
| Planning Risk | Depends on what form of procurement is adopted |
| Design and Construction Risk | Contractor is transferred these risks and is responsible for cost and time overruns |
| Operating Risk | Retained by the Government |
| Demand Risk | Retained by the Government |
| Residual Value Risk | Retained by the Government |
| Other Financial Risk | Depends on what form of procurement is adopted |
| Legislative Risk | Government is often in the best position to control regulatory and legislative risks |

In relation to RM on construction projects in Ireland, Cunningham (2013) observes that there are two standard forms of contract that exist in Ireland, the RIAI Standard Forms and the Public Works Contracts, which have an influence on the risk that is transferred to the contractor on a construction project. The RIAI contracts are published by the Royal Institute of Architects in Ireland; the Public Works contracts are published by the Government Construction Contracts Committee (GCCC). Both "families" produce guidance notes and supporting documents to complement the main contract forms. The selection of which contract to use depends initially on whether the project is public or privately funded. Publicly funded projects adopt the GCCC forms of contract. The Public Works Contract Forms (PW-CF) published by the Department of Finance which are mandatory for public sector contracts or where the exchequer provides at least 50% of the funding. Five forms of contract, PW-

CF1 to 5, now referred to as the "long" forms of contract, were introduced in 2007 in response to perceived deficiencies in public sector procurement arrangements. These contracts are not a negotiated form of contract and their introduction was greeted with widespread concern, particularly from within the contracting sector (Cunningham, 2013). The suite of contracts has since expanded to cover a number of procurement arrangements and now comprises eleven forms. Public sector authorities must now enter into fixed price lump sum contracts to the greatest extent possible, using competitive tendering in which a greater degree of risk will be borne by the contractor. The Department of Finance claims that this should deliver greater cost certainty, better VfM and more efficient delivery of public capital projects. A key objective is to rebalance the risk so that there is the optimal allocation of risk. It is claimed that the greater level of risk which is now borne by the contractor is possible by providing appropriate information in the tender documents to enable the tender to assess and price the risk (Cunningham, 2013).

So, one of the main ways of achieving VfM on school building projects from an Irish government's perspective is utilising the government forms of contract (GCCC), which allocates the majority of the risk to the contractor. However, the forms themselves, which introduced strict notice provisions for claims, required contractors to refer disputes to conciliation or forever hold their peace, significantly contributed to the unhappiness of the industry in using these forms. What resulted was an industry considering that they were asked to foot the bill, unfairly, for risks, which, whilst contractually theirs, were not ones that they could properly manage. (Irish Building, 2015).

From this it can be seen that the Irish government is of the opinion that by transferring risk they can achieve greater cost certainty and therefore VfM. Cost certainty and VfM do not necessarily go hand in hand. As Bruce Shaw (2011) one of the leading quantity surveying practices in Ireland stated *'the philosophy behind the suite of documents appears to be that transferring such risks whether quantifiable or not will improve VfM. It is more likely that the effect will be to improve cost certainty… but at a cost.'* The Irish government went down the route of risk transfer to the contractor which could guarantee cost certainty and in their view achieve VfM. However, the issue is that the government are probably paying a premium for this cost certainty as contractors are now beginning to add on the cost of taking on these additional risk items.

*2.3.4 Emerging themes in relation to achieving value in the construction industry*

The Irish government's response to achieve VfM in relation to school projects, in particular, is to utilise VE, VM and RM in relation to the design and construction stages of these schools. As far back as 1998 The Egan Report indicated that clients in the future will require an increased VfM that is expended on their capital projects. The principle involves reducing the relative costs of construction by designing, procuring and constructing the work in a different way than at the present time. This involves doing more for less by removing unnecessary costs. It has the aims to meet the perceived needs associated with efficiency, effectiveness and economy. This is even more important for the Irish government as they are concerned with the economic use of resources of the country as a whole. Until recently the cheapest method of construction was often the one selected. Nowadays, it is all about obtaining more from a given amount as the client and the end users are taken into consideration during the construction process; therefore the focus is on the business that the building is for rather than the client (Alhava et al., 2015). However, as depicted in Figure 2.6 the drawback with VE, VM and RM is that they look at a distinct phase in the construction process. In general VE focuses on the concept phase, VM is concerned with the design phase and RM is focused on the construction phase. If VfM is truly required in relation to a construction project, then the project needs to be looked at completely from inception to completion in order that a more holistic interpretation of VfM is achieved and all avenues are taken into consideration. What Figure 2.6 also demonstrates is that as the project progresses through the stages of concept, design and construction the impact on affecting the savings potential of the project reduce to an extent where it becomes evident that obtaining value should be about more subjective areas of a project which are dependent on the particular project and may include areas like social benefits and satisfaction.
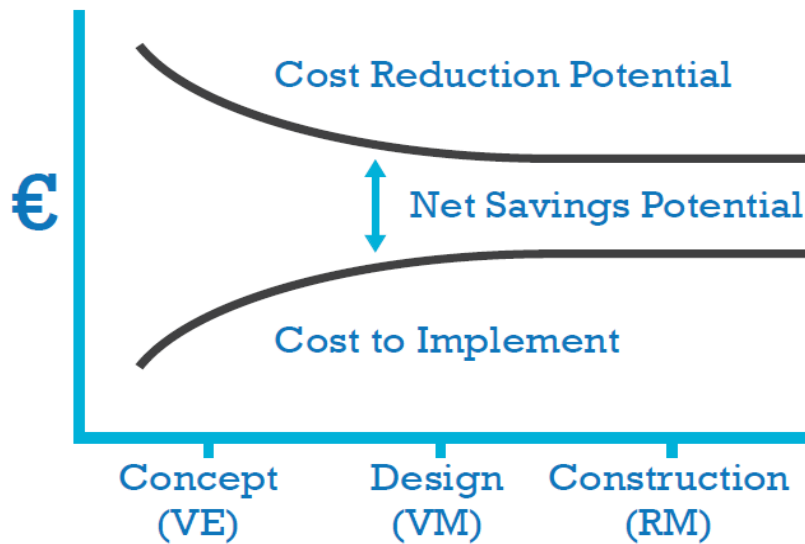
**Figure 2.6** Cost reduction Potential (adapted from Kelly et al., 2014)

A survey undertaken by Fong (2004) indicates that in relation to VM that most practitioners that have used VM in the last 6-10 years, indicate that the main reason for using VM is only for cost reduction. More surprisingly the survey indicates that in the eyes of practitioners VM does not have a clear professional image and that the use of VM is decreasing. It is clear from this that the use of VE and VM may be slipping as it is not achieving its goal of achieving true VfM. The reason for this might be that it is not looking at a construction project as a whole from inception to completion. To overcome these problems Male et al. (2005) argues that the future of VM lies in designing, tailoring and implementing a particular generic study to a specific situation. Rather than explaining generic VM steps for all construction projects, each project needs to be looked at on an individual basis or on the type of building that is being constructed. What Male et al. (2005) are advocating is that each project and its situation is different and that in order to achieve VfM, each project needs to be looked at in a distinct way. One of the ways of moving VM forward was proposed by Leung et al. (2003). Many of the researchers that have investigated traditional VM have focused on the technical tools and processes in the VM workshop (Leung et al., 2003). However, such techniques fail to consider the whole management process, as the organisational behaviour of human beings is equally important in the VM workshop. The major characteristics of the soft value management system, which was established by Leung, include various behavioural factors such as participation, communication, interaction, conflict resolution and feedback. Thiry (2001) advocated sense making in VM practice. Sense making can be seen as a system of interactions between different actions that are collectively using the intervention to make sense of the situation. Thiry (2001,

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p. 73) identified that *'lack of sense making time will trigger individuals anchoring into existing paradigms and confrontations, whereas understanding of the sense making process will allow value practitioners to help participants construct new paradigms from shared information and cross fertilisation and lead them to collaboration.'* This is true in all construction projects where the attitude a lot of time is that of "we always did it this way". It is only by looking at each project with fresh eyes and taking advice from all involved in the construction project can VfM be achieved. A focus on doing the job right first time has to be instilled in the minds of all project participants where problems are avoided not solved and advice is taken by all.

From an Irish perspective on school projects the DoE believes that VE has been achieved by using cost limits for the design and construction of schools, VM is achieved due to the fact that it is a repeat tested design and risk management is achieved by the use of the government form of construction contract which transfers the majority of risk to the contractor. It is clear from this that the DoE are achieving VfM by looking at the "hard" side, but in order for true VfM to be achieved in schools than the "soft" problems also need to be addressed. In order to do this all key stakeholders need to be involved in the design process in order that the values relevant to each construction project can be identified and understood. Assumptions should not be made about stakeholders' requirements or expectations. The importance of this is emphasised by (Leung et al., 2003) where it was stated that stakeholders can stimulate the conflict on a project, motivate teamwork, ensure decisions, reinforce job acceptance and subsequent action, as well as improving the level of job satisfaction for the implementation stage and the following works. It should be solely the customer, who decides what is valuable and what is not valuable (Grönroos, 2008). This represents a change in paradigm in the construction industry, in which architects and engineers are typically defining what is valuable and what is not on the behalf of the customer.

## 2.4 Irish government deriving value

In relation to the VfM concept and the Irish government, not only does the government's own perception of what they believe is value comes into play, but this is then tied up with monetary issues if true VfM is to be achieved in the Irish school building programme. From an Irish perspective on school projects, the DoE believes that VE has been achieved by using cost limits for the design and construction of schools, VM is achieved due to the fact that it is a repeat tested design and risk management is achieved by using the government forms of construction

contract, which transfers the majority of risk to the contractor. It is clear from this that the DoE is achieving VfM by focusing on the hard side, but in order for true VfM to be achieved on schools, then the soft problems also need to be addressed. These soft problems are rooted in a perception of values as human guidelines, which has an influence on human behaviour and actions, thus, creating a culture of cooperation. In order to realise this on school projects the stakeholders at each stage need to be embraced so that a more holistic view of VfM is reached. On school building projects where the design is set by the DoE this entails concentrating on the later stages of a project where value is not about potential cost savings (as demonstrated in Figure 2.6) but it is about the stakeholders involved. This necessitates concentrating on the construction stage and the post occupancy stage of school building projects to comprehend where additional value can be realised as the design stage has little scope for amendments to be made to it.

## 2.5 Summary

This chapter commenced with striving to realise an understanding of value versus values in order to define it for this research. Value being the beliefs of an individual and values are the principles by which we live. The chapter went on to interpret how adding value to something has developed over the years from being purely financial to also including a person's individual concept of what value means to them. The government perception on achieving VfM was discussed where it was agreed that the "3Es" of efficiency, economy and effectiveness was the dominant way of realising it. The focus then was on achieving VfM on construction projects where it was established that an objective view of value was prevalent. Finally, current ways of achieving VfM on construction projects were discussed and how the DoE undertake VE, VM and RM on school building projects. All of this serves to confirm that a "soft" view of achieving value on school building projects needs exploring.

The next chapter explores the background and processes involved in putting together a school building project in Ireland and the difficulties while endeavouring to achieve VfM on these projects.

# Chapter 3 Processes and procedures that influence the building of schools in Ireland

## 3.1 Introduction

The previous chapter addressed VfM and how it can be achieved in relation to construction projects. This chapter will focus generally on the education system in Ireland and specifically on how VfM can be achieved on the school building programme. The chapter commences with an overview of the education system in Ireland followed by an understanding of primary school design. It then goes on to explore the delivery of schools in order to understand how the DoE sees value is being achieved and more notably what can be done to obtain enhanced VfM. Finally, the chapter continues on from Chapter 2 into investigating the construction and post occupancy stage of a school construction project and justifies why these two areas need further investigation in relation to achieving enhanced VfM on school building projects in Ireland.

## 3.2 Overview of schools

Ireland's colonial past, religious affiliations, cultural traditions, economic developments and educational goals have combined to shape the complex structure of the education system (Walsh and Loxley, 2015). The primary education sector in Ireland includes state-funded primary schools, special schools and private primary schools. The state-funded schools include religious schools, non-denominational schools, multi-denominational schools and gaelscoileanna (Irish language schools). Most primary schools are state-aided parish schools, although this pattern is changing. In order to better understand the development of schools it is necessary to examine the legislative background of the educational system in Ireland and how this influences the design of schools. This section then goes on to trace the history of the educational system in Ireland from the foundation of the state in 1922 in order to get a better understanding of how this influences the design of schools in Ireland and ultimately how VfM is achieved. All of this establishes the contextual setting in which schools are designed and constructed in an Irish context.

### 3.2.1 Legislative background for schools

The constitution of Ireland called Bunreacht na hÉireann (1937) contains detailed constitutional rights and duties in regard to education. Article 8 (1) of the Constitution declares

that Irish is the first official language of the country and Article 42.4 provides that: *'... the State shall provide for free primary education and shall endeavour to supplement and give reasonable aid to private and corporate educational initiative, and, when the public good requires it, provide other educational facilities or institutions with due regard, however, for the rights of parents, especially in the matter of religious and moral formation.'* Therefore, the focus in Ireland is free education where the majority of the finance is provided by the state. It also indicates that education is predominately religious in nature with preference given to education in the Irish language.

As outlined in Chapter 1 the focus of this study is the primary school sector, which include state-funded primary schools, also known as national schools which have to comply with the rules and regulations set out by the DoE. These rules and regulations are contained in the Rules for National Schools (Department of Education, 1965) and subsequent updated circulars. Primary schools also have to comply with the Education Act, 1998 (Office of Attorney General, 1998) which provides generally for all education and ensures accountability within the system. A key function of the Act is to ensure that the education provided respects the diversity of values, beliefs, languages and traditions in Irish society. The Education Welfare Act 2000 (Office of Attorney General, 2000) provides that all children shall attend school by the age of six years. Although children are not obliged to attend school until the age of six, almost all children begin school in the September following their fourth birthday. Nearly 40% of four-year-olds and almost all five-year-olds are enrolled in junior infant classes in primary schools. Primary education consists of an eight year cycle: junior infants, senior infants, and first to sixth classes. Pupils normally transfer to post-primary education at the age of twelve. What this establishes is that from the age of five to the age of twelve pupils are educated in one classroom by a single teacher with no moving in or out of the classroom for different teachers. This has an influence on the design of the space as both the pupils and the teachers use the space throughout the day. In relation to the primary curriculum for schools a revised curriculum was launched in 1999 (Government of Ireland, 1999) which was the first complete revision of the curriculum since 1971. The revised curriculum is designed to nurture the child in all dimensions of their life: spiritual, moral, cognitive, emotional, imaginative, aesthetic, social and physical. As can be seen from this the legislative background that needs to be adhered to shapes the design of schools, which in turn, affects how VfM can be achieved on the school building programme.

*3.2.2 The provision of schools from 1922 until the late 1980's*

In 1922 the new Irish state inherited a proliferation of small schools, which were badly equipped and badly attended. Of approximately 5,700 primary schools 80 per cent were one or two teacher school (An Roinn Oideachais, 1965). At this time, many of the early schools were badly in need of replacement or considerable renovation. During the first decades of Irish independence, education policy focused on reviving the Irish language, culture, history and music, rather than on the structural elements of the system. The first major analysis of the education system was initiated in 1962 by the Department of Education in cooperation with the Organisation for Economic Cooperation & Development (OECD). Following publication of their report in 1965 the Minister for Education announced a policy for the rationalisation of primary school provision. A general policy of non-replacement of one teacher school which had already been pursued for many years was now extended to two-teacher schools and steps were to be taken to speed up the process of the amalgamation of small schools in general and the establishment of central schools. In 1964 the Investment in Education team found that the Board of Works had declared 22 per cent of national schools obsolete and 40 per cent non-effective. During the period 1962–1979 the number of one- and two-teacher schools reduced from 3,194 to 1,168.

In the decade 1969 to 1979 the overall number of schools fell from approximately 4,225 to 3,224 schools. Once the number of schools had been reduced the 1980's were then about the maintenance and upgrading of the existing school stock. This period saw growing public interest in the education system and parents saw education as a vehicle for social mobility for their children (Dolan, 2016). In addition Ireland's insularity since independence was beginning to abate and increased contact with international groups such as the OECD catalysed a change in thinking of education as a social expenditure to one of investment in people, the economy and society (Walsh, 2005). The drive may have changed to one where education was seen as an investment in the future of Ireland, however, what did not change were the budgetary and economic constraints of the 1970's and 1980's which saw many proposed schemes not going ahead.

*3.2.3 The provision of schools from the 1990s to the present*

During the 1990's the Commission on School Accommodation (CSA) conducted detailed studies to support policy formulation on the re-organisation of school provision as the economic constraints of the 1970's and 1980's meant that schools that were earmarked to be

built were not. Between 1996 and 2011 this commission produced a range of reports and Area Development Plans. In total 109 new primary schools were established in the period from 2000 to 2012. As can be seen from Table 3.1 the growth in primary school enrolments have increased year on year since 2000 which has necessitated a swift response to the need to provide more school accommodation. In 2000 the enrolment figure was 439,560 pupils and by 2015 this figure had jumped to 545,310 which shows nearly a 25% increase in a fifteen year period. This increase in school enrolments was a direct result of the increase in the birth rate, which saw the first quarter of 2011 with the highest quarterly birth rate since records began in the 1960's (Central Statistics Office, 2014). While figures are currently unavailable for enrolments for 2016 and 2017, predictions are that these figures will also show a growth year on year.

**Table 3.1** Growth in primary school enrolment 2000-2015 (Department of Education and Skills, 2016a)
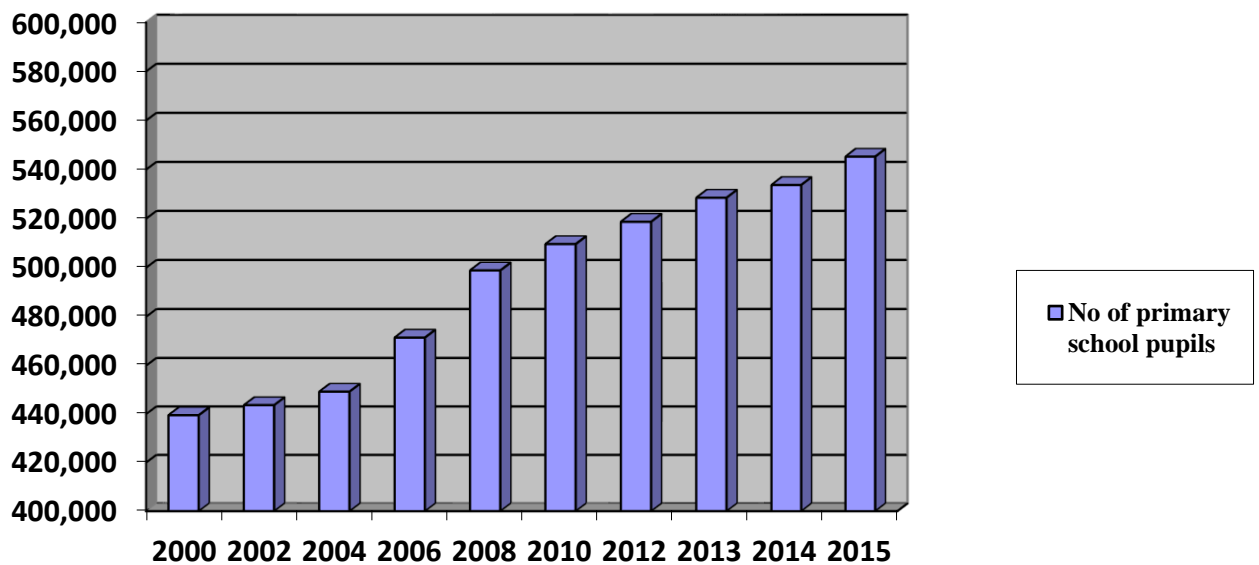


It is predicted that by end of 2017 enrolments in primary schools and secondary schools will grow by, up to 45,000 and 25,000, respectively, and growth is expected to continue at that level until at least 2024 (Central Statistics Office, 2014). The Government therefore has no choice but to provide new schools and, in many cases, dramatically improve existing ones. It is therefore imperative that the provision of these schools is investigated in order to appreciate how VfM can be achieved.

In order to provide new school accommodation the Minister for Education Ruairí Quinn announced in 2013 (Department of Education and Skills, 2013a) that construction was to begin on 37 new schools around the country and 33 other schools were to have extension projects

started. The 70 building projects scheduled included 22 new schools and 12 extensions at primary level, 12 new schools and 20 extensions at secondary level, along with three new special schools and one special school extension. The projects are part of a €2 billion building programme announced by Minister Quinn in 2012 which detailed 275 projects to be developed by 2016. Once completed, the 70 projects will provide more than 27,500 permanent school places. More than 21,000 of these will be additional school places and the remainder will replace temporary or unsatisfactory accommodation. In December 2014 Minster Jan O'Sullivan (Department of Education and Skills, 4th June 2014) announced another 70 school projects to be scheduled for construction in 2015 which included school projects that will replace inadequate educational infrastructure and provide much needed additional capacity to meet the demographic challenges. The 70 major projects included 44 new schools at primary level, 11 extensions at primary level, 5 new schools at secondary level, 8 extensions at secondary level and 2 new special schools. These school projects will deliver over 27,800 permanent school places and of these over 23,700 are additional places. As Minister Jan O'Sullivan (Department of Education and Skills, 4th June 2014) commented *'We have a pressing need to provide new schools and major extensions so as to continue to meet the accommodation requirements of our growing school going population.'* This implies that, school building work is not about to slow down in the coming years, therefore it is worth investigating how these buildings are designed and built and whether the government is making the most of the available resources that they are presented with. Moreover, as there is an immediate need for new schools at primary level it is therefore worth investigating this area first in order to understand the issues that exist when providing accommodation.

## 3.3 Primary schools

Due to the increase in population and the number of pupils entering primary school the DoE has focused on the pressing need to provide primary school accommodation and this is the focus of this research. One option available to them is the use of temporary accommodation. However, Minister Ruairí Quinn (Department of Education and Skills, 2013b) indicated that *'replacing prefabs offers better accommodation for students and savings for schools and the Exchequer, as well as providing construction jobs'*. He went on to state that *'replacing prefabs are part of the Government's €475 million education infrastructure plan for 2014'*. Another reason for not considering providing temporary accommodation is that such accommodation would still cost approximately two thirds of the cost of permanent buildings and would

need to be replaced after a number of years leading to further costs in the medium term. A related option would be to change the use of existing non-school accommodation. The Department's experience is that this option is also very costly in the short term (due to significant costs in the conversion and refurbishment) and does not provide a medium term solution (Department of Education and Skills, 2016b). A further option would be to consider providing transport to other locations where there may be capacity. This would involve lengthy journeys for some of the pupils in an area and would also be very costly. It also would be divisive in the local community where some pupils would be educated locally and others would not. This leaves the preferred option for the DoE is to build as much permanent accommodation as possible to cater for these increases.

In providing this new accommodation it is also essential to consider the constraints that may be imposed by the pedagogical brief that has been developed by the DoE for primary schools. It is also necessary to look at the constraints that are put on the design by the DoE themselves. In doing this, the framework in which new schools can be provided is laid out and the constraints surrounding the provision of schools are addressed. Finally, in this section, the cost involved in the construction of new school accommodation is addressed, which also adds another layer to the restrictions that are put in place by the DoE in the provision of new primary school accommodation.

### 3.3.1 Pedagogical brief for primary schools
The overarching principle of appropriate design for schools from the DoE perspective is that it should be a place that is physically, psychologically and socially safe, promoting the child's growth, health, learning and wellbeing as well as their positive interaction with teachers and fellow pupils (Department of Education and Skills, 2012a). The DoE set out in 2012 (Department of Education and Skills, 2012a) the pedagogical brief, which consultants need to take into consideration when designing a primary school. It also sets out the requirements that need to be adopted in relation to teaching practices in primary schools in Ireland. The DoE requires that these pedagogical practices are addressed in any design that is produced. The pedagogical brief that the consultants need to take into consideration when designing includes:

- facilitating peer to peer work and collaborative project-based work among pupils with ease

- complementing the range of learning styles among learners as much as possible, so that teachers can provide for an educational experience that is personalised more than ever before to the needs of the individual learner

- helping pupils develop strong interpersonal skills, self-confidence and self-knowledge

- helping pupils develop their ability to change and adapt

- making it easy for school management and for teachers to identify and share good pedagogical practice

- supporting and helping to foster teachers' reflection and self-evaluation about professional activity

- supporting teachers' professional development through learning from one another's best practice and from learners.

The pedagogical brief went on to require the design to make the supervision of pupils in the classroom space less about restricting pupils' access to different areas of the school and more about enabling pupils to know that they are safe and cared for by facilitating as much line of sight as possible for teachers from their classrooms (Department of Education and Skills, 2012a). By generating this information for consultants to use, the DoE are prescribing the way in which the consultants interpret the design of classrooms and ancillary spaces within the school building. They are also limiting the design ideas and concepts that may be generated by the design as they have a narrow concentration of what can be designed.

*3.3.2 School design*

Throughout the years the DoE has produced a number of documents and guidelines specifically in relation to the design of schools. This narrows the free reign of consultants to produce an appropriate design for schools. As can be seen from Table 3.2 the documents that are produced from the DoE fall under a number of categories and include: general, room layouts, construction standards, percentage for art and technical guidance documents. Under the general heading it includes technical guidance documents (TGD) on a diverse range of items including: site acquisition, general design guidelines and planning applications. This has the effect that consultants are unwilling to produce any designs that do not follow the norm and are thus reluctant to design something in a non-standard way. Under the heading room layout the DoE goes so far as to prescribe the classroom layout that is required and by doing this again, they are restricting the free flow of the design. The DoE is even more prescriptive in the information

they produce with the construction standard, which include the specifications for materials such as windows, sanitary facilities and acoustic performance. The DoE also set out the percentage allowance for artwork in schools, which can be restrictive on what can be paid to an artist for producing artwork for the school. Finally, general technical guidance documents are also produced by the DoE ranging from fire strategy to mechanical and electrical guidelines. All of these technical guidance documents add to the layers of information and restrictions that are put in place on the design of schools. It is therefore difficult to investigate alternative ways to design the school building due to the restrictions on the design being quite onerous. Moreover, this suggests that other areas need to be investigated in order to interpret if VfM is being achieved in these schools.

**Table 3.2** Relevant documents for design of primary schools (Department of Education and Skills, 2016c)

| Categories | Documents |
|---|---|
| 1. General | <ul><li>Fire Strategy for Schools - A Supplementary Guide for Design Teams</li><li>Memorandum of Understanding (MOU) on acquisitions of sites for school planning purposes</li><li>Code of Practice for The Provision of Schools and the Planning</li><li>Code of Practice for Management of Asbestos follow Procedures</li><li>TGD-020 - General Design Guidelines for Schools - Primary & Post-Primary (Revision 1 - October 2011)</li><li>TGD-022 - Primary School Design Guidelines (Revision 3 - February 2013)</li><li>TGD-023 - Post-primary School Design Guidelines (Published March 2008)</li><li>TGD-025 - Identification and Suitability Assessment of Sites for Primary Schools (2nd Edition, January 2012)</li><li>TGD 026 - Planning & Design Guidelines Primary & Post-primary School Specialist Accommodation for Pupils with Special Educational Needs (Addendum 1, 19th September 2013)</li><li>TGD-027 - Identification and Suitability Assessment of Sites for Post-Primary Schools (1st Edition, January 2012)</li></ul> |
| 2. Room Layouts | <ul><li>Room Layouts for Post-primary Schools</li><li>Room Layouts for Primary Schools (AutoCad, published March 2013)</li></ul> |
| 3. Construction Standards | <ul><li>TGD-021 - Construction Standards for Schools -Primary & Post-primary (Published March 2008)</li><li>TGD-021-1 - Guidance on the specification of windows (Published March 2010)</li><li>TGD–021-2 - Guidelines and Standards for Sanitary Facilities in Primary Schools (1st Edition April 2014)</li><li>TGD–021-3 - Guidelines and Standards for Sanitary Facilities in Post-Primary Schools (1st Edition April 2014)</li><li>TGD 021-5 - Acoustic Performance in Schools (1st Edition, February 2013)</li><li>TGD 021-6 - Structural Guidelines Disproportionate Collapse, Horizontal Tie, Vertical Tie and the Requirements in the Building Regulations</li></ul> |
| 4. Percentage for Art | <ul><li>Per Cent For Art Scheme</li><li>Download examples of Per Cent for Art PDF format or Video format Arts in Education Charter</li></ul> |

| 5. Technical Guidance Documents | <ul><li>Fire Strategy for Schools - A Supplementary Guide for Design Teams</li><li>TGD-001 - Mechanical & Electrical Building Services Engineering Guidelines for Temporary Accommodation School Buildings</li><li>TGD-002 - Mechanical & Electrical Building Services Engineering Guidelines for Primary School Buildings</li><li>TGD-003 - Mechanical & Electrical Building Services Engineering Guidelines for Post-primary School Buildings</li><li>TGD-004 - Information and Communication Technology (ICT) Infrastructure Guidelines for Primary Schools</li><li>TGD-005 - Information and Communication Technology (ICT) Infrastructure Guidelines for Post-primary Schools</li><li>TGD-006 - Energy Information FormTGD-007 - Design Team Procedures for Small Works (4th Edition, June 2014, Revision 1)</li><li>TGD-007 - Appendix D - Template Letter of Intent</li><li>TGD-007 - Appendix E - Template Letter to Unsuccessful Tenderers for use with Public Works Short Form of Contract</li><li>TGD-013 - Professional Indemnity Insurance for Consultants engaged on Education Sector Construction Projects (1st Edition, March 2005)</li><li>Revised Fair Wages Clause and Relevant Compliance Certificates</li><li>TGD-021-1a – Summer Works Scheme – Window Replacement – Primary and Post-primary Schools (1st Edition April 2015)</li><li>Guidance on the Protection of School Building Services Systems in Cold Weather</li><li>TGD-030 - Amendments to the M&E Building Services Guidelines (2004)</li><li>TGD - 002 & ICT Infrastructure Guidelines TGD - 004 for Primary Schools (Revision 1 June 2014)</li><li>TGD-030.1 - Guidelines on Mains Water Distribution Systems in Primary Schools (First Edition June 2014)</li><li>TGD-031 - Amendments to the M&E Building Services Guidelines (2004)</li><li>TGD - 003 & ICT Infrastructure Guidelines</li><li>TGD - 005 for Post-primary Schools (Revision 1 June 2014)</li><li>TGD-031.1 - Guidelines on Mains Water Distribution Systems in Post-Primary Schools (First Edition June 2014)</li><li>TGD-032 - Guidelines for the Design & Installation of Woodwork Dust Extraction Systems in Post-primary Schools</li></ul> |
|---|---|

Added to these documents is the research and development programme undertaken by the DoE in the area of sustainable energy efficiency in school buildings (DART Approach www.energyeducation.ie). This programme focuses on four key areas, namely: design, awareness, research and technology. The aim of this is to develop and include relevant energy efficiency technologies in school buildings, which are only used at certain times of the day (9.00am to 3.00pm) and 183 days a year. Again, what can be seen from this is that even the energy efficient technology that is included in the school has been prescribed by the DoE themselves and this again validates the need to investigate other areas in order for enhanced VfM to be achieved on school building projects in Ireland.

### 3.3.3 Class size

The latest figures on average class sizes in Irish primary schools for 2015-2016 was 24.9 pupils (Department of Education, 2016d); however the actual numbers of pupils and the physical size

of the pupils in classes vary with some schools reporting class sizes between 30-34 pupils. This is higher than the EU average, which is 21 pupils (OECD, 2016). With this number of pupils the DoE has recommended the accommodation for classroom sizes, which does not vary depending on the number of pupils in that classroom. The agreed allowances for accommodation as presented in Table 3.3 show that not only does the pedagogical brief set out by the DoE need to be taken into consideration, but they are also prescriptive in relation to classroom space and additional areas that are provided for in schools. This table sets out that the requirements laid out by the DoE for 24 pupils is 1,920m2 (Department of Education and Skills, 2012b). The DoE also specify the size allocated to pupil toilets within each classroom space. All of this does not take into consideration if there are more or less pupils in the classroom and is another standard that has to be met when designing a primary school. This may have implications in the future when some class sizes will need to be increased in order to take consideration of increase of pupil numbers in certain areas.

**Table 3.3** Classroom Space (Department of Education and Skills, 2012b)

| No. of Spaces | Area m2 | Description of Space | Total Area m2 |
|---|---|---|---|
| 24 | 80m2 | Classroom base, including storage (minimum 58m2) | 1,920 |
| Pupils Toilets | 5m2 | Per class may be grouped adjacent to classroom base | |
| Pupils Coat Storage | | Adjacent to groups of classrooms | |
| Literacy, ICT, storage | | Adjacent to classroom base | |

*3.3.4 School costs*

Moving on from parameters being put in place which restricts the ability of the consultants to design a primary school, limits are also put in place in relation to the overall cost of providing a primary school accommodation. The building cost limits for all educational buildings consist of two elements which are the Basic Building Cost (BBC) and the External Works Allowance (EWA). The DoE determines both the BBC and the EWA. The BBC and EWA are both maximum amounts and design teams are required to evaluate all elements of the project on a proper VfM basis to ensure that the project is of a durable construction with low maintenance and within the cost limit. However, where in the professional opinion of the design team in

consultation with the client, exceptional costs in excess of BBC and EWA will arise and can be justified, then, such costs should be listed under the heading of Abnormal Works and this is normally due to abnormal site costs only. The BBC is expressed as a cost per square metre of the new build floor area and provides for the cost of the superstructure and substructure of the building, together with the appropriate proportion of preliminaries, insurances and value added tax. The EWA provides for normal external works associated with the new build element of the project and is expressed as a % of the BBC and is normally 12.5% of BBC. The EWA is deemed to include all work in the National Standard Building Elements (-0) Site Series, viz (10), (20), (30), (40), (50), (60), (70) and (80) together with the appropriate proportion of associated Preliminaries, Insurances and Value Added Tax. Elements (50) and (60) of the EWA include for all work up to the point of entry into the Building. Abnormal Costs are exceptional project specific costs not normally associated with the BBC or EWA and which cannot be reasonably ascribed to either and are currently 20% of BBC. As of 1st February 2016 the cost limits for primary schools are €1,210.00 per m2 of gross internal floor area which is to include the building, the substructure, preliminaries, insurances' and value added tax (Department of Education and Skills, 0010/2016). What this means that all primary schools can only have a maximum cost of €1,210.00/m2 to build. This demonstrates that the DoE not only have Technical Guidance Documents, recommendations in relation to space requirements, they also specify the cost limits that are applied to the design of schools. Thus, in doing this the DoE are closed to introducing materials or modes of construction that may increase the capital costs of construction, but could lower the cost in use over the lifespan of the school.

When designing a school to cost limits the DoE also compels consultants to advance and gain approval for each stage before progressing onto the next stage. As shown in Table 3.4, there are numerous stages in the development which include stage 1 the initial design proposals; stage 2a developing the scheme; stage 2b design development; stage 3 tender stage; stage 4 construction; and stage 5 agreeing the final account. In order to advance through each of these stages, approval is required from the DoE. In some cases this may take an amount of time. This again adds to the inability of the design team to advance a project to tender stage in a reasonable timeframe. A lot of projects at the present time have only advanced to Stage 2b and have stopped at this stage awaiting approval from the DoE to advance to Stage 3.

**Table 3.4** Stages in school development process (Department of Education and Skills, 2012b)

| Stages | Involved |
|--------|----------|
| Stage 1 | Arising from the site investigations, initial design proposals and the cost review, a preferred option will emerge which achieves the best balance between the design (architectural, engineering and health & safety), educational, and economic requirements of the project. |
| Stage 2a | The Developed Scheme should evolve from the option agreed at the Pre-Stage 1 meeting and agreed with the Client on completion of Stage 1. |
| Stage 2b | The Design Team are fully responsible for ensuring that the project is fully designed and detailed before going to tender and that all the information necessary to complete the construction is included in the Tender Documents. |
| Stage 3 | During Tender Action the Design Team are required to ensure compliance with the procedure in DTP-2012 for examining tenders and ensuring that the lowest suitable tenderer's Bill is balanced and all elements are priced. If the tender price exceeds the approved pre-tender budget, the Design Team <u>must</u> identify any possible savings needed to bring the cost within budget. |
| Stage 4 | The Design Team objective for Stage 4 (Construction) is to administer the Contract effectively so as to achieve a high quality of construction and bring the project to substantial completion on time and within budget all in accordance with the conditions of contract and the Works Requirements. |
| Stage 5 | The Final Account is up to the Contractor to tell the Employers Representative (ER) that the works are ready for Substantial Completion and request that the ER certifies and not the other way round. Substantial completion should not be certified (and no certificate issued) until the works are ready for Substantial Completion and all relevant documentation has been provided. |

Therefore, as well as being prescriptive in relation to the design, the DoE is also rigid about cost that cannot be exceeded. In addition to this are the stages whereby approval needs to be agreed by the DoE before advancing to the next. All of this ensures that it is difficult to deviate in any way from a standard design. This suggests that if better VfM is to be achieved in primary school projects in Ireland other areas rather than the design need to be investigated.

## 3.4 Delivery of schools

An area that may ensure that enhanced VfM is achieved on the provision of primary schools is how these schools are delivered. Procurement refers to the process of obtaining goods and services from another for some consideration (Hackett and Stathham, 2016). They describe the process as being simple in theory: balancing quality, time and cost priorities, but complicated in practice: by legislation, the need to achieve VfM, demonstrate accountability, and coordinating consultant and contractual roles and obligations to achieve a satisfactory outcome. Naoum and Egbu (2016) note that procurement is a mechanism for linking and coordinating members of the building team together throughout the building process in a unique and systematic structure both functionally and contractually. In providing primary school accommodation there are a number of different procurement strategies that have been employed by the DoE in Ireland, namely, traditional, PPP, GRD and the rapid programme (D&B). Initially, it is important to examine each procurement method generally

and then specifically in relation to the school building to determine whether better VfM can be achieved and if so which procurements routes are best suited to achieving this.

### 3.4.1 Traditional procurement

According to Mitchell (2015) the traditional procurement arrangement typically involves a client appointing consultants to produce a design, select a contractor and supervise the work through to completion. The contractor is usually selected on the basis of competition and is responsible for the management and delivery of the facility and for the quality of workmanship and materials used, including those of the subcontractors. This approach is associated with projects where the employer prioritises the aesthetic and quality aspects of the project as; it allows them to maintain control over the quality of the work during the design and construction phases of the project (Naoum and Egbu, 2016). The process is typically linear in approach and proceeds through a succession of design development stages which should allow sufficient time for design teams to explore options and to finalise the work requirements within budgetary and time constraints. This process allows comprehensive tender documentation to be developed which facilitates competitive tendering arrangements and enables lump sum contracts to be agreed with contractors. The outcome therefore promotes cost certainty. Nevertheless, costs may need to be subsequently adjusted, as the arrangement provides the flexibility for employers to appoint named or nominated contractors to carry out specialist aspects of the design and the ability to introduce variations and scope changes to cater for contingencies and the changing needs of the employer (Mitchell, 2015).

The main drawbacks of the traditional approach derive from the separation of the design from the construction function (Murdoch and Hughes, 2008; Cooke and Williams, 2009; Ruparathna and Hewage, 2014; Naoum and Egbu 2016). The technical and management personnel involved in the project are not part of a single integrated team with single point responsibility for design and construction. Contractors, who are the construction experts are largely excluded from the design development process with the result that more buildable, innovative, or sustainable solutions may have been overlooked. This separation also complicates communication and may foster a "them versus us" attitude which reduces the team spirit vital for successful projects (Naoum and Egbu, 2016). This difficulty is compounded by the competitive tendering process associated with traditional procurement. The process is also viewed as being slow as full designs, are required before tenders can be

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obtained; thereby incurring additional financing costs for the employer. Where a full design is not provided at tender stage, additional information will be required during the construction phase; often resulting in variations, delays and disputes. Cooke and Williams (2009) conclude that traditional projects are, all too frequently, late, over budget, and prone to disputes.

As stated earlier, due to the predicted increase in population and the number of pupils requiring to commence primary and secondary school in the next few years, it does not seem appropriate to focus on a procurement option where the design is separated from the construction stage and the length of time to complete the building can be long. This means that on DoE projects the design is set by the DoE themselves, cost limits are implemented, stages are prescribed it is not suitable to use the traditional procurement route to provide for the volume of school projects required as soon as possible. Finally, this procurement option is not appropriate to investigate further as it may lead to cost certainty, but not necessarily VfM as the price is fixed, but at a cost to the overall project (Adriaanse and Robinson, 2015).

*3.4.2 Public Private Partnership*

The other procurement route is Public Private Partnerships (PPP's) which can be defined as '*cooperation between public and private actors with a durable character in which actors develop mutual products and or services and in which risk, costs and benefits are shared*' (Klijn and Teisman, 2003, p. 137). PPPs are often advocated on the premises that they provide better VfM than traditional procurement (Demirag and Khadaroo, 2008; Reeves, 2011; Shaoul, 2011). The PPP approach has the potential to offer VfM and timely delivery of infrastructure when applied to projects of the right scale, risk and operational profile. One key aspect of the PPP approach is that risk is transferred to the party best able to manage it (Department of Finance, 2006; Demirag et al., 2012). One of the principal reasons governments opt for the PPP model is that they accept the argument of superior private sector technical efficiency and therefore the prospect of delivering projects at a lower overall cost (Reeves, 2013a). In practice, the relevant argument in favour of PPP in this regard is generally made on the basis that it can provide better VfM than traditional procurement. VfM is achieved when it produces '*a flow of services of at least equivalent quality to that provided by the public sector, but at lower overall cost (taking everything into account, particularly the transfer of risk)*' (Ball and King, 2006, p. 37).

The origins of the PPP procurement in Ireland can be traced back to the acute nature of Ireland's lack of physical infrastructure that became more and more pressing as the country entered into the period of rapid economic growth in the mid-1990s (Reeves, 2013b). The urgent need to speedily deliver infrastructure provided an opportunity for private interests to make the case for more extensive private sector involvement in the financing and delivery of infrastructure assets as well as increased involvement in the delivery of public services on the back of these assets. Private interest pointed to the development of the Private Finance Initiative (PFI) in the UK and argued that this model of procurement presented a useful approach to addressing Ireland's supply-side constraints (Reeves, 2013b).

Initially, the government adopted a cautious approach, announcing eight pilot PPP projects in 1999. However, the PPP model quickly gained favour amongst relevant policy makers and when the National Development Plan 2000-2006 was published in November 1999 it stated that the urgent need to deliver infrastructure was such that the PPP programme would be expanded before pilot projects were completed. By May 2001 over 70 PPP projects were listed on the website housed by the Central PPP Unit in the Department of Finance. Despite the fact that more and more projects were nominated for procurement under PPP, progress in the early years was slow. By mid-2003, four years after the announcement of the pilot projects, the procurement process had been completed in just three cases, two of which were in the schools sector (Reeves, 2003). At this point the PPP programme was the subject of strong criticism from the private sector with respect to aspects such as the level of public sector skills in the context of procuring PPPs and the costs involved in bidding for PPP contracts (Reeves, 2008). Although a number of roads PPPs were close to completion by mid-2009 the total number of projects in operation remained low at that stage with just six projects (excluding water service projects) included in the data on PPP activity provided by the Department of Finance's Central PPP Unit. The procurement of many PPP projects has therefore proved to be a lengthy process in many cases and has been abandoned in other cases (e.g. nursing homes, national radiotherapy network, rail transport and prisons). In the meantime, however the extent and composition of Ireland's PPP programme have altered significantly in the context of the international and domestic economic crisis with a large number of PPP projects put on hold or abandoned.

The DoE announced in 2005 under their Public Private Partnership Programme educational projects to be developed under the PPP arrangement. These included 16 higher education

projects in 9 institutions. It is unusual that the decision to expand the use of PPP in Ireland came at a time when, in international terms, there was widespread disenchantment with the PPP experience. Indeed the UK, which is the world leader in terms of the scale of PPP activity, announced a major reform of PPP due to *'widespread concern that the public sector has not been getting value for money and taxpayers have not been getting a fair deal now and over the longer term'* (HM Treasury, 2012, p. 1). The majority of DoE led PPP projects are large scale projects and include the Cork Maritime College and the School of Music Cork. However, as Blyth (2009) stated as the PPP school projects are large due to financial crisis many sources of private finance have virtually disappeared. Therefore, it is not necessary to investigate VfM in relation to PPP programme as it is difficult to assess if value is being achieved and the number of projects that are at construction stage using the PPP process are minimal at present. Also the scale required for the feasibility of PPP projects is not appropriate in a primary school setting.

### 3.4.3 Generic Repeat Design school

One of the ways the DoE sees the response to the issues with the length of time traditional procurement has and the scale that is required to use in the PPP process was to develop the generic repeat design (GRD) for schools. The DoE considers this process to have many benefits (Sheppard, 2011) which include the development of a fully considered educational model, timeline savings through the application of an off-the-shelf solution, reduced professional fees and greater cost certainty. The objective of the GRD process was to develop an off the shelf solution to the pre tender stage by using a template design that can be given to design teams. The design team then deals with site specific issues, the planning process, tendering and construction. The key advantage of this are savings in significant design time and costs as the GRD accommodation can be provided in approximately fifteen months from need identification, site procurement and design team appointment. The GRD school project consists of a design for a standard 8, 12, and 16 classroom school undertaken by the DoE in Ireland. The aim of this is to produce a building design that uses less than 50% of the energy used by a school built to good practice standards without significant additional cost (Sheppard, 2008). As Sheppard (2008, p. 776) stated *'the overall energy impact of the design is considerable as 50 plus schools will be constructed to this proven and optimised, low energy design.'* What is even more interesting is that the DoE sees these schools as having a wider educational role in environmental awareness and will demonstrate the government's commitment to the

sustainability agenda. This was reinforced by Sheppard (2008, p. 782) stating that *'as schools within the communities they have a wider educational role in environmental awareness, and demonstrate government commitment to a sustainable future'*. As this generic prototype is being looked upon as the Department's benchmark for primary school accommodation for pupils ranging in age from 5 to 12 years it is important that the procurement route is assessed for its suitability. However, in 2010, a report from the Economic and Social Research Institute (ESRI, 2010) highlighted the importance of school design for pupil engagement, learning and achievement. School and classroom density, class size, quality of lighting, ventilation and absence of noise were among the factors found to enhance the student experience. The report went on to state that generic designs remain commonplace. In general, the Department's rules and regulations do not allow for "wow" designs. While the DoE is aware of the effect that better design will have on the school community, there are significant constraints posed by cost and compliance issues. Therefore, in providing a generic design the DoE has decided what "value" means to them as a client and are therefore ultimately value managing the design and construction stages of a building project. This reinforces the argument to focus on the construction and post occupancy stage of the project to determine whether there is anything that can be done to feed back into the design process in order to achieve enhanced VfM.

### 3.4.4 Rapid school programme/Design and Build

Under this arrangement the contractor undertakes both the design and construction of the work in return for a lump sum price (Jackson, 2011). The arrangement may be for total design and construction, (turnkey projects) or for development of an initial scheme design, completed designs with full bills of quantities are occasionally novated to contractors at the contract award stage. The contractor may be appointed either by competitive tender or as a result of a negotiated agreement. According to Jackson (2011) design and build (D&B) procurement tends to suit clients who are looking for the best value rather than just lowest cost bids. Although the D&B arrangements can be employed on sophisticated buildings, they tend to be associated with projects where the employer is more concerned with the functional aspects of the building rather than its aesthetic qualities. In essence, this means that D&B is suited to school projects as the projects are not sophisticated buildings and a number of projects can be bundled together into one large D&B project.

There are a number of benefits claimed for the D&B arrangement. The approach is characterised by an integrated design and construction structure, which eliminates many

of the problems associated with traditional procurement arrangements outlined above. It seeks to establish single point responsibility for the design and delivery of the project within a single organisation (Francis and Kiroff, 2015). The Joint Contracts Tribunal (2011), however, comments that this is rarely fully achieved in practice. With this arrangement the relationship and communications are more straightforward, as is establishing liability if things go wrong (Francis and Kiroff, 2015). D&B arrangements are "fast track", allowing for the overlapping of design and construction activities. This characteristic allows construction work to start early while much of the downstream detail design work is developed in parallel with site operations, thereby enabling earlier completion dates to be achieved (Reina, 2004; Walker and Hampson, 2008; Loosemore, 2014). One of the most attractive characteristics from an employer's point of view is the early involvement of, and the maximisation of competition amongst the tendering contractors in both the design and pricing aspects of the project.

The success of the D&B arrangement largely hinges on the ability of the employer to produce a definitive project brief; a process which usually requires the appointment of consultants. This process takes time; incomplete briefing information will result in inadequate proposals being developed (Hackett and Statham, 2016). Correcting these by introducing variations may cause significant disruption in the contractor's production process and it is often difficult to ascertain their cost implications. The contract sum analysis supporting the contractor's proposals is typically based on preliminary designs and is therefore not quantifiable to the level of detail associated with traditional approaches (Hackett and Statham, 2016). The individual elements of the descriptions contained in the contract sum analysis, for example design, labour, overheads and profit are not usually identifiable. The valuation of variations is therefore the subject of negotiated fair rates, and often cost significantly more than may be anticipated under traditional arrangements. Finally, according to Cunningham (2013) the imperative to deliver competitive designs focused on functionality has resulted in many instances of bland and occasionally ugly buildings.

On school buildings the bundling of two or more schools together as one project helps reduce the workload, but the number that can be bundled is limited by the capacity of consulting firms to deliver within the time frame required. The DoE began a rapid schools programme (D&B) in 2010 to deliver schools. They appointed project and cost manager, technical advisor and employer's representative to deliver it. The team provides a single point of

management to the DOE. Additionally, this delivery model allows greater efficiency and consistency across the programme of schools. Again the cost m2 is still prescribed by the DoE. Also, standard classroom layouts and arrangements are still expected to be adhered to. This infers that the DoE are again deciding what value means to them as a client so it is necessary to focus on the construction stage and post occupancy stage of D&B projects so that a more holistic view of VfM can be achieved.

*3.4.5 Summary*

There are a number of ways of delivery schools traditional procurement, PPP, GRD and D&B. All of the options have their advantages and disadvantages as outlined. In today's climate where schools need to be completed rapidly there are two options that need further investigation in relation to providing primary school accommodation. Traditional procurement takes too long and in situations where schools need to be built rapidly the procurement route is not appropriate. PPP, although have many advantages from a school perspective, it is not a solution that provides schools rapidly. Also, it is predominately only for large scale projects usually third level institutes. The two procurement routes that need further investigation are GRD and D&B as they are the procurement routes that the DoE are championing in order to deliver schools rapidly. The next stage is to investigate at what stages in the procurement process, VfM can be achieved on GRD and D&B projects.


## 3.5 VfM in relation to schools

*3.5.1 VfM on schools internationally*

In the developed world, building new schools is taking place at a time of considerable changes in the societal context as well as the field of education (Heppell et al., 2004). Schools today are increasingly expected to be flexible and to fulfil additional functions by, for example, offering sporting and cultural activities (OECD, 1996). According to the ESRI (2010) apart from international reports, principally from the OECD, on school design and recent documents related to the Building Schools for the Future movement in the UK, very little empirical research has been conducted internationally in this area in recent years outside the US and the UK.

In the US school facilities represent the second largest sector of public infrastructure spending, after highways, and yet there is no comprehensive national data on public school infrastructure

(Filardo, 2016). This means that the absence of official data and standards has left communities and states working largely on their own to plan for and provide high quality facilities. What is however clear, is that between 1994 and 2013 US public school enrolment grew by 4.8 million students. As a result, in that same time period, school districts reported a net total of about 13,000 additional schools (Dodge Data & Analytics, 2016). This increase in student numbers is continuing at a pace with national enrolment projected to increase by 3.1 million between 2014 and 2024 (Dodge Data & Analytics, 2016). Both the state and the federal government contribute funds towards school districts' annual operating costs, paying, on average, 45 percent and 10 percent, respectively. However, there are no national standards for public schools facilities conditions, spending and investment. Rather, communities use annual school district operating budgets, educational facilities master plans and capital budgets to determine what they need from their school facilities, and then they set priorities based on what they can afford (Filardo, 2016). It should be noted that with this system of funding and construction, school facilities have inequity built into them as what gets constructed is determined by local wealth in a particular state. VfM in this system can only be achieved at a local level as each individual school is being built.

The shortage of school places is also mirrored in the UK with RIBA (2016) stating that close to one million pupils will enter the English school system in the next 10 years. However, funding for school building work and improvement has fallen dramatically due to budget constraints. In 2010, £7.6 billion was being spent a year including £55 billion on Building Schools for the Future programme and the £7 billion Primary Capital Programme for primary schools, both of which were axed by the coalition government. The replacement initiative, the £2.4 billion Priority School Building Programme (PSBP), was unveiled in 2011 but, according to reports, attracted almost three times as many applications as it could afford to fund (RIBA, 2016). With limited funding available to address the growing school building problem, it is critical that every penny spent offers good VfM to ensure that as many schools can benefit from the funding available. In order to achieve this the PSBP offers a choice of three prefabricated designs for new school buildings, costing a third less than schools built pre-2010 (RIBA, 2016). It can be argued that the fundamental shift from a locally controlled education system to a national system that grants greater independence to school means that there is a danger that central control can reduce local circumstances and hinder how VfM is attained.

From this it can be seen that the US favours a more local state approach to the funding and construction of new schools while the UK favours a more centrally controlled system. The US allow the design to flow from the consultants while the UK, like Ireland, are looking at producing prefabricated designs. Both systems have their advantages and disadvantages and it is about trying to find a balanced approach to suits all. What is clear, is that the US and UK are also experiencing an increasing need to provide new school accommodation to alleviate the increase in pupil numbers but this needs to be achieved with limited constrained budgets that are available.

### 3.5.2 VfM on schools in Ireland

Following on from examining the history of school provision in Ireland, to the design requirements to the delivery of schools internationally it is necessary to examine how the DoE see VfM is being achieved on school projects. Chapter 2 investigated generally how value is achieved on construction projects: by the use of VM, VE or RM. This section will address the DoE's current interpretation of how VfM is achieved in the school building programme.

The VfM and Policy Review Initiative (Department of Finance, 2007) is a systematic process of evaluation conducted by government departments and offices under the guidance of the VfM and Policy Review Central Steering Committee and the Departments of Finance and Public Expenditure and Reform. This evaluation process is used by the DoE in order to review how VfM is being achieved in the department generally and specifically in the school building programme. The objectives of the evaluation are to analyse exchequer spending in a systematic manner and to provide a basis on which more informed decisions can be made on priorities both within and between programmes. The Comptroller and Auditor General Amendment Act (1993) and the Public Service Management Act (1997) set the context for expenditure reviews in terms of the achievement of economy, efficiency and effectiveness, and the maintenance of appropriate systems, practices and procedures for the purpose of evaluating effectiveness. It is these acts along with the evaluation that is carried out at a strategic level by the DoE. Any review according to the DoE should examine the scope for alternative organisational approaches to improve efficiency and effectiveness of provision (Department of Education, 2013b). It should be noted that the context in which a review takes place is the requirement in recent years to provide significant additional pupil places to cater for demographic growth. The provision of additional pupil places is costly in both current and capital terms. These challenges have been exacerbated by current economic conditions which are impacting on the

government's ability to direct increased resources to meet these growing needs (Department of Education, 2013b).

The estimated annual cost to the state for the provision of primary education was in the order of €3.3 billion in 2011 (Table 3.5). This has significantly increased since 2002 when the total spend on education was €1.85 billion. The most up to date figures are for 2015 and show an increase again to the order of €8.80 billion, with €7.92 billion of that spent on current expenditure and €0.53 billion on capital expenditure. With this increase year on year comes with it the awareness that VfM needs to be achieved not only at a DoE strategic level but also at a project level. Current expenditure includes costs associated with pay and operating costs, school transportation, grants and services. Capital expenditure includes the cost of building schools, furnishing schools and information technology activities within school buildings.

**Table 3.5** Statement of expenditure on primary level education 2002 and 2011 (Department of Education and Skills, 2015a)

**Total Expenditure €1.85bn 2002**

| | |
|---|---|
| 1% | |
| 11% | 3% |
| 8% | |
| 77% | |

- Pay & Overheads
- Capital Investment
- School Transport
- Grants & Services

**Total Expenditure €3.29bn 2011**

| | |
|---|---|
| 1% | |
| 8% | 3% |
| 16% | |
| 72% | |

- Pay & Overheads
- Capital Investment
- School Transport
- Grants & Services
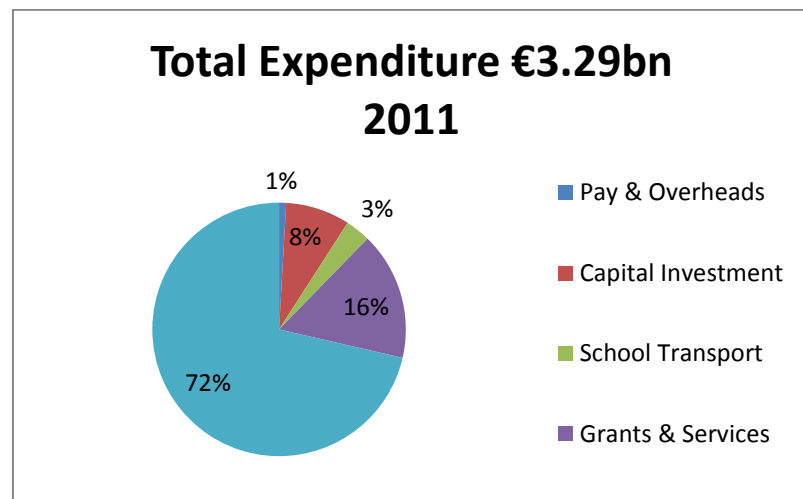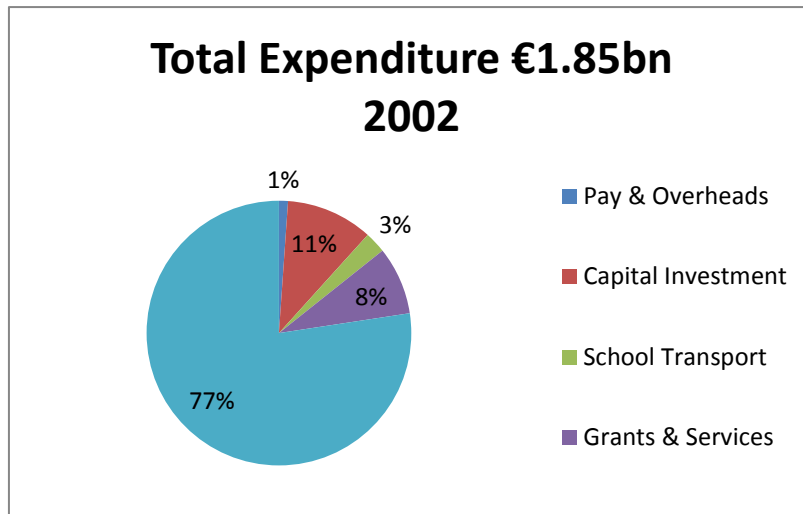
The DoE sees VfM as being achieved when an expenditure review is undertaken which investigates the economy, the efficiency and the effectiveness of spending as a whole. The last ten years have seen the annual cost to the state for the provision of primary education increased significantly. It is therefore important that rather than scrutinising VfM from the top down (strategic level) it may be more appropriate to investigate it a project level as well as a strategic level (bottom-up and top-down). As discussed previously, there are certain fixed requirements that are included in any construction project that is undertaken. This includes a fixed design requirement, fixed class size and fixed cost. This excludes the ability to investigate the concept or design stages of a project in order for better VfM to be achieved as there is limited opportunity to make changes and still achieve the design, class size and fixed costs that are required by the DoE. Other areas of a school project that the focus may be better placed in

order for VfM to be achieved, may include the construction stage and the post occupancy stage of a school project as the design stage is set by the DoE and the number of stakeholders that have an influence on the design stage makes it difficult to change. These two stages will now be addressed in order to gain an understanding of how better VfM can be achieved at each one of them.

## 3.6 Construction stage

Chapter 2 defined that in order for truly holistic VfM to be achieved, then along with the hard side of value the soft side of value also needs addressing. At the construction stage on a school project the hard side includes areas than can be quantified. These include VE, VM and RM. The other side that also needs addressing is the soft side of VfM, where the focus is on the people that are involved in the projects. If these stakeholders can be satisfied with the construction project this will then ultimately lead to achieving better VfM. Another soft area that needs exploring is the sustainability of the project not only from an environmental perspective, but also an economic and importantly from a social perspective.

### 3.6.1 Stakeholder satisfaction

Satisfaction as defined by Nzekwe-Excel et al. (2009, p. 168) is *a 'measure of how much, or the extent to which the needs, desires, requirements and expectations of clients or participants are met'*. It has widely been identified by researchers as the key challenges facing the construction industry (Torbica and Stroh 2001; Chan et al., 2003). Williams (2016) explains that satisfaction entails recognising the customer needs, requirements and devising measures to meet their requirements. Indeed Bryde and Robinson (2005) characterised a preference to focus on tangible time and cost success factors (see Chapter 2 section 2.2.5) rather than others, perhaps less tangible factors and a tendency to place greater importance on satisfying the procuring stakeholder alone. It is, however, difficult to represent stakeholder satisfaction merely based on the project goals in terms of time/cost. Satisfaction is an affective state reached by the individual through the attainment of certain goals (success) which gives rise to meeting any particular objectives. Table 3.6 shows that in order to deliver value, managing risk and managing relationships is all essential elements to project success. However, neither managing risk nor managing relationships can be clearly defined in isolation to the others, nor can one element stand alone as more important than any other (Bourne, 2016). Delivering value through managing schedules, budgets, scope and quality is not just about conforming to the project

plan. Delivering value requires managing project relationships and managing risks by ensuring that the expectations of all stakeholders are met with regard to what is delivered as well as when and how (Bourne, 2016). Another important point to note in relation to success is that some projects that construction practitioners consider as failures are often perceived by customer stakeholders as successes. Construction practitioner tends to focus on fulfilling a definition of client requirements captured only at the project outset, but a truly successful project is one that not only delivers value, manages risk but also manages relationships (Thomson, 2011).

**Table 3.6** Elements of project success (Bourne, 2016, p. 29)

| Delivery of Value | Managing Risk | Managing Relationships |
|---|---|---|
| Appropriate and consistent use of project management tools, processes and methodologies. | Identification and management of project risk. | Managing the expectations of project stakeholders. |
| Alignment of the outcomes of the project to organisational strategy. | Development of strategies for managing in an environment of uncertainty. | Appropriate, timely and consistent involvement by users and managers. |
| PM skills and knowledge. | PM skills and knowledge. | PM skills and knowledge. |

Many problems of stakeholder management at the construction stage proposed by previous scholars include inadequate engagement of stakeholders, project management having unclear objectives of stakeholder management, difficulty to identify the "invisible stakeholder" and inadequate communication with stakeholders (Bourne and Walker, 2006; Rowlinson and Cheung, 2008; Butt et al., 2016)). In order to solve these problems, project teams need to know what the essentials are for managing stakeholders at construction stage (Cleland and Ireland, 2006).

There are numerous Critical Success Factors (CSF) that can be implemented in relation to achieving stakeholder satisfaction at the construction stage of a project. CSF can be identified as areas, in which results, if they are satisfactory, will ensure successful competitive performance for the organisation (Hasler, 2016). Jergeas et al. (2000) identified two aspects of improvements for managing stakeholders which include communication with stakeholders and setting common goals, objectives and project priorities. Aaltonen et al. (2008) suggested that the key issue in project stakeholder management is managing the relationship between the project and its stakeholders. Aspects of stakeholder satisfaction that require assessment include

identifying the stakeholders involved, assessing the behaviour of those stakeholders and communication among those stakeholders.

Identify stakeholders

Many of the scholars studying stakeholder management (Karlsen, 2002; Olander, 2006; Walker et al., 2008; Jepsen and Eskerod, 2008) have pointed out the significant importance of identifying stakeholders. Public sector clients can be particularly pluralistic (Tzortzopoulos et al., 2006) comprising stakeholders who seek to use project outcome and those only interested in it as a capital asset. These goals often conflict. Olander and Landin (2008) note competing value systems, diversity, internal complexity and changing the relative importance of the clients' constituent stakeholders each of whom has a different value. Bourne (2016) has characterised stakeholders as politically motivated agents who seek to maximise their representation in the project solution and will adapt their goals during delivery to achieve this. So the first CSF in relation to stakeholder satisfaction is the identification of stakeholders. If this is achieved, then it can go a long way to achieving a successful construction project and ultimately obtaining VfM.

Assessing the behaviour and attributes of stakeholders

The next CSF is assessing stakeholders' behaviour in relation to the project. Stakeholders' behaviour can be sorted into three categories; observed behaviour, cooperative potential and competitive threat (Freeman et al., 2007). By analysing and estimating these three attributes a project manager enhances the understanding of all stakeholders and is thereby better informed about how to manage relations with them.

Relationships

The relationships between the project and its stakeholders are also a vital ingredient in the successful delivery of projects and meeting stakeholder expectations (Jergeas et al., 2000; Panahi et al., 2016). Trust and commitment among stakeholders can be built and maintained by an efficient relationship management (Karlsen et al., 2008). Cuppen et al. (2016) also identified several benefits of stakeholder participation and engagement. INVOLVE (2005) suggest benefits such as, greater social cohesion; improved quality of service, projects or programme; and a greater capacity for building and learning among others. However, Holt (2001, p. 149) argues that *involving these stakeholders throughout the facility life cause costly interruption to service delivery, as well as reflecting unduly the interests of a powerful or vocal*

*minority.'* Therefore the challenge is to innovate ways through which to maximise positive benefits attainable from stakeholders involvement or engagement.

Communication

Communication is also essential for maintaining the support and commitment of all stakeholders. It is important that communication is timely, accurate and relevant which is important for project success (Butt et al., 2016). In addition, Weaver (2007) believes project managers should be highly skilled negotiators and communicators capable of managing individual stakeholder's expectations and creating a positive culture within the overall organisation. Project meetings, project plans and reports, informal discussions, formal presentations are all communication vehicles. A project manager must be able to recognise the danger signals, the warning of possible trouble with senior stakeholders. Landin (2011) considers that the long term performance of any construction project and its ability to satisfy stakeholders depends on the decisions made and the care taken by the decision makers in fostering stakeholder communication. Young (2010) also points out that the key to good stakeholder management is management of the relationship between the project team and its stakeholders. All this leads to the conclusion that the ability of the project manager to communicate with all stakeholders is critical to the success of the project and ultimately achieving VfM. Good communication has the ability to contribute to building a trusting environment and supplies stakeholders with information about the strategic issues of the project.

From all of this it can be seen that there are a number of CSFs that need to be investigated further, in relation to stakeholder satisfaction these include identifying stakeholders, assessing the behaviour and attributes of stakeholders, relationships and finally communication among all stakeholders. By these being explored then this can potentially add to a more holistic view of VfM being achieved. Moreover, rather than looking purely at the hard side of value (building), the soft side of value (people) is also addressed.

*3.6.2 Sustainability*

The other aspect at the construction stage that needs exploring from a VfM perspective is sustainability. The meaning of sustainability and sustainable development is evolving over time and commonly the terms are interchangeable to broadly describe an approach that addresses the social, economic and environmental challenges mankind faces (Murray and Cotgrave, 2007). As Prasad and Hall (2004, p. 8) stated *'construction industry activities virtually impact*

*all human beings. From the three tiered sustainable development perspective, the built environment is believed to provide a synthesis of environmental, economic and social issues through the provision of shelter, physical infrastructure to communities and for being a significant part of the economy.'* However, as Turner (2006) has noted the aspiration to integrate environmental concerns into all aspects of social and economic life brings unexpected cultural, social and political challenges. He further suggests that in order to cope with these challenges, existing systems need to be modified by more participatory systems. This was reinforced by Murray and Cotgrave (2007) when they advocated that social and economic influences are harder to quantify and document than the environmental impact. The CIB acknowledges that in many countries the official context of sustainable construction emphasises ecological aspects and more or less ignores issues such as poverty, underdevelopment and social equity (CIB 1999, p. 119). The 2002 World Summit on Sustainable Development gave a shift in the perception of sustainable development towards a more comprehensive consideration of social and economic dimensions of development (Bernardi, 2013). Many evaluations on the sustainability of buildings have been limited to the physical boundaries of the building and it is mainly (or only interpreted from) the environmental perspective (ISO 9001, 2015). Consequently, sustainable assessments have been accused of only investigating the functioning of individual environmental criteria reflecting the idea of a building as a consumer of resources (Conte and Monno, 2012), rather than including the soft side of sustainability which includes the people that construct and use the building.

On a construction project the VfM and sustainability arguments seem to share many of the same tenets (Figure 3.1). The efficiency/environmental considerations seem to be addressed in these schools as the design is provided by the DoE. In relation to the economic aspects of achieving value VM/VE can be utilised. When trying to achieve the economic aspect of sustainability life cycle costing, can be utilised. However, what appears to be much harder to quantify is the effective/social and economy/economic aspects of both arguments. According to Bernardi (2013), the most ignored dimension of the concept of sustainability is the social one. The difference between stakeholders view on what is a sustainable building makes the identification and the characteristics of a sustainable building difficult (du Plessis and Cole, 2011; Parr and Zaretsky, 2010). By addressing these areas, a construction project is being focused on in a different way and not just in relation to discrete phases of a construction project. This can include how the construction stage can have a positive effect on the community that it is being constructed in.
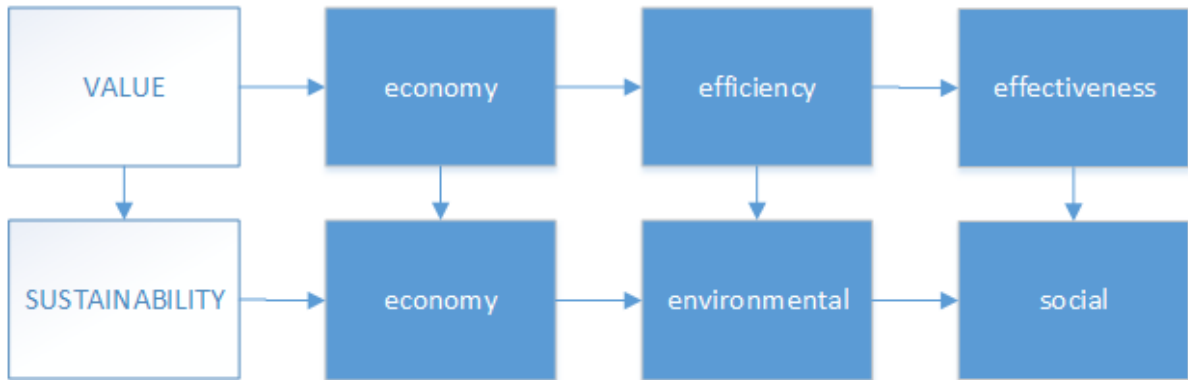
**Figure 3.1** Value and sustainability different interpretations of the same argument

*3.6.3 Emerging themes at construction stage*

A number of themes have emerged from the literature at the construction stage as depicted in Figure 3.2. In terms of stakeholder satisfaction it has been found that not all CSFs for stakeholder management are appropriate for primary schools in Ireland. Therefore, for primary schools, identifying stakeholders, behaviour and attributes, relationships and communication need to be investigated further. In the area of sustainability it is well defined in the literature that not only does the environmental impact of the school needs to be addressed but also the social and economic aspect of the school. If these areas are addressed then a more holistic view of VfM can be attained on school projects.
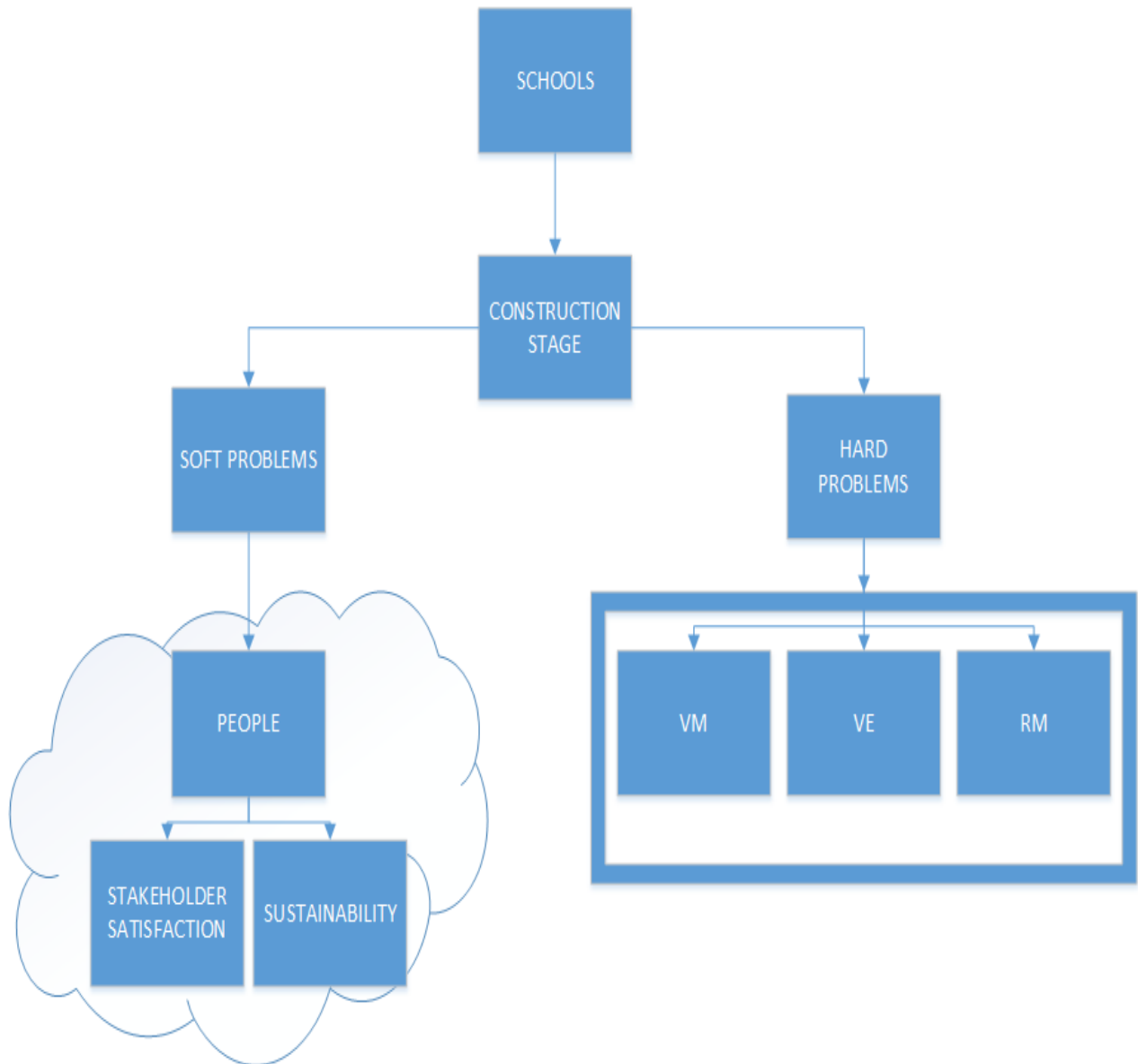
**Figure 3.2** Emerging issues at construction stage

## 3.7 Post occupancy stage

At the post occupancy stage of a project POE is used as the process of systematically evaluating the extent to which a facility, once occupied for a period of time, meets the intended organisational goals and user-occupant needs (Preiser et al., 1988). POE of building performance is vitally needed to ensure that building performance of government and public buildings and facilities is sustained (Nawawi and Khalil, 2008). Prior to terms such as post occupancy evaluation (POE) being commonplace, many studies were conducted on the basis of person environment research. These evaluations of the 1940's and 1950's yielded interesting findings, including drastic failures to meet basic end user requirements and perhaps even more

compelling was the realisation of stronger than anticipated connection between building configuration and the formation of social relationships (Sanoff, 1968). Today, the way in which buildings are assessed post occupancy has changed considerably since these environment behaviour studies of the 1940's and 1950's. Now building evaluation can come in many different forms and utilise many different methods. The field of POE has experienced most of its growth in the last 10 years as a direct result of the failings of low energy buildings to perform as had been predicted at their design stage (Sanni-Anibire et al., 2016) In the United States Preiser (2002) has been at the forefront of POE for the last 30 years. In the United Kingdom and mainland Europe, Bordass and Leaman have been the leading practitioners and researchers in the field of POE (Bordass et al., 2010). Now, due to the advances in technology to analyse data and growth in computer software POE has been transformed from a diagnostic tool to a knowledge tool where large scale, multi-year, multiple building POE's are undertaken (Mallory-Hill et al., 2012).

Assumptions made by designers dictate the post occupancy stage, but are rarely re-examined for accuracy and applicability in practice (Bordass et al., 2010). This has the effect that buildings are not fit for the intended purpose. POE provides a tool to examine the performance of buildings in terms of meeting design intent and occupied satisfaction (Alborzfard and Bernardi, 2013). The overarching benefit from conducting POEs is the provision of valuable information to support the goal of continuous improvement (Zimmerman and Martin, 2001). Other benefits include enhancing communication among stakeholders, providing knowledge when buildings do not meet design intent, providing data and knowledge for future designs and key decisions, supporting development of policy for design and hastening the learning process within organisations (Brown et al., 2010, Bordass et al., 2010). In essence POE provides a systematic way of learning from the successes and mistakes of previous buildings. It then offers that information in a timely and appropriate way to improve future buildings and to account for the design quality of buildings. Once a building has been investigated at the post occupancy stage, then the knowledge gained can be feedback into the design of future building. Zimmerman and Martin (2001) suggest; that despite a proliferation of purposes and reasons the overarching benefit from conducting POE is the provision of valuable information to support the goal of continuous improvement. In essence, by failing to evaluate buildings once they have been built, then we will fail to avoid avoidable mistakes in the future and ultimately fail to achieve VfM. Even though there are numerous benefits of undertaking a POE, the uncertainty and difficulties in the selection of indicators and feedback techniques have slowed their

adoption (Bordass et al., 2001, Cicelsky et al., 2009). Another obstacle to POEs is that a "one size fits all POE" does not exist, therefore POE should be tailored to specific applications (Turpin-Brooks and Viccars, 2006; Leaman and Stevenson, 2010). The construction industry fragmentation also hinders POE adoption (Hajri and Crozier, 2009, Riley et al., 2010) as the "one size does not fit all" cannot be attributed to one off unique projects. Due to the proliferation of technology tools and methods of carrying out POE it appears that it is difficult for organisations to decipher how to conduct a POE that is relevant to their building. Indeed, The Guide to Post Occupancy Evaluation published by The Higher Education Funding Council for England (HEFCE, 2006) suggests that the person undertaking a POE should refine the existing established method to suit the needs of that particular facility. Hadjri and Crozier (2009) have echoed this by stating that even though there are numerous interpretations of POE all should involve data collection from people and the building.

In order to carry out an evaluation it is necessary to gain an interpretation of what is involved. POEs aim to answer two questions: how is the building working, and is the actual performance intended? (Hadjri and Crozier, 2009). Assumptions made by designers dictate the post occupancy stage, but are rarely re-examined for accuracy and applicability in practice (Bordass et al., 2010) which means that the "lessons learnt" on one project are not being implemented on the next project (Cleveland and Fisher, 2014). POE provides many benefits (Brown et al., 2010, Bordass et al., 2010) including:

- aide communication between stakeholders

- create mechanisms for quality monitoring, providing knowledge when buildings do not meet design intent

- provide data and knowledge for future designs and key decisions

- support development of policy for design and planning guides

- hasten the learning process within organisations by building on successes and not repeat failures

On the other hand, the barriers to the adoption include costs for undertaking POE, resources required to successfully complete the process, litigation for underperforming buildings, and lack of overall awareness by all stakeholders (Turpin-Brooks and Viccars, 2006). Previous research conducted by Bordass et al. (2001) emphasised cost, responsibility of conducting POE and the repercussions on consultants of the results as potential barriers. Riley et al. (2010)

suggests that the structure of the construction industry is a significant inhibitor of POE given that it is mainly made up of a series of one-off projects carried out by a temporary project team.

However, Cooper (2001) has argued that without the feedback processes being in place, new systems or design approaches remain prototypes. So in order to understand fully if the schools are truly effective feedback needs to be sought by those using the school on a daily basis. This was reinforced by Cole et al. (2008) who emphasised the need for communication and dialogue with building occupants. Stevenson (2008) suggests that one of the best approaches to POE is open questioning which identifies hidden factors and tacit knowledge not revealed through a structured questionnaire. In order to achieve this the UK adopted the Soft Landings approach where designers and constructors are encouraged to stay involved with their new building beyond practical completion and into the critical initial period of occupation (Leaman et al., 2010). This is difficult to achieve in an Irish context as an additional fee would be expected by consultants and contractor in order to undertake this. Also the separation of the design, construction and occupation phase on government projects in Ireland would require a change in thinking by all involved in the process. It is therefore necessary to investigate different areas in order to achieve enhanced VfM on school building projects.

POE differs from more technical post-construction, technical evaluation or performance checks in that it addresses issues such as occupant comfort, worker satisfaction and productivity (Baird et al., 1996). This was reinforced by Ozturk et al. (2012) who stated that current views on POE suggest that it should cover issues such as user requirements, technical performance and the impact of the built environment has on the living or working conditions of the occupants. If we examine user requirements, technical performance and impact on living and working conditions in relation to primary schools it is clear that technical performance is an area that is being addressed by the DoE themselves. Since school design in Ireland has been researched and refined by the Energy in Education section of the DoE over the last 20 years to include materials and technology that enhance the performance of the school it is not necessary to address this area. It is therefore important to focus on the softer side of the argument which are the people who use the building (end users) in relation to user satisfaction and impact on working conditions.

The drawback of focusing on user requirements and impact on working conditions is that school building design is normally only evaluated by visiting "experts", who may be unfamiliar

with the school and the day-to-day and lived experience of the school by its occupants (Omari and Woodcock, 2012). Lackney (2009) commented that in reality only a small fraction of the school building is evaluated against the educational needs of the students and the end users, thus buildings are created that are not fit for purpose and mistakes are repeated again and again on buildings. The POE approach focuses on the need to transform people's relationships with the building rather than relying simply on improvements in technology. In order to achieve this in relation to school building the research will focus on the people using the building by assessing the user requirements, the interpretation of the design and any outstanding issues that should have been taken into consideration during the design process so that enhanced VfM can be achieved.

### 3.7.1 User requirements

In relation to user requirements understanding stakeholder issues are an important consideration at the post occupancy stage. As stated by Muhlebach (1998), in order to remain competitive a building or property manager must listen and respond to tenants' needs, concerns, expectations and opinions, and must use this information to quantify performance and compare with best practices. POE provides a mechanism for doing this by understanding the mutual interaction process between buildings and users' needs and for recommending ways of improving the environment necessary to accommodate these needs (Nawawi and Khalil, 2008). Adeyeye et al. (2013) had an interesting perspective when they advocated that design decisions made in isolation using tacit physical or semantic information alone can often yield less desirable results. This was echoed by Watson and Thomson (2005) when the building stakeholder commitment supports a learning culture by involving users in discovering how well building work for them. He went on to state that participants in POE also assists in strengthening a sense of ownership amongst school users. As Endsley (2016) advocated that user centred design challenges designers to mould the interface around the capabilities and needs of the operators. As can be seen from this understanding user requirements at post occupancy stage can not only yield information about how occupants use the building, but it can also solidify the sense of ownership of the building.

### 3.7.2 Design

One area that does need to be considered is how the design of a building works following occupation. As stated by Watson and Thomson (2005, p. 130) *'one of the most important outcomes of conducting building evaluations as early as possible in a school building*

*programme is to identify aspects of new schools that have been successful. Equally important is that less successful aspects be identified, so they can be avoided in future projects. It is important to carry out an evaluation to understand what are the failure and triumphs with the design following occupation'.* Whyte and Gann (2001) identify a number of advantages of carrying out a POE in relation to the future design and these include measuring occupant perceptions against the original design intent of the facility. Therefore, this may facilitate in making the link between the initial procurement choice, the design stage and the final building. On many occasions, once buildings have been constructed and handed over design teams have no more involvement in the building. The stakeholders at the POE stage have no feedback loop in order to explain failures or triumphs with the new building. Such feedback could generate lessons, which might be used to improve the commissioning and design of subsequent buildings. Equally important is applying the skills of building teams and their suppliers more effectively as knowledge that is generated can be fed back to the design teams. Furthermore, by conducting POE with end users it should subsequently improve user requirements and management procedures as issues can be fed back into subsequent designs. Finally by conducting a POE, it should provide knowledge for the design guides of future buildings. Moreover, evaluating the design of buildings following occupation can yield important information going forward for the future of a building programme which in turn can mean improved VfM is achieved. This is achieved as a result of any design problems, areas of concern or recommendations to improve the design that are suggested during the POE are implemented in subsequent projects going forward.

### 3.7.3 Issues

Watson and Thomson (2005) assert that a building evaluation provides an insight into how the building and services support and frustrate the activities of the users. In many cases, making minor adjustments such as altering taps or providing additional signage or shelving can be experienced as significant improvements for users. Preiser (1995) outlined a number of issues which can have a negative effect on users, including:

- Health and safety problems which are particularly important in relation to a school building were illness can spread around a classroom very quickly and the welfare of young children is imperative.

- Security problems where a large amount of technology and equipment in the building can be the target of robbery.

- Leakage even if small, can cause disruption and problems in the workplace.

- Poor air circulation and temperature control which can become a big issue for staff if the room is either too cold or too hot.

- Handicapped accessibility problems which can interfere with the smooth running of the building.

- Lack of storage and privacy may be a minor issue but this can lead to resentment amongst staff that their wellbeing is not being addressed.

- Hallway blockage can cause annoyance among staff.

- Aesthetic problems as every stakeholder wants to feel proud of how the building looks in their area.

- The maintenance of surfaces which can lead to cleaning staff not being able to fully complete their work to an acceptable standard.

While these are examples of small issues, if left unresolved they can lead to larger issues emerging which can eventually inhibit attaining VfM. Way and Bordass (2005, p. 134) put it in simple terms when they stated that *'users occupying new buildings just want to get on with their lives and their business. If teething problems become embedded, even if minor and correctable, irritation and dissatisfaction increase dramatically'*. All of this leads to the requirement that POE should be conducted so that all issues are addressed.

*3.7.4 Emerging themes at the post occupancy stage*

POE when carried out has two sides. The hard problems includes the building itself and the sustainability of the structure and the soft problems that addresses the people using the building on a daily basis following occupation (Figure 3.3). The hard problem side has been taken into consideration by the DoE where a section within the department (Energy in Education) is responsible for including materials and technology that enhances the performance of schools. From a sustainable perspective, the DoE only incorporates technologies in a school that is only occupied nine months of the year. What the DoE does not address when conducting POE is the soft problems which are the people occupying and using the school. When investigating this side, what has come to the fore is that the user requirements, the design of the school and any issues that have emerged following occupation also need to be addressed.
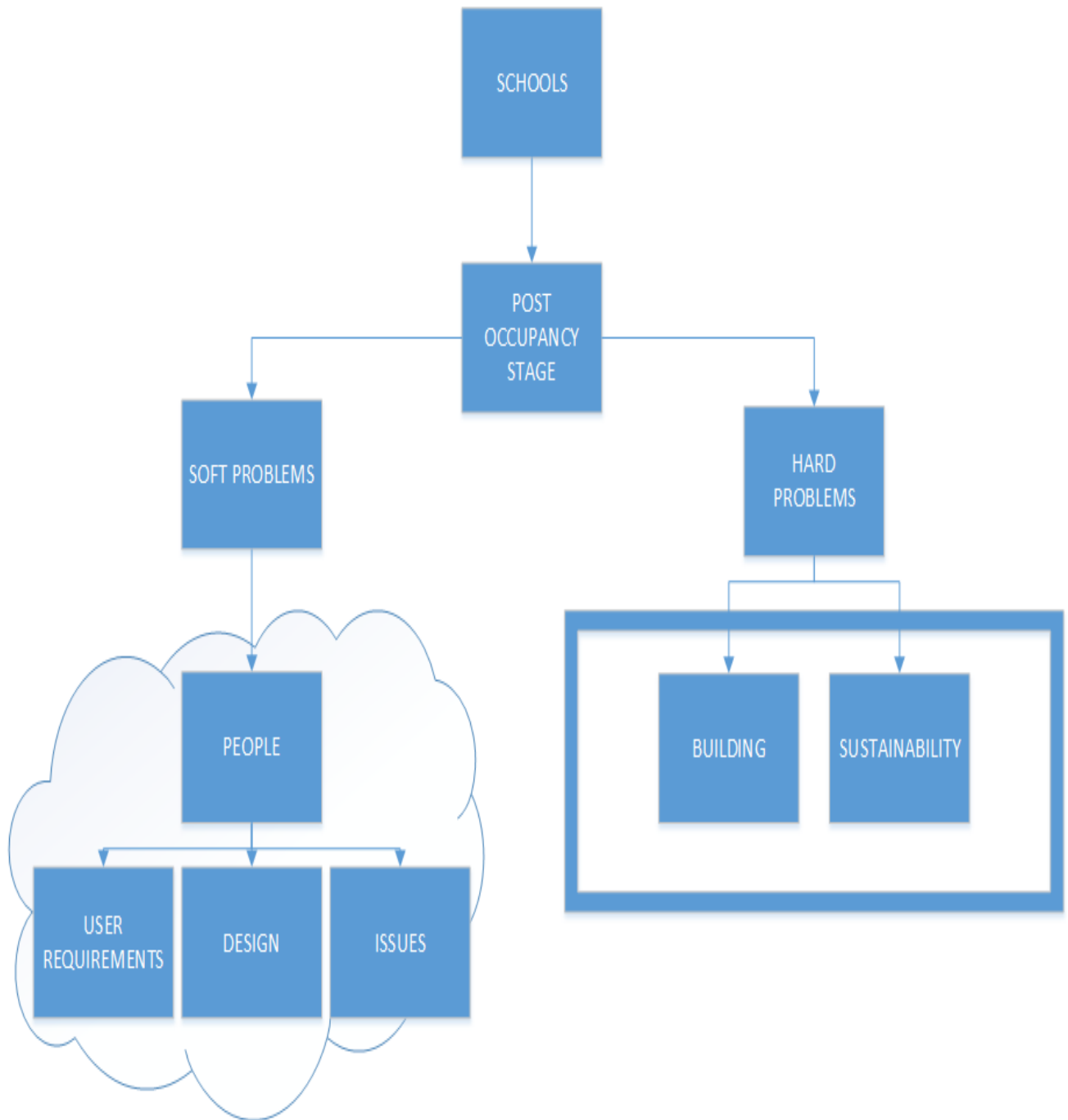
**Figure 3.3** Emerging issues at post occupancy stage

## 3.8 Critical Discussion

What has been established is that Ireland's colonial past, religious affiliations, cultural traditions, economic developments and educational goals have combined to shape the complex structure of the education system (Walsh and Loxley 2016). Not only does the pedagogical brief (Department of Education and Skills, 2012a) influence the design of school accommodation but the design of any new school has to take the documents and guidelines

produced by the DoE into consideration (Department of Education and Skills, 2016c). All of this limits the ability of the design team to influence VfM on schools as the DoE are also prescriptive in relation to cost limits for schools (Department of Education and Skills, 0010/2016). All of this suggests that if better VfM is to be achieved on primary school projects in Ireland other areas rather than the design and cost need to be investigated.

One of these additional areas is the delivery of schools be that using traditional procurement, PPP, GRD or D&B. Some of these options may lead to cost certainty but not necessarily VfM as the price is fixed at a cost to the overall project (Adriaanse and Robinson, 2015). It should also be noted that on schools it is imperative that they are delivered rapidly. Only two options can provide this and they include the GRD and D&B procurement route. It has been established that by using either of these options the DoE decide what value means to them as the client, so in order to provide VfM it is the construction stage and the post occupancy stage of these procurement options that need to be focused on.

At the construction stage in order for VfM to be achieved VE, VM and RM needs to be undertaken on a project along with providing stakeholder satisfaction. It is imperative as characterised by Bryde and Robinson (2005) that the tangible time and cost success factors along with the less tangible factors of stakeholder satisfaction also need to be focused on. As Thomson (2011) explained a truly successful project is one that not only delivers value, manages risk but also manages relationships. In order to attain this identifying stakeholders, assessing behaviour and attributes of stakeholders, relationships, communication between stakeholders and sustainability also need to be delivered so that VfM can be attained on school projects.

At the post occupancy stage of a school project in order for VfM to be delivered POE should be undertaken. The overarching benefit being the provision of valuable information to support the goal of continuous improvement (Zimmerman and Martin, 2001). As supported by Cooper (2001) without the feedback processes being in place systems or design approaches remain prototype. In relation to conducting POE it has been established that it should be undertaken not only on the building but also the user requirements, the design and any issues in order for a truly holistic interpretation of VfM being achieved. What is being established here is that the traditional focus on the 'hard' side of providing VfM be that by utilising VM, VE and RM at the construction stage and building performance measurements at the post occupancy stage

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also needs to be supplemented with 'softer' areas if true VfM is to be realised. These 'softer' areas include stakeholder satisfaction at the construction stage and user requirements, the design and any issues that arise at the post occupancy stage.

## 3.9 Summary

What this chapter has demonstrated is that the legislative background, the pedagogical brief for schools, the DoE design documents and the DoE cost limits, all have an influence on the design of school projects in Ireland. It went on to establish that primary schools can be delivered in a number of ways by using traditional procurement strategies, PPP, GRD and D&B. Each one of these procurement strategies has their merits, but it has been shown that the DoE focus on using the GRD option or the D&B option in order to deliver schools. The chapter also determined that in order to achieve VfM on school projects in Ireland it is the construction stage and the post occupancy stages of a project that need to be investigated further. This included at the construction stage the themes that have emerged include achieving stakeholder satisfaction and sustainability. At the post occupancy stage what has emerged is that the design, user requirements and issues need to be investigated in relation to schools if true VfM is to be achieved.

The next chapter investigates the methodology that needs to be implemented in order to achieve the aim of the research. It includes a general discussion on research philosophies followed by a more specific discussion on the research approach and strategies adopted.

# Chapter 4 Research methodology

## 4.1 Introduction

Chapter 2 and 3 presented a literature review which focused on defining what value means in a construction context and an understanding of the processes and procedures that influence the school building programme in Ireland. It defined areas that need to be investigated further when endeavouring to achieve VfM in the schools building programme. This chapter is a justification of the research methodology that is employed in order to achieve this aim.

The chapter is divided into two main parts that flows throughout the chapter: research methodology theory, and the research design specific to this research. The theory part aims at providing a review of the various philosophical concepts and how they apply to the research being undertaken. The second part forms a unique map for conducting the research that appropriately suits achieving the aim and objectives. In order to achieve this, the chapter will cover the philosophical paradigms, philosophical approach, the research approach, the research methods, triangulation, the research strategies, the research design, data collection, data analysis, reliability and validity, time horizon, research approach adopted and the ethics that need to be taken into consideration when conducting research.

## 4.2 Research methodologies

There are a variety of research methodologies available to the researcher. However, although there are several options to choose from, it is important that the researcher employs a methodology that will be both applicable and relevant to the research. A definition of research methodology is the theory and philosophical assumptions upon which research is based and the implications of these for the method or methods adopted (Saunders et al., 2015). Brewerton and Millward (2001) defined research methodology as the process of how research questions are implemented and measured to achieve the overall research aim and objectives.

Having identified the research aim, which is achieving VfM from the government's perspective in relation to the school building programme in Ireland, it is critical that the methodology adopted is defined and set out so that the aim and objectives of the research are achieved. In

order to achieve this it is important to define the research philosophical paradigm that this research belongs to.

## 4.3 Research philosophical paradigm

The research philosophy relates to the development of knowledge and the nature of that knowledge (Saunders, et al., 2015). The values and beliefs of the researcher have an influence on the research philosophy and in turn an influence on the research design as a whole. Easterby-Smith, et al. (2002) identifies that the exploration of philosophy is significant in reference to research methodology. It allows the researcher to refine and specify the research methodology to be used in the study by clarifying the overall research strategy to be used. Included in this would be the type of evidence to be gathered and its origin, the way in which such evidence is interpreted and ultimately how this helps to answer the research aim and objectives. The research philosophy encourages the researcher to be more creative and innovative in the selection of research methods which previously may not have been under consideration. Fellows and Liu (2008) outline how a lack of awareness of the alternatives does not mean that the research cannot be executed well, but, often, it does mean that the work could have been more easily and/or could have achieved more. Easterby-Smith (2015) states; three reasons why an understanding of philosophical issues and approaches to research is very useful. Firstly, it enables the researcher to take a more informed decision about the research design. Secondly, it can help the researcher to understand which design will work and crucially, those that will not. Thirdly, the knowledge of different research traditions enables the researcher to adapt research design according to the constraints of different knowledge structures.

According to Bazeley (2013) emerging theoretical and ideological perspectives – sometimes also referred to paradigms are designed to alert the researcher to the important bias which implicitly or explicitly influence the way they approach questions, participants and methods. Research has built upon and defined by assumptions and a researcher carries out their research based on certain beliefs and assumptions on how social reality is interpreted and understood. The stronger the assumptions the clearer the analysis and research interpretation. These beliefs and assumptions are known as paradigms. A paradigm is a way of examining social phenomena from which particular understandings of these phenomena can be gained and explanations attempted (Saunders et al., 2015). Paradigms provide the direction for the research no matter what methods are used. Creswell (2013) defined paradigm as a way of

thinking, communicating, perceiving and viewing the world. It shapes how the researcher thinks, writes and talks about knowledge. It defines the type of questions to be asked and the methodologies to be used in answering the research questions. Hence, the researcher's findings are interpreted and defined by the paradigm adopted. Cryer (2006) points out that the research paradigm is a school of thought about the nature of truth as it can be realised from a piece of research. It points to the underlying assumptions regarding what constitutes valid research and what research methods are best to fulfil the research aims (Myers, 1997). While there are a number of research philosophical paradigms. Gray (2004) advocates that there are three main paradigms as applied to social phenomena. These three paradigms include positivist, interpretive and the realism paradigm. For clarity each of these paradigms will be discussed, followed by a justification of the most applicable paradigm to adopt in relation to this research.

### 4.3.1 Positivist paradigm

The modern term of positivism is depicted as the traditional scientific approach in human inquiry for the philosophical paradigm that is based on the numerical representation of observations for the purpose of describing and explaining the phenomena (Saunders et al., 2015). Positivist paradigm adheres to the view that only factual knowledge gained through observation such as measurement, is reliable. In positivism studies, the role of the researcher is restricted to data collection and understanding through an objective approach. The research findings are usually observable and quantifiable. Research approaches that are appropriate for this paradigm include cross-sectional studies, experimental studies, longitudinal studies and surveys (Yin, 2013). Positivist research philosophies assume that reality is objectively given and can be described by measurable properties which are independent of the observer (researcher) (Saunders et al., 2015). Positivist studies generally attempt to test theory, in an attempt to increase the predictive understanding of phenomena (Saunders et al., 2015)

### 4.3.2 Interpretivism paradigm

In contrast, the interpretative paradigm is based on the notion that reality is constructed by the persons involved (Fellows and Liu, 2008). Thus, one person's reality is derived from observations and perceptions and modified by upbringing, education and training, is likely to be different from another's. The researchers are concerned in their research with attempting to accurately describe, decode, and interpret the meanings of phenomena, occurring in their normal social contexts (Fryer, 1991). Interpretative research philosophies assume that access

to reality is only through social constructions such as language, consciousness and shared meanings. The interpretivist studies generally attempt to understand phenomena through the meanings that people assign to them. With this paradigm, there is a clear interrelationship between the investigator and what is being researched. Research approaches most appropriate, include action research, case studies, ethnography, grounded theory and participatory enquiry (Saunders, et al., 2015).

### 4.3.3 Realism

Realism as a paradigm is based on the notion where perceptions are windows onto reality (Dawood, 2010). Schwartz (1997, p. 256) defines realism in a broad sense as *'the doctrine that there are real objects that exist independently of our knowledge of their existence'* and argues that *'most of us probably behave as garden-variety empirical realists – that is, we act as if the objects in the world (things, events, structures, people, meanings, etc.) exist as independent in some way from our experience with them'*. This definition was reinforced by Saunders et al. (2015) where realism was defined as the research philosophy that believes in and seeks to understand the existence of an external and objective reality that influences people's social interpretations and behaviours but which may not be perceptible to them. It relies on the idea of independence of reality from the human mind. It has often been suggested that it is a mix between positivism and interpretivism, as it is based on real facts as well as on feelings. Huber and Harvey (2016) believes that the realism paradigm is more suited for generalising research. Huber and Harvey (2016) went on to state that the ontology of realism considers there is one "real" world to discover, which is external to the researcher's mind; in contrast to the world of positivism, where the world is only considered as imperfect and hard to apprehend.

### 4.3.4 The research paradigm of this study

For this study, in relation to the positivist paradigm, there are weaknesses that undermine its usefulness to the subject matter of this study, which include the skills needed for the engagement of different stakeholders in school projects. The positivist ontological position of reality exists independently, therefore, it is not useful for this research as this research focus is to seek and understand the stakeholders' varying perceptions in relation to school projects. The positivist position on the epistemological question of how do we obtain knowledge of reality is also inappropriate as it proposes that the act of investigating such a reality would have no effect on that reality. In addition, it is also impossible to treat people as being separate from the social contexts and they cannot be understood without capturing their perceptions of their own

activities. Also, this paradigm cannot be objective as the researcher also brings their own values and interests to this study and becomes part of what they observe.

Realism as a type of paradigm could be closer to this research because realism is implicit in much qualitative research (Healy and Perry, 2000). However, as this research seeks to put meaning to a phenomena, it is the interpretivist paradigm that is considered as the closet paradigm for this research. Furthermore, this study seeks to ascertain what the general trends are involving different stakeholders' perceptions and level of engagement and skills requirements. In addition, the nature of the research focus is that of a dynamic process and lived experience rather than a static reality. Finally, the interpretivism paradigm is useful for understanding the meaning of stakeholders in this study, the context within which the stakeholders act, generating new theories and understanding the process by which the events and actions take place. So the research philosophical paradigm that is to be employed in this study is the interpretivism paradigm.

## 4.4 Philosophical approach

Grix (2010) specified that ontology and epistemology are to research what "footings" are to a house as they form the foundations of the whole edifice.  If they are laid incorrectly, then the whole research will come crumbling down.  He goes on to state that there are several reasons for wanting to have a clear and transparent knowledge of the ontological and epistemological assumptions that underpin any research. These include an understanding of the interrelationship of the key components of research, to avoid confusion when discussing the theoretical approaches to social phenomena and finally to be able to recognise others and define their own position. Thus, making the axiology explicit helps to set and clarify the guiding tone for the research and it adds rigour for the action of the research.

### 4.4.1 Epistemology and ontology
Ontology
Ontology is how one sees and views the world and reality. It is the study of being. It is concerned with the nature of existence, with the structure of reality as such (Crotty 1998). This study favours more towards idealism. The nature of this study is to seek an understanding of the stakeholders' various perceptions and meanings via human interactions. This means that this study does not treat the phenomenon under consideration as an independent and single

reality. Rather, it accepts the knowledge claims by understanding different stakeholders'
interpretations given to the reality.

Epistemology
In relation to the epistemology which is related to the philosophy about the nature of
knowledge, this study favours towards interpretivism. The nature of this study is rooted in the
notion of lived-world experience. As Creswell (2013) put it rather than their being a "distance"
a "closeness" follows between the researcher and that being researched. This study
acknowledges that knowledge is socially constructed through interpretation of different
stakeholders who are involved in school projects. This study intends to explore the explanations
of the perceptions and actions of different stakeholders who are involved in the school building
process by understanding the way in which they comprehend their world.

Axiology
Axiology is a branch of philosophy that studies judgement about value (Saunders et al., 2015).
Axiologically, this study favours more towards the value-laden and subjective nature of
research. The phenomenon under study is interpreted within a context through direct
interactions within different levels of organisational settings. As a consequence, the author's
understanding is highly subjective and filtered through their own understanding, which is
modified and evolved as more understanding accumulated over time (Saunders et al., 2015).

*4.4.2 Justification for the selected philosophical approach*
Creswell (2013) went on to categorise social reality into five concepts: ontology considerations
(the nature of the knowledge under study), epistemological considerations (scope of knowledge
being researched), rhetorical considerations (the discourse and use of specific terms),
axiological considerations (the philosophical study of value) and methodological
considerations (techniques for solving and investigating the phenomenon). In view of the
paradigms explained above, and as can be seen from Figure 4.1 the phenomenon that is being
investigated comes about as a result of individual dealings with the concept of achieving VfM
(ontology). This has to do with understanding VfM in providing school accommodation
(epistemology). Within the intellectual terminology (rhetoric) in which the difficulties of
achieving VfM (axiology) are used to understand the world better in terms of achieving VfM
through personal experience (methodology). In summary, the research philosophy that is
adopted in relation to this study include the ontology as being socially constructed and
subjective and with the epistemology as having the subjective meaning of a social phenomenon

with focus on details of the situation. Axiologically the researcher is part of what is being researched with the research being value laden and subjective in nature. Having looked at the paradigms that underpin research generally, the next section investigates the research approaches that can be adopted in relation to conducting this research in order to acquire new knowledge.
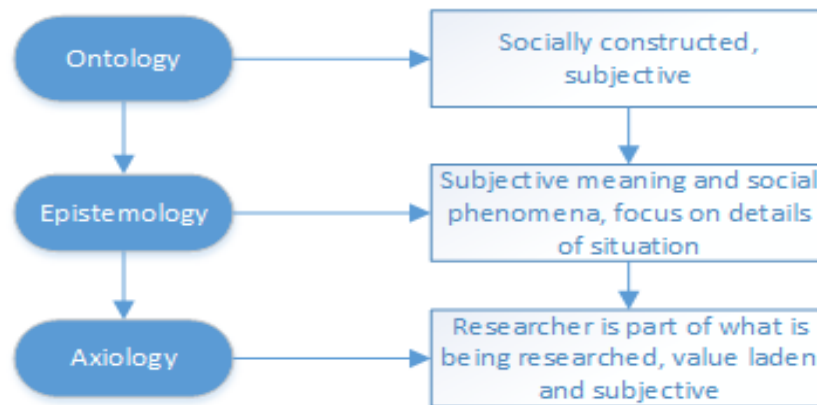


**Figure 4.1** Research philosophy (adapted from Saunders et al., 2015)

## 4.5 Research approach

There are mainly two kinds of research approaches which may result in the acquisition of new knowledge. They are known as inductive and deductive reasoning. Understanding these approaches is important in increasing the efficiency of the research study. Both approaches are the other extreme from each other as can be seen from Figure 4.2 and Figure 4.3. Inductive reasoning, by its very nature, is more open-ended and exploratory, especially at the beginning. Deductive reasoning is narrower in nature and is concerned with testing or confirming hypothesis. Finally, an abductive approach is in effect a combination of the inductive and deductive approach.

### 4.5.1 Deductive approach

Deductive reasoning occurs when the conclusion is derived logically from a set of premises, the conclusion being true when all the premises are true (Ketokivi and Mantere, 2010). The deductive approach is a method by which the researcher starts with a theoretical proposition and then moves towards concrete empirical evidence (Cavana et al., 2001). The deductive approach is linked to the positivism philosophy, which includes a

hypothesis to prove assumptions. In this kind of approach it is necessary for the researcher to move from the general to more specific as it allows the researcher to establish hypothesis by using theory. Different types of data and information is collected by the researcher to confirm or reject the hypothesis in order to resolve issues (Gill and Johnson, 2010). As shown in Figure 4.2, the various steps of the deductive approach are the development of theory, hypothesis, observation and confirmation. The theory involves the cause and effect relationship between two or more variable. The hypothesis is the testable proposition stating that there is a significant difference or relationship between two or more variables. Observation involves the recording, description, analysis and interpretation of people's behaviour and finally the confirmation involves establishing the accuracy, validity, or genuineness of the approach. The deductive method relies on instruments such as, surveys and experiment in order to achieve this.
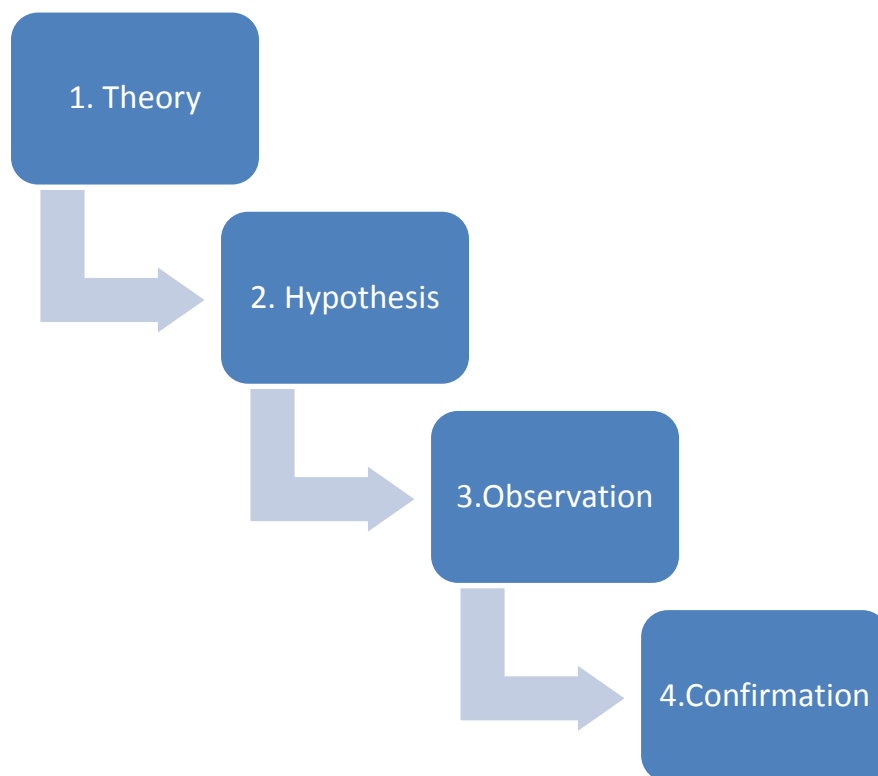


Figure 4.2 Deductive approach (Trochim, 2006)

### 4.5.2 Inductive approach

In contrast, in inductive approach to research, there is a gap in the logic argument between the conclusion and the premises observed, the conclusion being "judged" to be supported by the observations made (Ketokivi and Mantere, 2010). This is a flexible approach because there is no requirement for a pre-determined theory to collect data and information. The researcher

uses observed data and facts to reach a tentative hypothesis and to define a theory with regard to the research problem. This helps the researcher to give inductive arguments (Merten, 2008). It is used in research where theories and hypothesis occur after the gathering and analysis of some or all of the data (Robson, 2011). Observation, pattern, tentative hypothesis and theory, as shown in Figure 4.3, are important steps in the inductive approach. Observed data involve the systematic observation, recording, description, analysis and interpretation of people's behaviour. Following observation patterns are produced which leads to a tentative hypothesis where a testable proposition stating that there is a significant difference or relationship between two or more variables is produced. Finally a theory which involves the cause and effect relationship between two or more variable is created. It is an approach by which a phenomenon is observed and certain conclusions are derived.
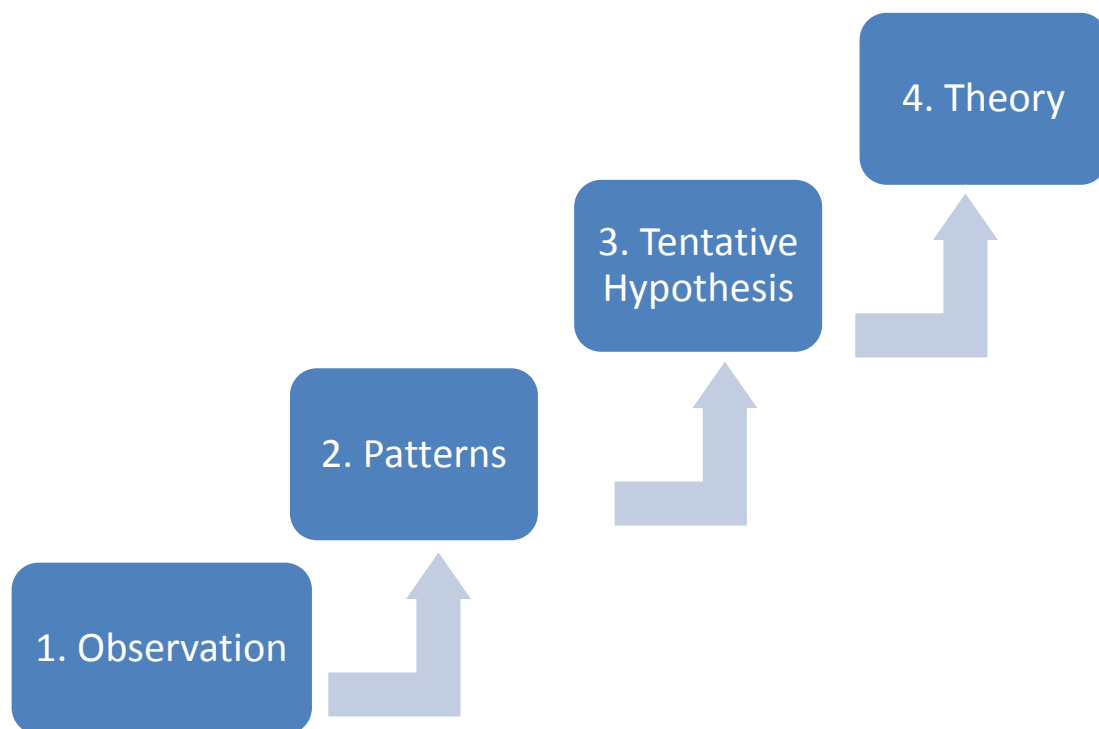


**Figure 4.3** Inductive approach (Trochim, 2006)

### 4.5.3 Abductive approach

By using an abductive approach, instead of moving from theory to data (as in deduction) or data to theory (as in induction), an inductive approach moves back and forth in effect combining deduction and induction (Suddaby, 2006). As Woo et al. (2016) explained abduction takes things one step further in that it not only drawing an inference based on observation but deriving a feasible (and by some accounts most feasible or best) explanation for a phenomenon.

In research practice, abduction is about explanation and the development of theories concerning the reason for phenomena (Folger and Stein, 2016). Abduction, or as it is also often called "inference to the best explanation" or simply "best guess" is a type of inference that assigns special status to explanatory considerations (Gustafsson and Vallverdú, 2016). As Douven (2011) explained most philosophers agree that this type of inference is frequently employed, in some form or other, in everyday life and in scientific reasoning.

*4.5.4 Selected approach*

The deductive research approach is based on the general idea of reaching a specific situation and it is connected with the positivism paradigm, whereas, the inductive approach works on a specific idea to generalise the situation as per the research topic, which is linked with the interpretivism paradigm (Crowther and Lancaster, 2008). Therefore, the researcher adopted both the inductive and deductive approach in this research, by first deducing from literature and then interviewing participants (inductive) in order to obtain data on the nature of schools. According to Saunders et al., (2015) using both approaches makes it very easy to estimate a logical and correct result, but it is necessary for the researcher to combine the correct pieces of these approaches. This is also justified by Perry's (1998) work which asserts that in research it is unlikely that any researcher could genuinely separate the two processes of induction and deduction and that it is impossible to go theory free into any study. The essential distinction between the two methods is that the deductive method tests theory, while the inductive method generates theory. As the approach has been established for the study it is necessary to discuss the research methods adopted.

## 4.6 Research methods

The majority of research methods fall into two categories: interpretivist/qualitative or positivist/quantitative. In the scientific and social inquiry, positivism is always associated with deductive reasoning and interpretivism with inductive reasoning (Creswell, 2013). Mason (2002) observed that they tend to be complementary rather than competitive, and the use of either of the two depends on the nature of the actual research at hand. While quantitative methods are said to research economic shortcuts in the process of generating data, qualitative methods are able to provide the actual explanation of facts (Creswell, 2013).

In choosing which option is best suited to the subject matter of this research, it must first be explained what the distinction between using a quantitative, qualitative or mixed method approach. According to Saunders et al. (2015), the easiest way to differentiate quantitative research from qualitative research is to distinguish between numeric data (numbers) and non-numeric data (words, images, video clips and other similar material). He further states that quantitative is often used as a synonym for any data collection technique (such as a questionnaire) or data analysis procedure (such as graphs or statistics) that generates or uses numerical data. In contrast, qualitative is often used as a synonym for any data collection technique (such as an interview) or data analysis procedure (such as categorising data) that generates or uses non-numerical data. In reality, however, it can also be necessary to sometimes combine both quantitative and qualitative elements. For example, a research design may use a questionnaire to collect statistical data on a certain topic while also employing a follow-up interview to seek to explain the findings of the questionnaire. This is defined as being a mixed method approach. In this way quantitative and qualitative research may be viewed as two ends of a continuum, which in practice is often referred to as a mixed method research design (Saunders et al, 2015).

While numbers can be used to summarise qualitative data, answering this research aim requires rich, contextual descriptions of the data, often referred to as a thick description (Borrego, et al., 2009) and that is why qualitative research is more closely aligned to this research. Qualitative research is a multifaceted approach that investigates culture, society, and behaviour through an analysis and synthesis of people's words and actions (Hogan, et al., 2011). Hogan, et al. (2011) outlines how qualitative research data remains the level of words, either the research participants' own words, the words written in documents or the words used by the researcher herself/himself to describe the activities, images and environment observed. It is this rich, deep contextual descriptions that comes from qualitative research that will be applicable to investigate how VfM can be achieved on school building projects in Ireland.

## 4.7 Triangulation

Before moving on and discussing the strategies that can be employed in research it is necessary initially to discuss how triangulation is to be achieved. Triangulation as a strategy for validation usually involves independently obtaining one or more alternative sources of (qualitative or quantitative) data and checking to see if the inference you draw from the data are comparable

with those obtained in the first instance (Bazeley 2013). Triangulation refers to the use of different data collection techniques within one study in order to ensure that the data are telling you what you think they are telling you (Saunders et al. 2015). According to Williamson (2005), the main purpose for the use of multiple methods adopted in triangulation is to avoid possible errors and biases inherent in any single methodology. Triangulation involves looking at the research questions from different viewpoints (Olsen, 2004). Decrop (1999) notes that triangulation can reduce and/or eliminate personal and methodological biases and increase the probability of generalising the findings of a study as the data is gathered from different angles and by different methods. Denzin (1970) identified four different types of triangulation that can be used: methodological triangulation (the use of multiple methods to gather data), data triangulation (gathering data through several sampling strategies in a study in terms of person, time and space), investigator triangulation (use of multiple researchers to gather and interpret data), and theoretical triangulation (the use of more than one theoretical position in interpreting data).

In respect of this research, data and methodological triangulations are the major approaches used to evaluate the outcome of this research. This facilitates exploration of a phenomenon within its contexts using a variety of data sources. It also ensures that the issue is not explored through one lens, but rather a variety of lenses which allows for multiple facets of phenomena be revealed and understood (Baxter and Jack, 2008). This is accomplished through collecting data from different sources and by using multiple methods, including a review of the literature and semi-structured interviews in order to ensure that bias is avoided.

## 4.8 Research strategies

Following on from research methods, the research strategy is about laying down a plan of action in order to achieve a given goal. According to Amartunga et al., (2002), each research strategy has its own approach to collect and analyse empirical data, and therefore each strategy has its own advantages and disadvantages. Yin (2013) reinforced this by stating that research strategy should be chosen as a function of the research situation. It is therefore important to assess the best approach to take in relation to the research being undertaken. There are a variety of techniques that can be used and these include quantitative design of experimental research, survey research, case study research, field research/ethnography and qualitative design of archival research, design science research, action research and archival research. An

explanation of each strategy that may be undertaken is now given along with the reasons for choosing a particular strategy.

### 4.8.1 Experimental research

Experimental research is more closely allied to the principals of a positivist approach than other research techniques (Neuman and Robson, 2012). This research begins with a hypothesis, making controlled changes and then comparing the results of the changed situation with the original, unchanged situation. This research can be conducted in the controlled conditions of a laboratory or conducted in the field and it is best suited to research that has few variables or a narrow scope. Advantages of this technique are ease of replication, lower cost and requiring less time than other techniques. Its limitations include that it can test only one or two hypotheses effectively at one time (Neuman and Robson, 2012).

### 4.8.2 Survey research

Survey research is the most widely used data gathering technique for social research (Neuman and Robson, 2012). It was developed within the positivist approach to social sciences and produces numerical results about the beliefs, opinions, characteristics and past or present behaviour, expectations and knowledge of respondents. This technique is able to test several hypotheses in a single survey and can be conducted through questionnaires or in person. In addition, data collected using a survey strategy can be used to suggest possible reasons for particular relationships between variables and to produce models of these relationships (Saunders et al., 2015). However, one of the drawbacks of this strategy as outlined by Saunders et al. (2015) is that the data collected by the survey strategy is unlikely to be as wide-ranging as those collected by other research strategies.

### 4.8.3 Case study

According to Naoum (2012), case studies are used when the researcher intends to support their argument by an in-depth analysis of a person, a group of people, an organisation or a particular project. Saunders, et al. (2015) defines a case study as a strategy for doing research, which involves an empirical investigation of a particular contemporary phenomenon within its real life context on multiple sources of evidence. Case study research consists of a detailed investigation, often with data collected over a period of time, of phenomena within their context (Hartley, 2004). The aim is to provide an analysis of the context and process which illuminates the theoretical issues being studied. The research also involves acquiring an in-depth study and

analysis of one aspect of a probe (Hamilton, 1980). Its strength and relevance lies in the ability to focus on a specific situation as well as the attempt to identify the interaction of its various facets. The focus is about one instance or a few instances of a particular phenomenon with a view to providing an in-depth account of events, relationships, experiences or processes occurring in the particular instance (Denscombe, 2010). The phenomenon is not isolated from its context, but is of interest precisely because the aim is to understand how behaviour and/or processes are influenced by, and influence context (Hartley, 2004). The context is deliberately part of the strategy; "variables" for the number of observations made and so the application of standard experimental or survey design and criteria is not appropriate (Hartley, 2004). Within this broad strategy a number of methods may be used – either qualitative, quantitative or both. Participant observation, direct observation, ethnography, interviews (semi-structured or relatively unstructured), focus groups, documentary analysis, and even questionnaires may be used, or in combination. A case study research design is therefore flexible, in that it is able to adapt to and probe areas of a planned, but also emergent theory. However, this requires a rigorous approach to the research design, the formulation of research questions and the data collection. One of the drawbacks of this strategy is that it becomes difficult to discern interactions in a large-scale survey; neither is it possible to crosscheck the information (Denscombe, 2010).

### 4.8.4 Ethnography

Rudrum (2016) describes ethnography as being concerned with the study of a particular culture and relies, either partially or mainly, on participant observation. According to Gill and Johnson (2010) ethnographic research takes place in the natural setting of the everyday activities of the subjects under investigation. There are a number of different ethnographic data collection instruments to choose from, most notably the interview technique, and more commonly the semi-structured interview. Williamson (2005) warns that if a semi-structured interview technique is to be used, it should be piloted so that you can be sure that you will be collecting the kinds of data you need. Nevertheless, there is the flexibility to adjust questions to encompass new perspectives, especially in the early stages of data collection.

### 4.8.5 Other methods

Other methods of research strategy also exist and these include design science research, action research, archival research and grounded theory. Design science research is where the object of the research is the design process i.e. the knowledge retrieved is not always knowledge about

the phenomenon, the artefact, or the design, but rather knowledge is also about the method used (Carstensen and Bernhard, 2016). Typical results for this type of research include constructs, models, methods and instantiations (Vaishnavi and Kuecher, 2015). Action research relies on the understanding of a phenomenon in its real context. This strategy is used to have deeper insight and improvement of practice over a period of time (Bryman and Bell, 2015). In this method the researcher is part of the community of the study by working reflexively with the people of the studied community. Action research is typically associated with the interpretivism stance (Oates, 2005). Archival research makes use of administrative records and documents as the principal source of data. This strategy allows research questions which focus upon the past and changes over time to be answered, be they exploratory, descriptive or explanatory in nature (Saunders et al., 2015). Finally, grounded theory was developed as a process to analyse, interpret and explain the meanings that social actors construct to make sense of their everyday experiences in specific situations (Charmaz, 2013; Glaser and Strauss, 1967 and Suddaby, 2006).

### 4.8.6 Research strategy for this study

As can be seen from Figure 4.4 choosing the research method for this research, is dependent on a number of issues. Firstly, as the research question asked in relation to this study consists of "how" and "why" this narrows the choice down to undertaking an experiment, archival research or case study method. Secondly, as the extent of control the investigator has over actual behaviour events is minimal this eliminates carrying out an experiment as observation and recording will provide the clearest evidence of current events in relation to this research. Finally, as this research will be focusing on contemporary rather than historical events this narrows the study down further to a case study. Further justification for choosing the case study approach derives from the interpretive paradigm and the exploratory and explanatory nature of the research.
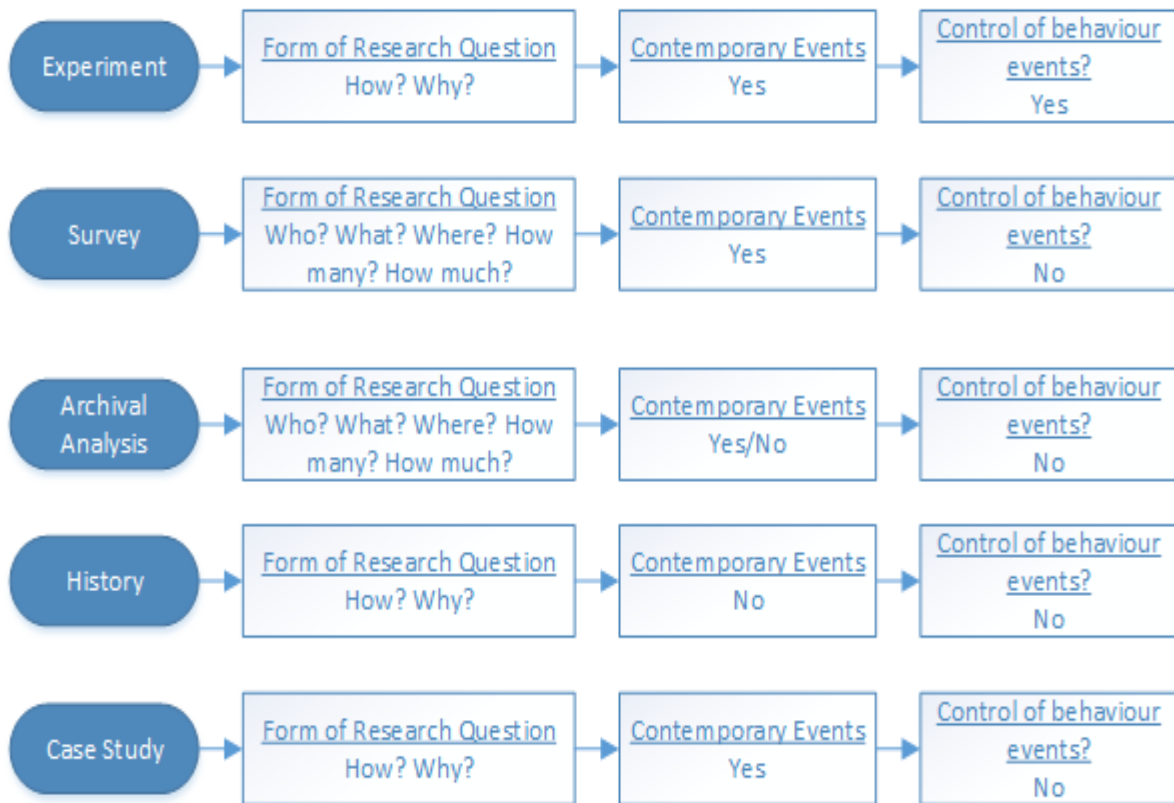
**Figure 4.4** Relevant situations for different research methods (adapted from Yin 2013, p. 8)

As Amaratunga et al., (2002) advocated, detailed case studies are essential in comparative research, where an intimate understanding of what concepts mean to people, the meanings attached to particular behaviours and how behaviours are linked are important. In addition, a case study approach is more useful for this study over other research approaches as it has the ability to deal with a full range of evidence. Not only can documents be used in the data analysis stage, but also interviews, observations and physical artefacts; thereby achieving triangulation of results and enhancing their reliability. Case studies are often limited in their capacity to be representative of whole populations. Here; however, the uniqueness of construction projects is an advantage. If several case study projects can be explored in a consistent and repeatable operational manner, then, it is possible to gain a rich understanding of the context of the research and the processes being enacted (Eisenhardt and Graebner, 2007).

Yin (2013) distinguishes between four case study strategies based upon two discrete dimensions. Case studies can be single-case or multiple-case designs, they can also be holistic (only a single unit of analysis) or embedded (multiple subunits) depending on the number of units of analysis involved (Yin, 2013). Researchers can apply either a single-case or multiple-case design depending on the issue being researched. In cases where there are no other cases

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available for replication, the researcher can employ a single-case design. One rationale for a single case is when it represents the critical case in testing a well-formulated theory. A single case is often used where it represents a critical case or, alternatively, an extreme or unique case. Conversely a single case may be selected because it is typical or because it provides you with an opportunity to observe and analyse a phenomenon that few have considered before. However, the drawback of a single-case design is its inability to provide a generalising conclusion, especially when the events are rare. One way of overcoming this is by triangulating the study with other methods in order to confirm the validity of the process. The other design for a case study is multiple-case design. This case study design can be adapted with real-life events that show numerous sources of evidence through replication rather than sampling logic. Multiple-cases also permit cross-case analysis, a necessary feature for widespread generalisation of theories. The rationale for using multiple cases focuses on whether findings can be replicated across cases (Yin, 2013).

In this research multiple cases and cross sectional analysis will be employed. According to Yin (2013), a generalisation of results from case studies, from either single or multiple designs, relies on theory rather than on populations. Therefore, by adopting an embedded multiple case study this research aims to describe phenomena and to develop and test theories to yield more general research results. In this research in order to achieve this cases will be carefully chosen so that by combining cases of GRD and D&B schools at two different stages in the construction process the contextual factor is deliberately different so that findings can be replicated across cases.

## 4.9 Research design

As can be seen from Figure 4.5 the research design that has begun to emerge for this research as identified in section 4.3, section 4.4 and section 4.5 comprise the philosophy of interpretivism, using both an inductive and deductive approach, incorporating a case study strategy using a cross sectional time horizon. Once this was ascertained it is now necessary to clarify how the next stage of the research design is to be carried out. The secondary data collection that was undertaken in Chapter 2 and 3 utilised reports, academic journals, public body publications and conference proceedings in order to broaden research knowledge in the area in order to establish theories and inform the primary data collection stage. As explained in section 4.6 and 4.8 in order to undertake the primary data collection qualitative research was

demonstrated as being relevant while a single case study was utilised. The data analysis stage of this research will involve comparing and contrasting the findings with the literature in order to draw out the findings, the conclusions and recommendations.
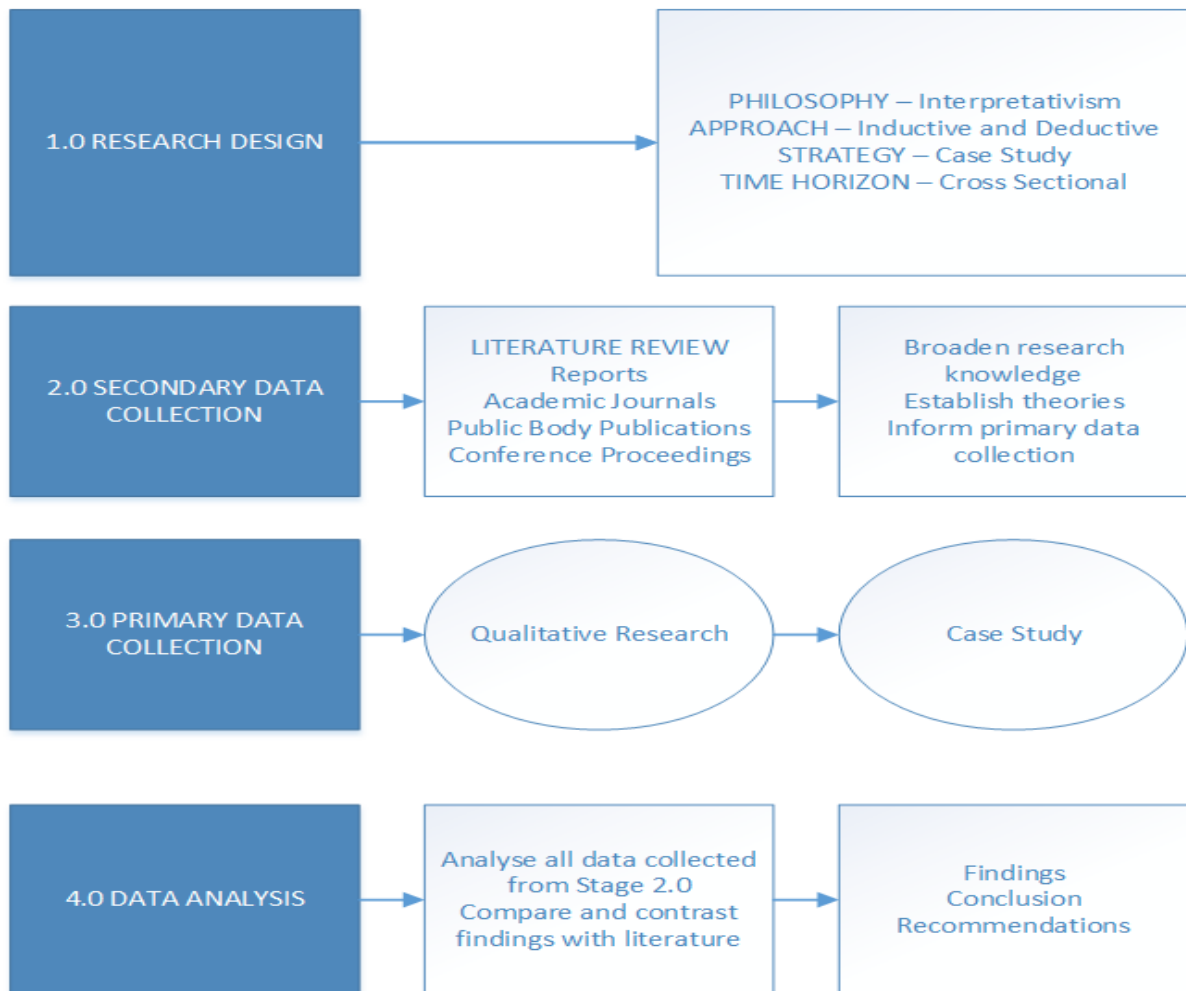


**Figure 4.5** Research design

As the research design to be employed has been outlined and how the secondary data collection has been established it is now necessary to explain specifically how the primary data collection is to be progressed. Having adopted a single case study for this research in order to achieve literal replication four schools were selected. These schools were carefully selected to predict similar results by being the same size (16 classroom), similar design, in a similar location and constructed within a five year timeframe of each other. As can be seen from Figure 4.6 Case A was investigated at both the construction and the post occupancy stage which was designed and built using GRD method. Case B was investigated at the construction stage using the D&B method and finally Case C was investigated at the post occupancy stage that was built using

the D&B method. The selection criteria was based on their size (16 classroom), the fact that they were all new build projects constructed on greenfield sites. They were also selected on the willingness of participants to take part in the research. In order to protect the confidentiality of the research participants the three case studies are referred to as Case A, B and C (see Figure 4.6). Anonymity was assured to all the participants so as to facilitate an open discussion. A brief overview of the three case studies selected are provided below.



| Case A Construction Stage GRD | Case A Post Occupancy Stage GRD |
| Case B Construction Stage Design and Build | Case C Post Occupancy Stage Design and Build |
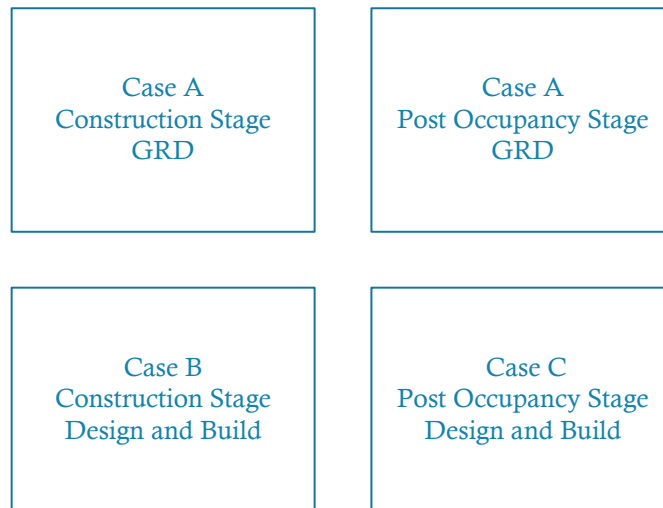
**Figure 4.6** Cases

Case A Construction stage and Post Occupancy stage

This school was the main focus of the research. It consisted of investigating the school at the construction stage and post occupancy stage. It was decided to use Case A school as it was one of the first GRD schools that was constructed in the area. Not only was it the first GRD school constructed by the contractor, it was also the first GRD school that was worked on by all of the design team. This means that there is not over familiarity with the system so that any issues or problems had to be dealt with from first principles rather than referring to how they have always resolved the same issue.

The staff employed at the school consisted of a principal, twelve mainstream teachers, four learning support teachers and one language support teacher. Current enrolment in the school at the time of the case study was three hundred and twenty three (323) pupils aged between 5-13 years (Department of Education and Skills, 2015b). This €3 million school consisted of 16 classrooms along with associated facilities. Work on site commenced on this GRD school project in June 2011 and was finished in August 2012. Interviews in relation to the construction stage of this project took place in May 2012 when the project was coming to the critical phase

of trying to get it completed on time and any problems would be realised at that stage. Interviews in relation to the post occupancy stage took place in October 2013 when the school had been occupied for just over a year. This gave the stakeholders time to become embedded in the new school.

Case B Construction stage

The construction of this 16 classroom D&B school commenced on site in November 2014 and was completed in August 2015. At the time of undertaking the case study the final account had still not been agreed but the construction costs were estimated to be in the region of €4 million. It was decided to use this as a case study as there is a completely different design team employed in relation to this school, so a different perspective in relation to the construction stage of a school can be achieved. This school is also located in a different region to Case A.

The new school consists of the construction of the new building, which incorporated a courtyard into the design which makes the design different to the GRD standard design. The school at present has one teaching principal along with three other teachers and one learning support teacher. As of 2014-2015 total enrolment for this school is eighty six (86) (Department of Education and Skills, 2015b). The construction of this school is to address the needs for the future and not the present needs of the school. There are pupils in four classes: juniors, seniors, first and second, which will expand in the coming years due to an increase in the population in the area.

Case C Post Occupancy stage

It was decided to focus on Case C as it was similar in size to Case A. It was also a project that was completed before Case A, so stakeholders have been embedded in this D&B school over a longer period of time.

The staff employed at this school consist of a principal, fifteen mainstream teachers and five learning support teachers. Enrolment in the school for 2014-2015 was three hundred and ninety seven (397) pupils aged between 5-13 years (Department of Education and Skills, 2015b). This €3 million school consisted of 16 classrooms along with associated facilities. Work on site commenced on this school project in June 2011 and was finished in June 2012.

## 4.10 Data collection

In order to achieve the aim of the research, which is evaluating how VfM can be achieved from a government's perspective in relation to school building projects in Ireland, it is necessary to collect data. As it has been defined that this research is qualitative in nature, interviews with expert in the field were selected as the data collection instrument in order to gather in-depth knowledge on the subject. There are a few different options with regard to how interviews are conducted. For example, they can either be highly formalised and structured using standardised questions, or they can be informal and unstructured. According to Naoum (2012) there are approximately three options to choose from, which include: structured interviews, semi-structured interviews and unstructured interviews. Each one of these options will be explained in more detail below.

### 4.10.1 Structured interviews

Structured interviews use questionnaires based on a predetermined and standardised or identical set of questions (Saunders, et al., 2015). A set of questions is read out to interviewees and answers are written down. This technique is more suited to carrying out quantitative research as the data obtained is quantifiable in nature.

### 4.10.2 Semi-structured interviews

In contrast, semi-structured interviews are non-standardised, that is to say the research has a list of themes and possibly some key questions to be covered (Saunders et al, 2015). This technique allows the interviewer to have a great deal of freedom to probe certain areas when required and to raise specific questions during the interview which may only become apparent at that particular time. Semi-structured interviews (SSIs) allow an element of freedom in the content of the interviews as they take an exploratory approach. They have the advantage of not being rigid in the sequencing of questions, with the opportunity to be able to re-word questions and allow interviewees the opportunity to spend more or less time on questions (Robson, 2011). SSIs elicit the interviewee' views rather than leading them towards preconceived choices. As a participants' interpretation of events are important SSIs allow for the exploration and development of an understanding of the meaning of participants' own experiences within their specific context (Robson, 2011).

*4.10.3 Unstructured or in-depth interviews*

These types of interviews are informal in nature and are used to explore in-depth a general area that the researcher has an interested in. With this technique, there is no predetermined list of questions to work through, although there is a clear idea about the aspect or aspects that you want to explore. The interviewee is given the opportunity to speak informally about a particular topic, behaviour or events. It has been labelled as an informant interview since it is the interviewee's perception that guides the interview (Saunders, et al., 2015).

*4.10.4 Data collection for this research*

Semi-structured interviews were used for this research as the interviewer used a list of issues and themes that came from the literature review to guide the interview. SSI's allow for some flexibility in the order of the topics covered and can allow the interviewee to elaborate on the issues raised (Denscombe 2010). Strauss and Corbin (1998) argue that the initial interview questions may be based on prior literature or experience. However, the original questions may be altered during the data collection process to allow emerging concepts to be pursued (Strauss and Corbin, 1998). This process was followed during the research and some questions were slightly adapted. The interview questions were designed to address specific variables in the objectives and open-ended questions were used which defined the area to be explored, but allowed the interviewer or interviewee to diverge so that particular areas could be followed up in more detail (Saunders et al. 2015). Appendix 5 provides a list of interview questions that were used at the construction stage and post occupancy stage of the data collection stage.

During the interviews, techniques such as probing for further information, requesting clarification, asking for examples and reflecting the responses of interviewees should be used; each of which, according, to (Gillham, 2005), is considered to be a core skill of interviewing. All interviews were audio digitally recorded and later transcribed verbatim. These interviews used open ended questions so as to achieve guided conversation rather than structured queries. In addition, multiple sources of evidence were obtained, including gaining an understanding of the design, the stakeholders involved, the procedure involved in getting this project to construction stage and the facilities in the adjoining area. The interviews were all carried out face to face with stakeholders at their place of work which meant that a sense of their work environment was also achieved. To aid in the undertaking of these SSIs a Likert scale was employed at the construction and post occupancy stage. At the construction stage these questions were divided into areas including; time, cost and quality. At the post occupancy stage

questions were divided into area including; user requirements, design and issues. All questions were developed from the literature review of obtaining VfM at the construction stage and the post occupancy stage a school building project. See Appendix 5 for interview questions that were employed at the construction and post occupancy stage.

As stated earlier in section 4.8, it is necessary to carry out a case study on a GRD school and a D&B school in order to achieve the aim of evaluating how VfM can be achieved from the government's perspective on the school building programme in Ireland. Chapter 3 (sections 3.6 and 3.7) demonstrated that the areas that need primary research to be carried out on include the construction stage of a school project and the post occupancy stage of a school building project. This was underpinned by information about the processes and procedures involved in providing schools in Ireland. Each of these stages will now be addressed in relation to the data collection for this research along with the selection criteria that should be adopted for stakeholders that are to participate in this research.

Semi-structured interviews in relation to school buildings
The first phase of the study involved in-depth interviews conducted with key stakeholders selected to reflect a range of organisations involved in achieving VfM in primary education. The sample was purposive, in that participants occupied key positions in education organisations, but the sample should not be regarded as representative and responses cannot necessarily be taken to reflect the views of the organisations. The purpose of including these stakeholders was to gain an initial perspective with regard to the issues surrounding the design and construction of primary schools. As well informed experts, their views were important for triangulation with the perspectives of the stakeholders at the construction stage and post occupancy stage. Participants were selected in this study to reflect the knowledge that they possessed in regard to school building in Ireland (see Figure 4.7). This included the DoE who were selected as they are the authority responsible for providing school buildings. The actual participant within the DoE was chosen as they had the responsibility for the design of primary school accommodation and were also actively involved in the production of the GRD design. Augmented with this was the in-house QS within the DoE who has responsibility for deciding and implementing the cost/m2 that are included for primary school accommodation. Both of these participants have worked with the DoE for over 20 years and have a wealth of knowledge and experience with different economic times within the building section of the DoE. It should also be noted that within the DoE the building unit is a small section where there is a single

person responsible for the overall design and the overall costs associated with the provision of school accommodation and that is why only two stakeholders require to be interviewed from the DoE. As well as gaining the perspective of how the DoE consider the building process of schools to have evolved and whether VfM is being achieved this was added to the perspective of a GRD QS and D&B QS who work on these projects. Both the GRD QS and the D&B QS not only have knowledge about how VfM is being achieved they also have knowledge about how the project worked specifically. The GRD QS has over 20 years' experience working on school building projects that have been procured either using the GRD process or the traditional procurement route. They also have insight into how the procurement process works in practice. The D&B QS again has significant experience working in the industry particularly in relation to D&B projects and how these projects are assembled which is fundamental to gaining data on how VfM can be achieved. Supplemented with these participants is information that will come from stakeholders in relation to the case study projects who will also give some general information that they have from working on a number of these projects. The selection of only two quantity surveyors is purposeful in that these interviews were about gaining in-depth knowledge of each school building process rather than gaining knowledge from all quantity surveyors who have worked on a GRD or a D&B school building project.
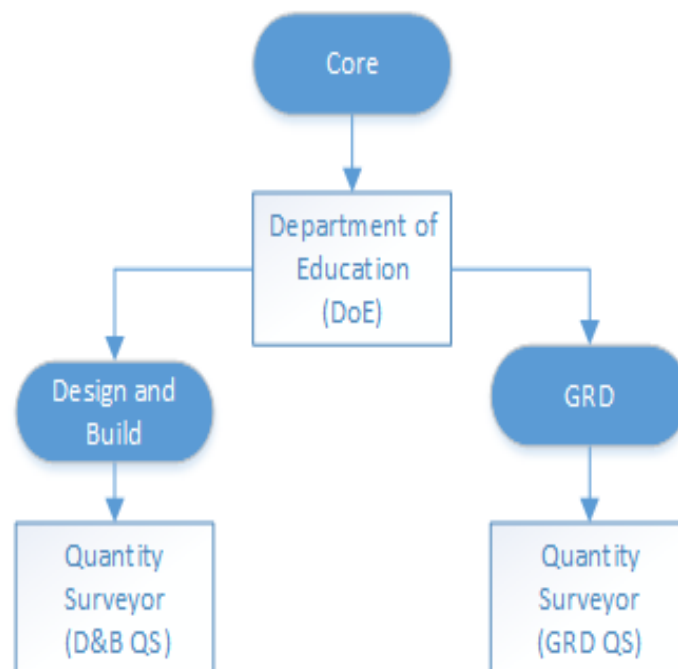


**Figure 4.7** Delivery of school interviews

<u>Semi-structured interviews at construction stage</u>

As outlined in section 4.8.6 as it was appropriate to incorporate a case study research strategy, it was then applicable to select participants who have knowledge on achieving VfM at the construction stage of a project. At the construction stage as can be seen from Figure 4.8 there are a number of participants that it is appropriate to participate in this study. The school principal (P) on GRD school was the one person that had an involvement with the DoE, the construction stage and the end users. Even though the DoE is the official client on the project it was the principal who undertook the day-to-day responsibilities at the construction stage of a GRD project. On D&B projects as the principal involvement is kept to a minimum the project manager (PM) was seen as the client representative and it was appropriate that they participated in the study at the construction stage. Not only did they have knowledge about how the other stakeholders were put together on the case study project but they also had invaluable insight into how each of these stakeholders worked together to get the project through the construction stage. The participation of the consultants was also necessary in order to gain insight into how they perceive VfM is being achieved at the construction stage of the project. These consultants included the architect (ARC) who is has either been given the design by the DoE (GRD project) or is designing for the contractor on the project (D&B project). The contribution of the quantity surveyor (QS) is also appropriate in order to gain their opinion in relation to cost and progress of the project on site and whether any variations and extras were included or should be included on the project in order to achieve enhanced VfM. The structural engineer (STRUC) input can contribute to areas in the design where enhanced VfM can be achieved at the construction stage. The service engineer (SERV) should have information in relation to the environmental sustainability of the design. They should also have information about how enhanced VfM can be achieved on the mechanical and electrical equipment that is included in the school building and the ease of installation of this equipment at the construction stage Finally, the main contractor (MC) participation should gauge whether ease of construction on-site is achievable and how the process of procuring a school using the GRD process or the D&B process differ from each other. It should be noted that as these construction projects are relatively small in size there are normally only one consultant from an organisation employed on these projects and that is why it is appropriate to only interview one person form each stakeholder group.

Other stakeholders in relation to the supply side may include the source of finance, accountants and lawyers. It was decided that as these participants were not involved in either the design or construction stage of a school project so it was not appropriate to include these participants.

From the supply side, it was also decided not appropriate to include the participation of the subcontractors as the main contractor is the person with overall responsibility for the project and they are the only contractor that is employed directly by the client. This is due to the fact that the government contract usually stipulates that all the other contractors are domestic subcontractors to the main contractor and there are no nominated subcontractors on any government construction project.
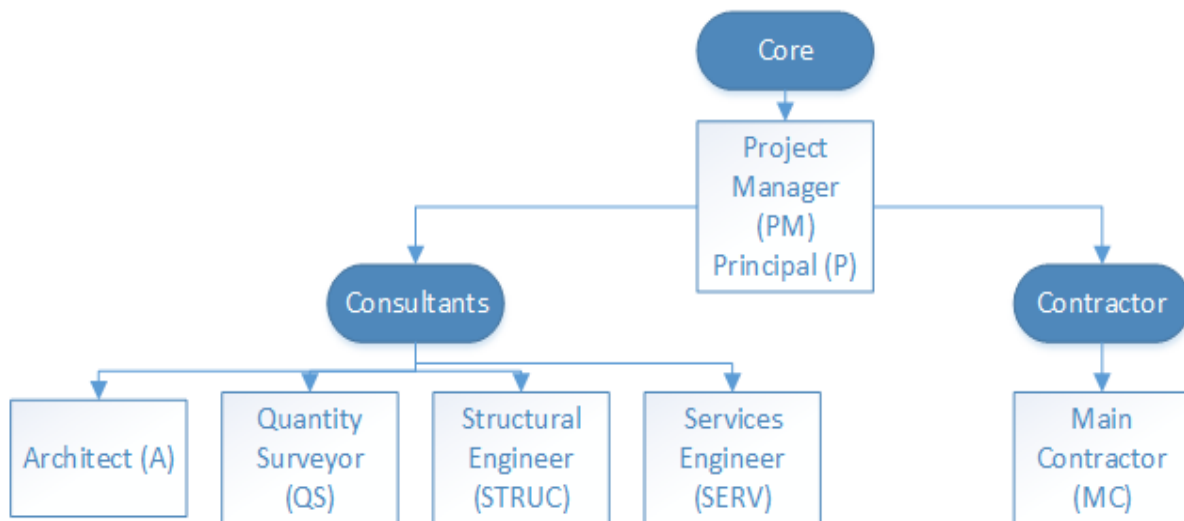


**Figure 4.8** Stakeholders at construction stage

Semi-structured interviews at the post occupancy stage

As can be seen from Figure 4.9 the participants that were identified at the post occupancy stage include the principal (P) of the school. The principal is not only the manager of the staff and the pupils in the school, but they are also the person that was heavily involved in the construction stage of the school acting as the client. At the post occupancy stage the participation of a teacher (T) was also required as they use the classroom space on a daily basis. Other participants that are required for the study include the special needs assistant (SNA) who cares for students with a disability as they are the one person who is involved with a pupil as they sit at their desk and can see it from a pupil's perspective. Participation of the backup staff within the school is also required. These include the administrator (A) and the caretaker/cleaner (C) who see the school from a different perspective than the T and SNA as they use different spaces within the school on a daily basis. The board of management (BoM) are also an appropriate body in include in the study as they have knowledge about the funding of the new school versus the funding of the old school. A decision was taken that it was not appropriate to include the pupils of the school as this would necessitate achieving additional approvals in the

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school. To compensate for this the participation of a parent who is involved in the parents association (PA) within the school was included. This was necessary in order to gain an insight into the issues and problems for the pupils within the school. It should be noted that it is appropriate to interview at least one stakeholder from each of the stakeholder groups be that core, backup, teaching or interest.
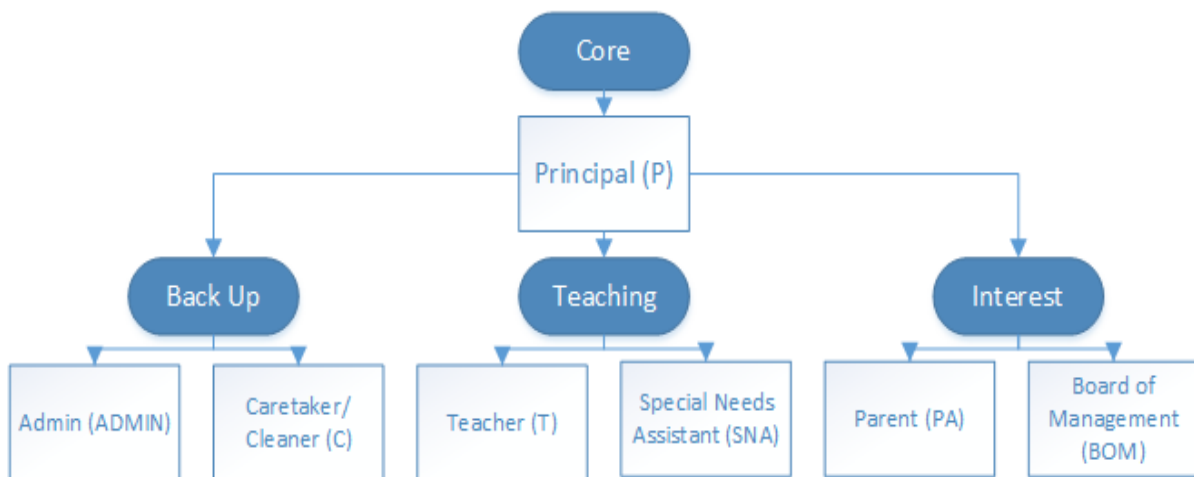


**Figure 4.9** Stakeholders at Post Occupancy stage

Finally, as can be seen from Table 4.1 the data collection that requires to be employed in relation to achieving the objectives of the research include undertaking a review of all the available literature, undertaking semi-structured interviews generally, undertaking semi-structured interviews at the construction stage of a case study project and undertaking semi-structured interviews at the post occupancy stage of the case study project.

**Table 4.1** Summary of research objectives and related methods of data collection

| Research Objectives | Data Collection |
|---|---|
| Ascertain how value generally, from both a government perspective and construction perspective is achieved at the present time in order to gain an understanding of how VfM can be attained. | • Literature Review |
| Establish specifically how VfM is achieved on a construction project at the present time and propose steps that may be introduced in order to achieve VfM in the future. | • Literature Review<br>• Semi-structured interviews generally<br>• Semi-structured interview at construction stage on the chosen case study<br>• Semi-structured interviews at the post occupancy stage on the chosen case study |
| Determine the government challenges in building schools in Ireland from a legislative background, to the design and the delivery background in order to explain the processes and procedures that influence the building of schools in Ireland and how VfM can be realised. | • Literature Review<br>• Semi-structured interviews generally |
| Establish how VfM can be achieved at the construction stage and post occupancy stage of the delivery of a primary school project in order to gain an understanding of how enhanced VfM can be attained on these projects. | • Literature Review<br>• Semi-structured interview at construction stage on the chosen case study<br>• Semi-structured interviews at the post occupancy stage on the chosen case study |
| Determine how a more holistic view of VfM can be achieved on school building projects by proposing a model of the processes and procedures that should be implemented in the future. | • Semi-structured interviews generally<br>• Semi-structured interview at construction stage on the chosen case study<br>• Semi-structured interviews at the post occupancy stage on the chosen case study |
| Formulate recommendations in relation to achieving better VfM on school projects, which can be fed back into the provision of future schools. | • Semi-structured interviews generally<br>• Semi-structured interview at construction stage on the chosen case study<br>• Semi-structured interviews at the post occupancy stage on the chosen case study |

## 4.11 Data analysis

Once the data collection has been conducted it is necessary to undertake the data analysis phase of the research. Data analysis approaches to qualitative data collection are numerous representing a diverse range of epistemological, theoretical and disciplinary perspectives (Patton, 2015). The key part of any research process is the selection of an appropriate data analysis method. This involves identifying, analysing and reporting patterns (themes) within the data (Braun and Clarke, 2006). Thematic analysis was considered to be a fit for the primary

research purpose of this study as it afforded a better fit to the research purpose: to identify commonalities in experience and perceptions across participants in relation to a shared phenomenon. Braun and Clarke (2006, p. 86) explain that *'... thematic analysis involves the searching across a data set – be that a number of interviews or focus groups, or a range of texts – to find repeated patterns of meaning'*. As Maykut and Morehouse (1994) point out words are the way that most people come to understand their situations; we create our world with words; we explain ourselves with words; we defend and hide ourselves with words. Thus, in relation to this research the task of the researcher is to find patterns within those words and to present those patterns for others to inspect. All of this requires to be carried out, while at the same time, staying as close to the construction of the world as the participants originally experienced it. This data analysis will now be discussed under the area of themes, codes and undertaking thematic analysis itself.

*4.11.1 Themes*

In order to overcome the criticism that within thematic analysis "anything goes", the six clear and detailed key stages of Braun and Clarke's (2006) carefully structured approach should be followed. The method involves breaking down the data into discrete "incidents" (Glaser and Strauss, 1967) or "units" (Lincoln and Guba, 1985) and coding them to categories (see Table 4.2). A further distinction in terms of what constitutes a theme (or coding category) lies in whether it is drawn from existing theoretical ideas that the researcher brings to the data (deductive coding) or from the raw information itself (inductive coding). In relation to this research deductive coding was utilised in relation to the themes that have been captured from the literature. Interviews were transcribed verbatim and analysed to see patterns of meaning and issues of potential interest in the data. By utilising the qualitative data analysis package NVivo10, transcripts were read line by line and extracts or "chunks" of meaningful text was highlighted and emerging codes were noted (Braun and Clarke, 2006).

While qualitative research is not given to mathematical abstractions, it is nonetheless systematic in its approach to data collection and analysis (QDA Training, 2015). Framed by a focus of inquiry, data is collected in relation to this research through semi-structured interviews which allows stakeholders to articulate their perceptions and experiences freely and spontaneously. In analysing data generated in this format, responses are not grouped according to pre-defined categories, rather prominent categories of meaning and relationships between categories are derived from the data itself through a process of inductive

reasoning (QDA Training, 2015). The thematic analysis approach offers the means whereby the researcher may access and analyse these articulated perspectives, so that they may be integrated in a model that seeks to explain the social processes under study (QDA Training, 2015).

Categories arising from this method  generally take two forms: those that are derived from the participants' customs and language, and those that the researcher identifies as significant to the project's focus-of-inquiry. Lincoln and Guba (1985) state that the goal of the former is to reconstruct the categories used by subjects to conceptualise their own experiences and world view. The goal of the latter is to assist the researcher in developing theoretical insights through developing themes that illuminate  the social processes operative in the site under study (Lincoln and Guba, 1985). Categories undergo content and definition changes as units and incidents are compared and categorised, and as understandings of the properties of categories and the relationships between categories are developed and refined over the course of the analytical process (QDA Training, 2015). As Taylor and Bogdan (1984) summarise that by using  this method,  the  researcher  simultaneously  codes  and  analyses data in order to develop concepts; by continually comparing specific incidents in the data, the researcher refines these concepts, identifies their properties, explores their relationships to one another, and integrates them into a coherent explanatory model. Essentially, this is all about language and creating a vocabulary that brings the myriad of interchangeable terms together in a single document that describes the processes deployed in your data analysis and links them to a tool like NVivo (QDA Training, 2015).

*4.11.2 Coding*

The researcher codes in order to answer the research questions, and the coding frame is developed in a manner that allows for this. Coding involves noting patterns in the data and dividing up the data to give greater clarity regarding their detailed content (QDA Training, 2015). In order to do this, patterns are labelled with codes. In order to code effectively a qualitative computer programme called Nvivo10.0 was used to  organise  data  into manageable areas which,  according  to  Richards (2014), helps to manage and synthesise themes from large amounts of qualitative data.

The aim of the analysis of the data is to discover patterns, concepts, themes and meanings. According to Biklen and Bogdan (2011), qualitative data analysis works with the data,

organises it, breaking it down into manageable units, coding it, synthesizing it and searching for patterns. In case study research, Yin (2013) noted the importance for checking the data for patterns which may explain or identify causal connections within the database. Patton (2015) and Judd et al. (2008) describe the process of categorisation as one of constantly revisiting the logical explanation and the concrete data to look for significant relationships. In this process, the researcher concentrates on the whole data first, then attempts to take it apart and re-constructs it again more meaningfully. What one chooses to code depends upon the purpose of the study. Bauer and Gaskell (2000) warn against adopting a purely inductive approach when one codes whatever one observes in the text. Rather, codes need to flow from the principles that underpin the research, and the specific questions one seeks to answer.

*4.11.3 Undertaking thematic analysis*

As can be seen from Table 4.2, while undertaking thematic analysis, there are eight cycles of analysis which can be spread over the six stages as defined by Braun and Clarke (2006). This not only shows the analytical process in order to undertake thematic analysis, but it also identifies its practical application by using the software package Nvivo10. It goes on to identify the strategic objective of undertaking certain steps followed by defining the iterative process by carrying such steps. This eight cycles of analysis involve three separate cycles of coding, two of which required managing codes, one for initial categorisation of open codes and one for data reduction through consolidating codes into a more abstract theoretical framework (themes) and two which uses writing itself as a tool to prompt deeper thinking of the data (Bazeley, 2013). This all leads to findings from which conclusions may be drawn. The eighth phase involved validation of findings (self-audit) and the write up itself.

**Table 4.2** Analytical hierarchy to data analysis (QDA Training, 2015)

| Analytical Process (Braun & Clarke, 2006) | Practical Application in NVivo | Strategic Objectives | Iterative process throughout analysis |
|---|---|---|---|
| 1. Familiarizing yourself with the data | **Phase 1 - Transcribing data, reading and re-reading the data, noting down initial ideas. Import data into the NVivo data management tool**. | Data Management (Open and Hierarchical coding through NVivo) | Assigning data to refined concepts to portray meaning |
| 2. Generating initial coding | **Phase 2 – Open Coding - Coding interesting features of the data in a systematic way across the entire data set, collecting data relevant to each code.** | | |
| 3. Searching for themes | **Phase 3 – Categorisation of Codes - Collating codes into potential themes, gathering all data relevant to each potential theme.** | | Refining and distilling more abstracts concepts |
| 4. Reviewing themes | **Phase 4 – Coding on – Checking if the themes work in relation to the coded extracts and the entire data set, generating a thematic map of the analysis.** | Descriptive Accounts (Reordering "coding on" and annotating through NVivo) | |
| 5. Defining and naming themes | **Phase 5 – Data Reduction – On-going analysis to refine the specifics of each theme and the overall story the analysis tells, generating clear definitions and names for each theme.** | | Assigning data to themes/concepts to portray meaning |
| 6. Producing the report | **Phase 6 – Generating Analytical Memos Phase 7 – Testing and Validating Phase 8 – Synthesising Analytical Memos Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back the analysis to the literature, producing a report of the analysis.** | Exploratory Accounts (Extrapolating deeper meaning, drafting summary statements and analytical memos through NVivo) | Assigning meaning<br><br>Generating themes and concepts |

Each phase of analysis that needs to be carried out will now be explained in more detail below.

**Phase 1**: Involves transcribing, reading and re-reading the interview data, noting down initial ideas. Extracts or chunks of meaningful text are then highlighted and emerging codes noted (Braun and Clarke, 2006).

**Phase 2**: Open coding involves broad participant driven open coding of the interview transcripts recorded from interviewees, supported with definitions so as to deconstruct the data from its original chronology into initial non-hierarchical codes (Maynut and Morehouse 1994).

**Phase 3**: The next phase of undertaking a thematic analysis involves the categorisation of codes. This involves the re-ordering of initial codes identified and coded in Phase 1 into categories of codes by grouping related codes under these categories and reconstruct the data by organising the open codes into a framework that made sense to further the analysis for a particular study (QDA Training, 2015). This phase also includes distilling, re-labelling and merging similar codes generated in Phase 1 to ensure that labels and rules for inclusion accurately reflect the coded content (QDA Training, 2015).

**Phase 4**: "Coding on" involves breaking down the now restructured categories into sub-categories to offer more in depth understanding of the highly qualitative aspects under scrutiny, such as divergent views, negative cases, attitudes, beliefs and behaviours coded to these categories and to offer clearer insights into the meanings embedded therein (QDA Training, 2015). As initial codes are broken down into sub-categories this assists in obtaining clarity from the information obtained from the interviews.

**Phase 5**: Data reduction involves consolidating codes from all three cycles into more abstract, philosophical and literature based themes to create a final framework of themes and explore their inter-relatedness for reporting purposes (QDA Training, 2015).

**Phase 6**: This involves writing, analytical memo against the high level themes to accurately summarise the content of each category and its codes and propose empirical findings against such categories. According to QDA Training (2015), these memos consider five key areas which include: what was said, the coding pattern, background information, considering the relatedness of themes to each other and finally the relationships with the literature.

**Phase 7**: Validation involves testing, validating and revising memos so as to self-audit, proposed findings by seeking evidence in the data beyond textual quotes to support the stated findings and seeking to expand on deeper meanings embedded in the data (QDA Training, 2015). This process involves interrogation of data and forces the consideration of elements beyond the theme itself; drawing on relationships across and between themes and cross tabulation with observations and literature.

**Phase 8**: Finally, this phase involves synthesising analytical memos into a coherent, cohesive and well supported outcome statement or findings report. By undertaking each of these phases there is a structured approach put in place in order to analyse the data consistently.

## 4.12 Reliability and validity issues

While conducting any research the issues of reliability and validity are of the utmost importance. Reliability and validity is concerned with checking the status of the data collected to determine if they are reliable and valid (Struwig and Stead, 2001). According to Reynolds (2010), the ability and expertise to calculate variables accurately is a cornerstone to progress while undertaking research. Trochim (2006) defined validity as the best estimate of the truth of any proposition or conclusion or inference described in the research. According to Kidder and Judd; (1986), there are generally four tests that have been commonly used to establish the quality of any empirical social research. These four tests include construct validity, which involves identifying correct operational measures for the concept being studied. Secondly, internal validity, whereby certain conditions are believed to lead to other conditions. Thirdly, external validity, which involves defining the domain to which a study's findings can be generalised. Finally, reliability where the operations of the study can be repeated with the same results.

As this research is qualitative in nature, there is an issue with achieving validity and reliability which are perceived to be more applicable to the positivist, quantitative research (Saunders et al., 2015). As Lincoln and Guba (1985) advocate, it is more appropriate in qualitative research to formulate "dependability" for "reliability", "credibility" for "internal validity" and "transferability" for "external validity". Therefore, this research has dependability in that the research is carried out in a standard way. The research has credibility in that the data can be trusted that it came from a worthy source and also has transferability in that the data can be

conveyed to another situation. If all of this is taken into consideration then reliability and validity should be achieved.

## 4.13 Time horizon

Another important consideration in any research is the time horizon of any research that is being undertaken. The question to ask is if the research is going to be a snapshot taken at a particular time, or, will it be a series of snapshots or akin to a diary, giving a representation of events over a specific time period. This will of course be largely dependent on the research question being posed (Saunders et al., 2015). When choosing the time horizon applicable to research there are two main options to choose from: cross sectional or longitudinal studies. Cross sectional studies are a snapshot scenario and longitudinal studies are multiple snapshot or diary scenario, which is based over a time period. In the case of this research, a cross sectional study is considered the best option to achieve the overall objectives of the research. This is due to the fact that the research is undertaking a study of a particular phenomenon which is how VfM can be achieved in the school building programme in Ireland at the present time.

## 4.14 Research process adopted for this research

Taking all the foregoing about this research into consideration Figure 4.10 summarises the process that is being adopted in order to conduct this research. As explained, there are numerous methodological choices that are available to the researcher. In the methodological context of this research it was decided to choose the mono-method, which means that only one technique for the collection and analysis of primary data will be used. More specifically, however, it has been decided to use the mono-method where qualitative techniques will be used for the collection and analysis of the primary data.
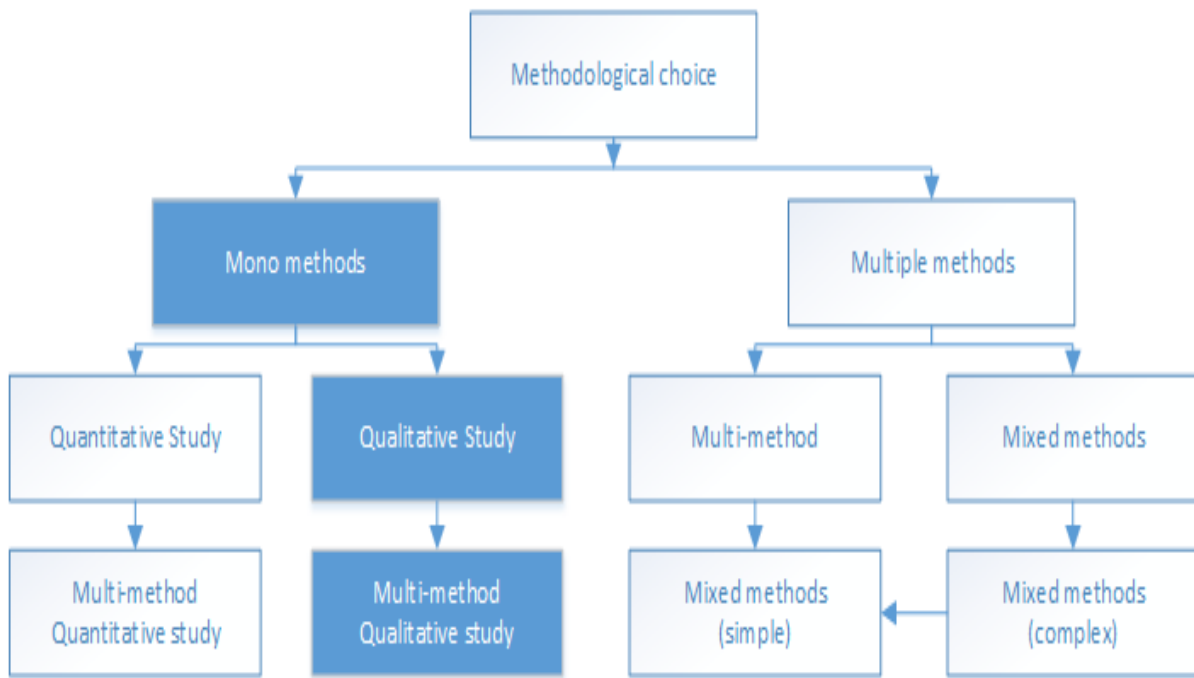
**Figure 4.10** Methodological choice (Saunders et al., 2015)

Also due to the subjective and socially constructed nature of achieving VfM, especially achieving VfM in the sphere of the government building programme, qualitative research is viewed as the correct approach. Qualitative is also the most appropriate methodology as it is often associated with an interpretive philosophy (Denzin and Lincoln, 2011). In conclusion, as can be seen from this research is subjective in nature, using interpretivism taking an inductive approach, research which is qualitative in nature (Figure 4.11).
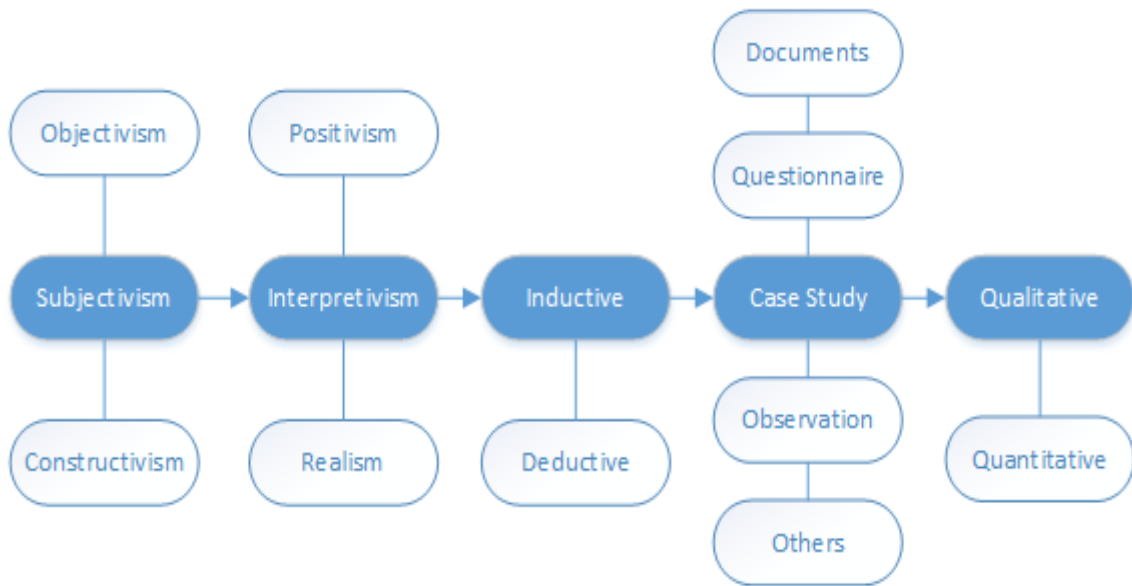
**Figure 4.11** Research methodology in relation to achieving VFM school buildings

Finally, drawing from the body of knowledge that was reviewed in Chapters 3 and 4, and the research methodology outlined in Figure 4.11 the following conceptual framework is proposed for this research. The framework for this research as can be seen from Figure 4.12 brings together all the variables outlined in this chapter for the purpose of guiding the design of the method in which data should be collected. This figure includes areas of emphasis which include VfM schools, the delivery of schools, the construction stage and the post occupancy stage in order to finally make recommendations in order to achieve a more holistic view of VfM.
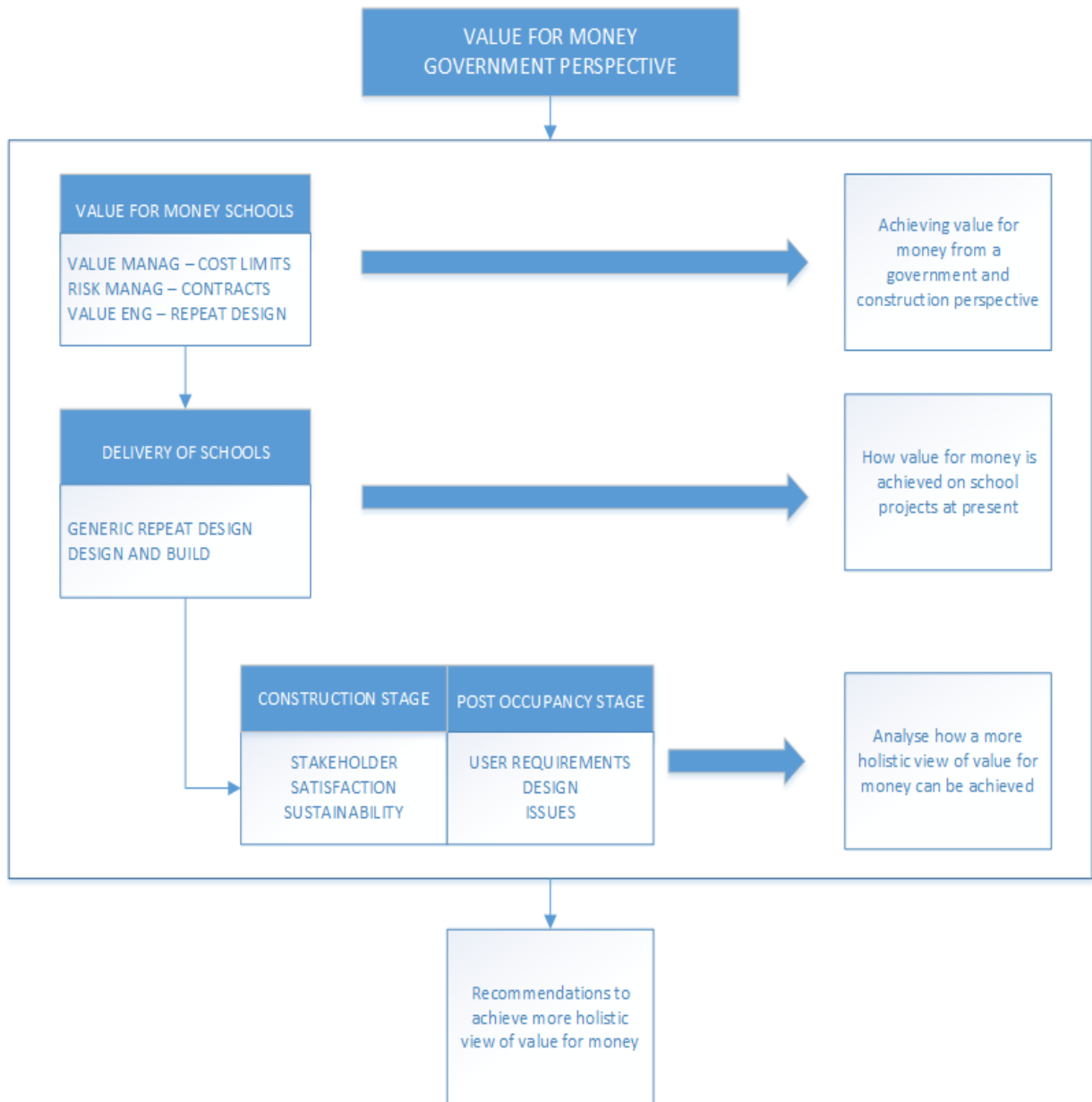
**Figure 4.12** Research methodology conceptual framework

## 4.15 Ethical approach to research

Before any interviews were conducted, ethical approval was sought and obtained from the Ethics Committee of the University of Salford and guided by the UK Research Integrity Office Code of Practice (UKRIO, 2014). As part of addressing the ethical considerations each interviewee was forward a participant information sheet to provide them with an understanding of what they were being asked to participate in and why they were being asked to participate in the research (Appendix 3). This was followed by a research participants consent form that was completed by the interviewee agreeing to take part in the study (Appendix 4). Participation

was completely voluntary and the anonymity of participants was protected as individuals were not identified at any point in the study. Equally, interview transcripts from participants were assigned a code which was used when presenting transcript quotations in the report of findings. The researcher avoided including any personal information about participants or using any quotations which may have made them identifiable at any point in the research. Participants were free to withdraw from the study at any time, without giving a reason, and they were informed that if they withdrew from the research then the information that was provided was destroyed appropriately.

Data collected for the research was treated in the strictest of confidence. The computer on which data were stored was password protected and paper records were kept in a locked filing cabinet. Only the researcher had access to the data. On completion of the study the audio tapes of recorded interviews will be wiped out after a reasonable period of time. Confidentiality issues were addressed as part of the informed consent process and details of how data would be kept confidential were described on the participant information sheet.

## 4.16 Summary

This chapter has described the research methodology and methods used in achieving the objectives of this study. The research philosophy, as well as the research techniques, research approach, data collection strategy and ethical consideration have been discussed. A qualitative research strategy has been proposed using a case study strategy, utilising semi-structured interviews to collect data and thematic analysis employed to analyse the data. The issues of reliability, validity and bias have also been duly considered. The next chapter provides background information on the issues and problems that affect building schools in Ireland.

# Chapter 5 Analysis and findings for achieving VfM on the school building programme in Ireland

## 5.1 Introduction

The previous chapter addressed the research methodology, justifying the choice of strategy and method adopted. This chapter discusses the findings from conducting interviews with identified stakeholders in order to get an understanding of how GRD and D&B are perceived to work. The chapter commences with information obtained from the DoE, and two consultants that have worked on numerous school building projects on how they consider VfM to be achieved. It then proceeds to reveal how these stakeholders consider VfM can be achieved on GRD projects and finally on D&B projects. The final part of this chapter discusses the interpretation that were exposed and relates the information obtained back to the literature in Chapters 3 and Chapter 4.

## 5.2 Undertaking data analysis of school projects

As these initial interviews were about obtaining information on how GRD projects and D&B projects are organised it was not necessary to have a detailed interview schedule in place. Indeed, this strategy provided the opportunity to "probe" answers where it was necessary for the interviewee to explain, or to build on, their responses. By probing meanings this afforded the opportunity to add depth to the data obtained. The information was analysed here so that not only an understanding of how these procurement options are put together was obtained, but also how they differ from each other was achieved. These interviews were also used to understand how VfM is perceived to be achieved by the DoE in relation to school building and the reality of carrying out projects using these procurement options was obtained.

Figure 5.1 shows the responses in relation to these interviews, be it general information that was obtaining or information pertaining to GRD or D&B projects. It should be noted that along with information from the DoE, who were interviewed on two separate occasions, information was also obtained from two consultants who have worked on numerous school building projects. Added to this, was information that was obtained from stakeholders that were interviewed in relation to the case study, who also gave information that was not specific to the case study project that was carried out but was relevant to school building projects in general.

Figure 5.1 from Nvivo10 shows initial comments attributed to school buildings, GRD schools and D&B schools from the stakeholders. There were 72 references (comments or answers) made from the 17 sources (participants) who commented in relation to providing school building generally. In relation to comments on providing GRD schools, there were 16 references (comments or answers) made from 5 sources (participants). On D&B schools, there were 66 references made from 13 sources. The reason that the references from D&B projects was greater than GRD projects is that the structure of the GRD design is uncomplicated as the only difference between it and the traditional way of procuring a school is that the design is given to the consultants, who only need to change for site conditions. In contrast, the procurement of a school using D&B is more intricate and could potentially be provided in a number of ways. It was therfore important to gain an understanding of the procurement arrangement that was being employed. This means that the majority of information in relation to D&B was to figure out the structure of how this particular procurement system is carried out.
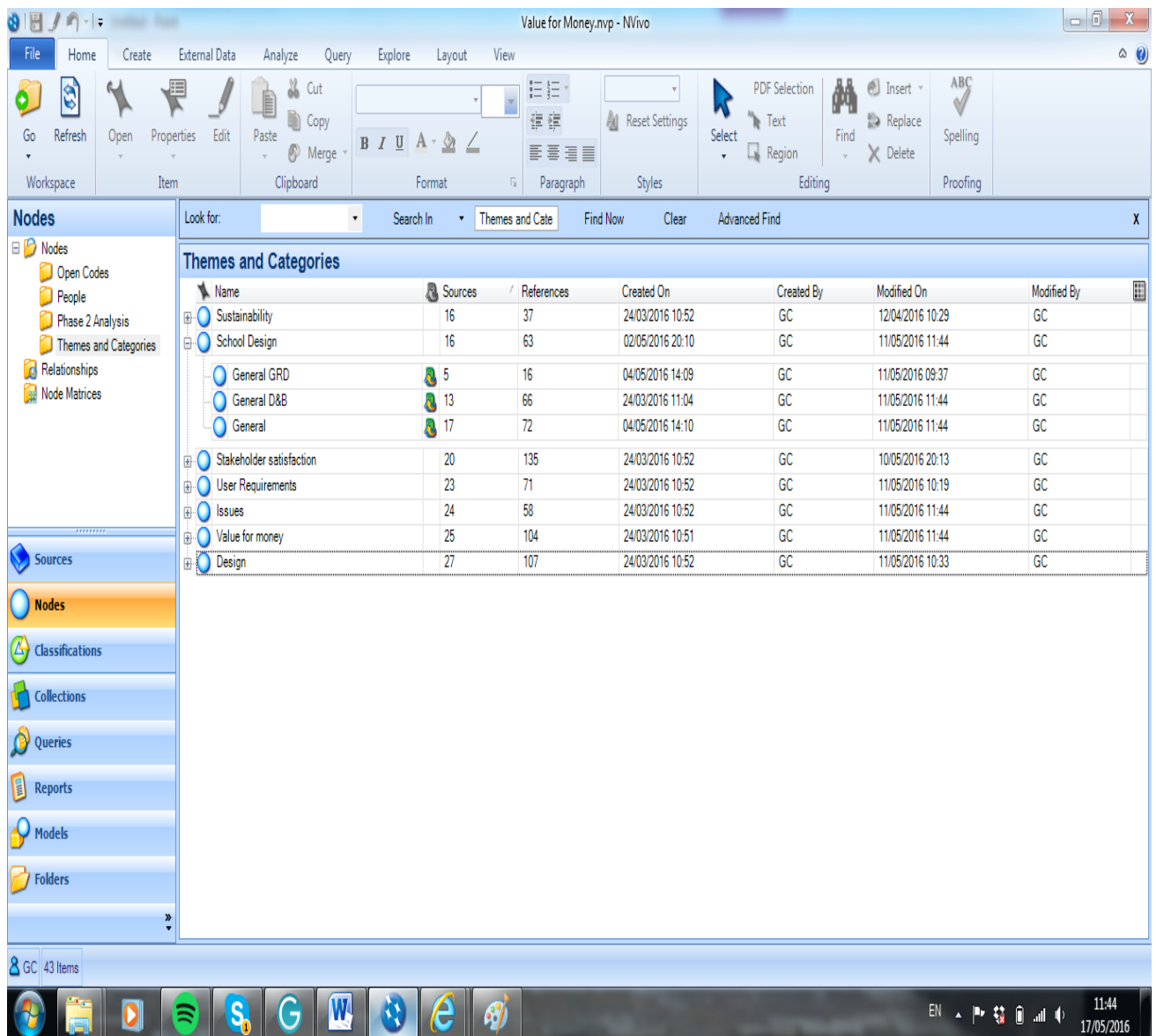
**Figure 5.1** Screenshot from Nvivo of sources and references in relation to school design

As there were a number of stakholders that participated in this research Table 5.1 is included to assist in relation to what category and what stakeholder each quotation used in this chapter is attributed to. This shows all the stakeholders that interviews were conducted with and the abbreviations that are used for each stakeholder. Each stakeholder is also assigned to a category with includes stakeholders generally, stakeholders at the construction stage on GRD schools and D&B schools. The other category is the post occupancy stage of GRD schools and D&B schools. As can be seen from Table 5.1 it shows stakeholders, the abbreviation used and the category that the semi-structured interviews are attributed to.

**Table 5.1** Stakeholder abbreviation and category

| Stakeholder | Abbreviation | Category |
|---|---|---|
| Department of Education July 2012 | DoE July 2012 | General |
| Department of Education May 2015 | DoE May 2015 | |
| Generic Repeat Design Quantity Surveyor General | GRD QS (2) | |
| Design and Build Quantity Surveyor General | D&B QS (2) | |
| Generic Repeat Design Main Contractor | GRD MC | GRD Construction Stage |
| Generic Repeat Design Quantity Surveyor | GRD QS | |
| Generic Repeat Design Architect | GRD A | |
| Generic Repeat Design Mechanical and Electrical Consultant | GRD M&E | |
| Generic Repeat Design Structural Consultant | GRD STRUC | |
| Design and Build Main Contractor | D&B MC | D&B Construction Stage |
| Design and Build Quantity Surveyor | D&B QS | |
| Design and Build Project Manager (1) | D&B PM1 | |
| Design and Build Project Manager (2) | D&B PM2 | |
| Generic Repeat Design Principal | GRD P | GRD Post Occupancy Stage |
| Generic Repeat Design Teacher | GRD T | |
| Generic Repeat Design Parents Association | GRD PA | |
| Generic Repeat Design Special Needs Assistant | GRD SNA | |
| Generic Repeat Design Administration | GRD ADMIN | |
| Generic Repeat Design Caretaker | GRD C | |
| Generic Repeat Design Board of Management | GRD BOM | |
| Design and Build Principal | D&B P | D&B Post Occupancy Stage |
| Design and Build Teacher 1 | D&B T1 | |
| Design and Build Teacher 2 | D&B T2 | |
| Design and Build Teacher 3 | D&BB T3 | |
| Design and Build Teacher 4 Learning Support | D&B T4LS | |
| Design and Build Special Needs Assistant | D&B SNA | |
| Design and Build Administration | D&B ADMIN | |
| Design and Build Caretaker | D&B C | |

In addition, Figure 5.2 shows each stakeholder and the amount of references (comments or answers) and nodes (themes or topics) attributed to each. This demonstrates that all stakeholders had comments and suggestions in relation to the school building and some more than others. No project is flawless and all stakeholders have issues and suggestions on how to make either the project run more smoothly on site or suggesting changes that can be made to the final project in order to get better VfM from the project. As can be seen from Figure 5.2 the extent of references (comments or answers) are dependant on the stakeholder interviewed and range from limited comments from GRD BOM of the school building to numerous comments from D&B MC who are involved in the design and construction of the school building. The figure also demonstrates that the themes (nodes) that are obtained from this information is also dependant on the stakeholder interviewed with limited themes emerging from GRD BOM to numerous themes emerging from D&B MC.
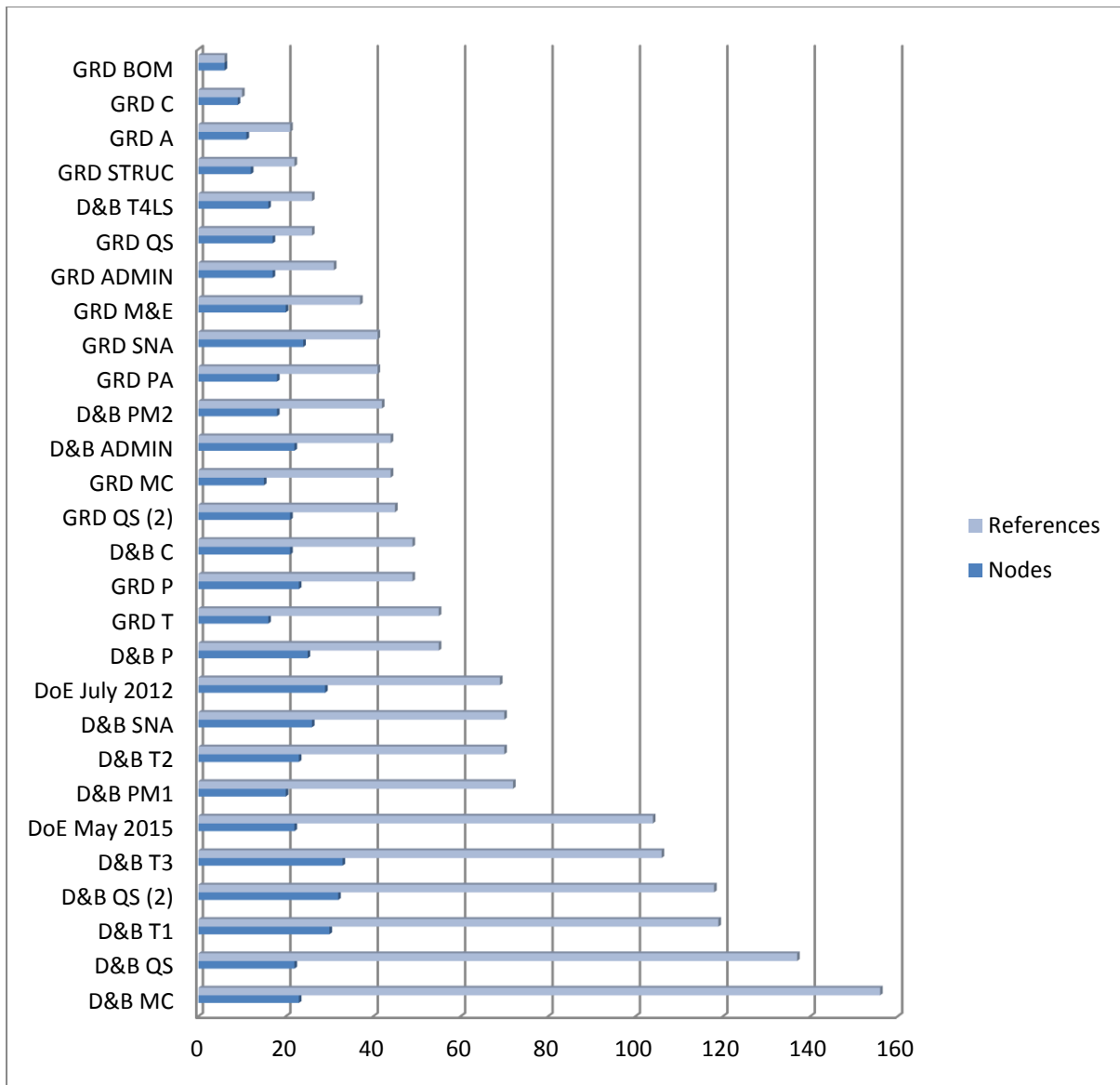
**Figure 5.2** Quantity of themes or topics and comments or answers per stakeholder

The next three sections provide an analysis of the information obtained from the semi-structured interviews and present the findings in relation to the school building programme generally, along with the general information on GRD schools and D&B schools.

## 5.3 Data analysis and findings of the school building programme

Initially, for this research it was necessary to obtain data pertaining to the issues about school building in Ireland. This sections discusses the findings that are not specific to any case study project, but which came to light when carrying out interviews with stakeholders. It includes information from a quantity surveyor who has carried out a number of D&B school projects. A quantity surveyor who has carried out a number of GRD school projects was also

interviewed. These interviews were followed by interviews with the DoE on two separate occasions in order to gain knowledge on how the school building programme is working and whether they consider that they are obtaining VfM. As interviews were conducted with stakeholders at the construction stage and post occupancy stage in schools, some general information on the school building programme also came to light and this was also included. This comprised of four stakeholders at the construction stage and three stakeholders at the post occupancy stage of the case study project.

Principally, as can be seen from Figure 5.3 a word frequency model was produced. This is a text-mining function which searches selected text and identifies the most frequently used words in that text, displaying it as a summary lists or cloud (Bazeley and Jackson, 2014). It was useful to produce this model as it gave and initial understanding of the terms and words that were used most frequently when carrying out analysis in relation to school buildings. By reviewing the most frequently used words, it meant that chunks of data were beginning to be broken down into more detailed data and analysis. Figure 5.3 shows that terms that come to the fore on schools include achieving the most appropriate *'design'* is very important from the stakeholders that were interviewed. This follows on with the *'building'* as being important as from a stakeholder perspective, what the building looks like is also an important consideration. The *'relations'* between the parties involved in the project is also imperative. This follows on with the *'contractor'* being an important part in the jigsaw according to the stakeholders that are involved. Moreover, *'cost and time'* is an important issue, but one item that does not appear is quality. It seems that the quality comes from the contractor as it appears that it is not an issue for stakeholders who work on these projects on a regular basis. From this it can be seen that the systems that are in place in order for contractors to qualify to work on these projects ensure that all contractors are capable of producing quality workmanship which safeguards the DoE from reworking being required and not being completed on time.

**Figure 5.3** Word frequency in relation to school buildings

Following the analysis of the word frequency cloud Figure 5.4 shows what themes surfaced in relation to school buildings. Five main areas have come to the fore, which will be discussed below and include the *'building'*, *'cost and time'*, *'relations'*, *'design'* and the *'contractor'*.



**Figure 5.4** Key themes for school projects

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*5.3.1 Building*

What influences the building of schools in Ireland has a lot more than just the need to provide a new school. What also needs to be taken into consideration is the preference to send a child to a certain school, religious choice and political influence in certain areas. All of this needs to be balanced with providing a building in an area that requires it. The Irish Constitution of 1937 (Bunreacht na hEireann, 1937) Article 42 3.1 states that *'The State shall not oblige parents, in violation of their conscience and lawful preference to send their children to schools established by the State, or to any particular type of school designated by the State.'* This means that you can send your child to a school in any area that you wish even though you are not living in that area providing they gain entry. This causes some schools to be oversubscribed, while other schools might be undersubscribed even though they may be in the same geographial area, which was outlined by the DoE July 2012. The effect of this is that understanding and interpreting the requirement for a new school in a certain area is not only down to the population in that area but also down to parental preference for a particular school whether a school is oversubscribed or not:

> *"Location of the new school is done in conjunction with the local authority. Department of Education and Skills primary concern is with delivery of classroom spaces. Planning of schools in Ireland is complicated by parental choice."* [DoE July 2012]

Not even consultants working of these school projects on a regular basis have an understanding of how some schools get new buildings and others are waiting a number of years for a new school to be built. Consistency does not exist in the ability of some schools to gain approval while others spend years trying to gain approval for a new school, as stated by GRD QS:

> *"Overall, they have a very funny policy of giving out new schools. Sometimes you look and you think how did that get ahead. I have been working on a school for the last 6 or 7 years and they have been getting an extension after extension, but they have a very proactive board that is driven by this.."* [GRD QS]

Taking all of this into consideration, during the last three years since speaking with the DoE May 2015 it appears that the ability to recognise where there is a need to provide a new school is getting more advanced with Personal Public Service Number (PPS) for individuals and the Central Statistics Office (CSO) maps tracking population increases in order to provide the schools in the areas where it is needed. One of the criticisms of providing schools is that political influence has been used in a particular area for getting a new school. This is slowly

beginning to change for the better, but still schools that are on the list for a new school are sometimes put to the top of the list depending on the area they are in and the political influence that is wielded in that area. What this means is that even the way schools are prioritised has led to confusion and resentment over the years. If a system was put in place to explain why certain schools were prioritised this would ensure that stakeholders on school building projects were only working on projects where they knew that the projects would advance to construction stage and not stall at the design stage:

> *"We have more accurate information than we would have had five years ago as every child now has a PPS number and that PPS number is decoded so we can put it on our geographic information system (GIS) maps along with central statistics office (CSO) information. All this information together shows us in a catchment area the number of children that have been born and where places will be needed in 4 years time."* [DoE May 2015]

In relation to the building of D&B projects what was noted by the D&B QS is that the template has changed recently. What this means is that lessons learned from one school can be brought forward to another school. In this way there is continuous improvement from one project to the next, which ultimately should lead to better VfM being achieved in relation to D&B projects:

> *"This is the first time that this one has been built ... It has been useful so there are some very useful lessons that we have learnt from it which will be incorporated as there will be at least another three of these coming down the line shortly."* [D&B QS]

The same cannot be said of GRD where lessons learned on one school cannot be brought forward to another school as the building is the same and ultimately they are given the design by the DoE. It is one aspect of repeat work that should be harnessed and is not at the moment which is a lost opportunity. This is at odds with what the DoE July 2012 suggested where the sense is that their ultimate goal is to provide a template which can be adjusted to take the site and the local community into consideration. What consultants are finding is that it is not easy to change the building as you need to have all consultants on board in order to do it with strong opposition being put in place from the DoE. What needs to be suggested by the main contractor is that options need to be made available to the school when they are being built. A team needs to be put in place that will make suggestions that can make the building more embedded in the community which ultimately can achieve better VfM:

> *"The DoE has a relationship with Fingal County Council. They located a school next to all weather pitches. They also expanded the school hall and with additional funding from Fingal it was turned into a community centre along with additional meeting rooms and offices."* [DoE July 2012]

This was reinforced by the DoE July 2012 where they reiterated that it is up to the local authorities in the areas to work with the DoE in finding ways to use the school for other activities. The schools are only used from 9am to 3pm, Monday to Friday, with two months off for the Summer, two weeks off at Christmas and Easter. There is one week off in February and October with various days off in between. Therefore, the primary schools in Ireland are only used around 37 weeks out of the 52 weeks in the year. As it should be embedded in a community in order for VfM to be achieved the school should be a focal point in bringing the community together and the building should allow for this to happen:

> *"The DoE is merely a funding agency to allow voluntary boards of management to build the school. Requires at local level commitment and interaction with other voluntary organisations. It is a taxpayer investment in the community."*
> [DoE July 2012]

The DoE July 2012 feel that the school should be opened up to the community, however, they have not put anything in place in order to encourage it to happen. A proposal would be that a system is put in place within the DoE to make suggestions to the school to encourage it being opened up to the wider community after school hours. In doing this enhanced value can be obtained from the school building to provide not only an educational facility but also a facility for the whole community:

> *"My intention is that the whole building could become available by means of master keyed locks with individual classrooms locked."* [DoE July 2012]

However, this is all very well to suggest, but in reality it is difficult to do as in situations like this you need a champion to push the school to become more than just an educational facility. In the last few years, this is not happening in the DoE where there was an embargo on recruitment to the civil service and things were stretched to capacity. For this to be done from the outside it meant that someone had to champion the new building. This is difficult for anyone to do and unfair on the stakeholders that were closest to the project to suggest changes as they usually do not have the expertise and knowledge to bring these changes about. One problem that the DoE has in relation to these schools is the fact that during the recession, there was an embargo on recruitment in the civil service in Ireland. As stated by the DoE  May 2015 staff

was drafted in from other areas to help with the increase in the number of schools that were required and sometimes these staff members did not have the knowledge and expertise to do anything beyond the norm. This meant that any suggestions or proposals to change the building were not included as staff were unwilling and sometimes unable to understand what was being suggested:

> *"The assistant secretary at the time could see that there were limited resources in the planning and building unit. There was an embargo on civil service numbers, but there was this demographic bubble so the now secretary general pulled resources from other parts of the state. The Office of Public Works has about 120 staff and a direct capital allocation of €50million. We in the DoE had a budget of €500million and 30 staff. There was a spare capacity so we took advantage of it."* [DoE May 2015]

Finally, it is interesting to note that there may be a crunch for primary school buildings at the present time, but this should ease going forward in the next four to five years as indicated by DoE May 2015. The next area that will see a peak is in relation to post-primary schools and then in relation to third level colleges, so it is imperative that VfM is achieved in the building process of these schools so that potential areas than can enhance school buildings are attained:

> *"Numbers in primary schools will peak in about 2021 or 2022 but the peak at post-primary will not be until 2025 and 2026 so the bug is already going into post-primary."* [DoE May 2015]

*5.3.2 Cost and time*

Spending on school buildings at the present time is large and it will continue to increase over the next few years as the birth rate increases. It is imperative from the DoE perspective that VfM is achieved in relation to the school building programme as the government's goal is about achieving more from any expenditure base. Ireland is spending a large portion on new schools and it is about getting these schools built and finished so that pupils can be educated in them as soon as possible, which was emphasised by the DoE in May 2015. As explained this is a significant programme of works that has not been seen before in Ireland. It also has been prompted not by the desire from the DoE to upgrade schools but the fact that the increase in the birth rate is fueling this increase in the requirement for school places. As the government is spending a significant portion of money on these new schools it is essential that value is achieved at all levels:

> *"I am not aware of any other developed OECD country that has the same problem as us in relation to demographics. When you look at the UK spending €2-3 billion for primary schools and with their population and we are spending €½ billion."* [DoE May 2015]

Interestingly, the DoE is still only focusing on providing new schools and have not even begun to focus on the existing building stock that needs upgrading. This is an area that will need addressing as the building stock gets older. Once the demographic bubble has eased, with regard to providing new schools in the primary school sector, there will then be a stretch on funding for the maintenance and upgrade of the existing stock of schools in Ireland. It is an area that will need addressing in the future and therefore it requires to be monitored, as identified by the DoE May 2015. So not only do new schools require to be provided but also funding is required for the upgrade and maintenance of the existing stock of schools:

> *"At primary and post-primary level the five year programme we are focusing on additionality. We know that there are 20-30 year old buildings that are fit for the skip and we are not even in a place where we are thinking about replacing them yet."* [DoE May 2015]

In relation to the main contractors working on these school projects, they are getting busier with the upturn in the construction industry and as the DoE May 2015 identified they are moving away from undertaking school work where the profit margins are low and the contracts are onerous. This could have a significant effect on the competiveness of contractors tendering for school building work in the future. This signifies that other ways of achieving VfM need to be investigated rather than purely the hard problem side of reducing overall costs:

> *"Went to see a project last year and the quality of the build was the best I have ever seen. That particular contractor has built a number of schools for us and along with some other contractors they have a scale about them. Unfortunately, they are now moving into building simpler buildings where the profit margins are greater. I feel that there will a lot of good contractors moving away from us."* [DoE May 2015]

A number of contractors that have done good work for the DoE are also moving away from this work as they consider that the profit margins are tight and the contracts used push risk onto them. This is a shame and there should be some way of rewarding a contractor for producing a building where the standard of finish, the time taken to complete with limited cost overruns are achieved. It appears that this is a lost opportunity to reward the good contractors for doing good work. The suggestion is that a scheme be set up to have a preferred list of contractors that have

achieved a number of successful projects in the past. VfM is being achieved at the present time, but this may be just due to the fact that these projects were still tendered during recessionary times. As momentum starts to build in the industry and contractors start to get busier, the number of contractors interested in carrying out this type of work will decrease. This needs to be taken into consideration going forward as the recessionary times, are beginning to ease and the number of contractors willing to undertake this work may decreases. What is clear from this is that as also stated by the DoE May 2015 they are getting great VfM purely from a cost side in relation to these schools in the past. The DoE May 2015 understand that this may be due to the contracts being quite onerous on the main contractor. However, contractors will become loath to tender for this work going forward as the margin of profit is extremely low and there is the perception that contractors can make a better profit on private projects:

> *"The recession for the DoE hit at the right time. We got very competitive prices from contractors, very competitive prices from consultants. Now that things are on the up again, you are starting to see contractors moving away from public work contracts. They were too onerous, but they were the only game in town during the recession."* [DoE May 2015]

From a cost point of view what the recession did in Ireland was to make not only tendering between contractors competitive, but it also made tendering consultants reduce their fees significantly. As explained by the DoE May 2015 they have achieved tremendous VfM based on the hard problem side of value in relation to these schools, but going forward this will not always be the case as the economy starts to improve. What the DoE need to do is create a market or a share of the market where consultants and contractors see these projects as an attractive option for them to work on. This may be done by bundling more projects together in order to make them larger for contractors to tender for and achieve a steady stream of work over an extended period of time:

> *"Throughout the recession we believe we got incredible value for money. Before the recession GRD consultants were on a set fee of 13.39%. With fee bidding during the recession, it has gone as low as 6%. That effectively means that fees were down by ¼ of what they were."* [DoE May 2015]

*5.3.3. Relations*

From the DoE May 2015 perspective, they have the perception that the design is set and if the design is set, then they do not need to develop a new design every time they decide to build a new school. The DoE are of the opinion that since they have achieved a good standard design their work on any school project is complete and progress should run smoothly on site:

> *"Our intention was coming from a background where you designed individual schools, we felt that if you got something right then you should not have to reinvent the wheel every time."* [DoE May 2015]

What has been found though is that all consultants have worked really well together in relation to GRD schools may be due to the fact that the consultants have spent a lot of time on the schools trying to get it off the ground and advancing through the tender stages as laid down by the DoE. As noted by GRD A once the project gets on-site everything goes quickly, which means that VfM is being achieved in the work carried out on-site but in order for a project to advance to that stage it can take a significant length of time:

> *"Even at the end of May when things should be heating up in relation to project as coming towards the end there seems to be no issues."* [GRD A]

This is the same in relation to D&B schools as the consultants are working for the main contractor. One area that does not work in GRD school favour though is gaining approval for changes. All of the contractors and consultants have said that it takes time as it is difficult to find the person in the DoE who takes responsibility for an issue. This may be explained by the previous comment where the DoE explained that as the design is set they expect the consultants and contractor to just get on with the work. This is not the same in relation to D&B schools as the DoE has a dedicated team to take control of the process so that changes and issues can be approved of swiftly. This should not need to be the case. There should be no need for this if the DoE were dealing efficiently with changes that are required. What needs to be the case going forward is that all consultants and contractors get the sense that all changes and queries are dealt with effectively and efficiently within the DoE regardless of whether the project is procured using GRD or D&B method.

### 5.3.4. Design

The design is one area that was discussed in detail by stakeholders. What needs to be understood is that the design of school buildings in Ireland is not only up to the consultants to design it is also a combination of what is laid down by the DoE in relation to cost limits, room layouts, construction standards and technical guidance documents (see Chapter 3 for more information). It should also be noted that as explained by the DoE July 2012 they are very slow to make massive changes to the design. They have ultimately had the same design since 1978. The reason for this is that changes are difficult to implement as agreement is needed from a number of stakeholders including the teachers unions in Ireland (INTO), which can be quite

complicated to achieve. The teachers union is slow to make any changes and agreement to any changes can be very slow not only to the curriculum, but also to the space that the teachers are using. The effect of this is that not only are the end user stakeholders aware that the changes to the design could have a benefical effect on their teaching ability but the DoE are also aware of this. The only obstacle to implementing these radical changes to the design is the long battle that may ensue to implement these changes with the relevant unions:

> *"Primary schools are designed to a brief that was designed in 1978. We still have cellular classrooms with en suite toilets. We are the only OECD country that has that. To break out of that box it will have to be a gradual, incremental exercise."* [DoE July 2012]

This hurdle to the implementation of any changes to the teaching space and the current teaching curriculum was explained by DoE May 2015 when it was stated that the teachers union in Ireland can yield a lot of influence on any proposed changes:

> *"We are building these schools to the current norms. We cannot build to future norms. If we build differently there is a risk that the teachers unions could object or parents could object so we have to be very careful."* [DoE May 2015]

The DoE is aware of changes that are being made in other countries in relation to teaching, but this has not been implemented in the Irish school system and as clarified by the DoE May 2015 this is somewhat of a lost opportunity. However, as explained the need to provide additional space in schools is immediate and a timely delivery of new schools is of the upmost importance:

> *"Our teachers might not be aware about developments in other parts of the world in relation to shared teaching, outdoor space self-teaching informal learning group learning active learning."* [DoE May 2015]

One thing to observe about the design is that as stated by the DoE July 2012 they are trying to ensure that there is consistency in place throughout the country. This is to ensure that all primary schools have the same amount of space and that there is consistency in school buildings from one end of the country to the other so the number of additional spaces in a new school is standard across the board:

> *"... we in the building unit translate into an architectural brief for building. Not saying any of that is perfect, just means that school in Donegal has equal facilities to school in Cork."* [DoE July 2012]

What is noteworthy is that consultants may want to change the design and feel that there might be a better way of constructing the spaces but they are bound by the rules and regulations that are laid down by the DoE and which have been agreed upon with unions and interested stakeholders.

One of the criticisms of the GRD design which was identified by GRD ADMIN is that the school considered that if they went with the standard design it might speed things up, but in fact all that it ensured was that the end users had no input in the design whatsoever. This is an unusual situation as one of the reasons that GRD procurement method has been promoted by the DoE is the speed at which it can be completed as the design does not have to developed from first principles. This may be due to the length of time that projects take to advance through the tender stages:

> *"We went with the generic design which is supposed to speed things up, but in fact it did not speed things up all it meant was that we had no input in the design."* [GRD ADMIN]

Consultants that have worked on the design of D&B projects like it, but believe that it also has its flaws. One of the criticisms as stated by D&B P associated with the D&B projects is the lack of consultation in relation to the design for the end users. Consultation with end users ensures that they take ownership of the building at an early stage. If no consultation takes place then end users do not feel engaged with the design of the school:

> *"It would have been nice to be consulted in relation to it. We were hardly consulted in relation to the new school."* [D&B P]

This has not been the case in relation to GRD school projects were in order for the school to be built the principal need to champion the project as stated by the DoE Juy 2012. When end users have an input in the design of a project, they then feel ownership of that project and are less likely to be critical of the end product as they understand the comprimises and decisions that were made for the design. This was the case in relation to GRD school projects where end users felt included in the decision making process:

> *"School principal would of had very little involvement with design might be a criticism that they would level. If they want a school they need to drive the design team, keep an eye on the design team, design team have a liability to the school."* [DoE July 2012]

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Interesting to observe that even the DoE appreciates that the design of these projects is not perfect but the DoE are also conscious of the fact that a new design does not need to be employed on every new school project that is being built.

*5.3.5 Contractor*

Consultants and contractors generally appreciate the whole D&B approach as highlighted by D&B QS. With this approach the contractor having an influence in the design of the building has beneficial consequences which ultimately should achieve a better building and greater VfM. However, the exclusion of the end users to influence the design of the building is a criticism that can be laid upon the D&B approach as they too have a positive influence on the design of the building:

> *"I think that the people who build it need to have some kind of input into the detailed design otherwise you can get design teams who otherwise have a good idea, but they don't build things so you are missing that link."* [D&B QS]

As identifed by the DoE July 2012 the delivery of these schools needs investigating, particularly as there are dynamic changes happening as the country emerges from recession. What needs to be investigated is the requirement for serial suppliers of materials and preferred contractors. This will be a move away from the traditional way of procuring projects, but it may be a way of ensuring that VfM is still being achieved going forward as the country emerges from recession. What is being acknowledged here by the DoE is that they are aware that the way they procure these buildings in the future will need to change based on the changing economic climate of the country:

> *"I would of loved to have built a second school with some of the good contractors that I have worked with. If we had done a second one together the design team and the contracting team could of done it virtually blindfolded."*
> [DoE July 2012]

Going forward, it appears that the main contractor is the one stakeholder that can have a major influence on whether or not, VfM is being achieved in relation to the school building programme. It will be interesting to see in the future, as contractor workloads increase, whether they continue to carry out school building work. The belief of contractors that have worked on these school building projects is that the conditions and risks that are attributed to them are quite onerous and the risks outweigh the profit attained on carrying out this work. What needs to be handled carefully by the DoE is as the country heads out of recession that contractors are

still willing to carry out work on the school building programme so that the DoE are not left with a small number of main contractors to choose from.

### 5.3.6 Interpretation of findings on school buildings

Finally, from the data Table 5.2 shows the findings that emerged in relation to achieving VfM on school buildings in Ireland. The table summarises each theme and the key findings that are attributed to each. This section will now discuss the findings in relation to themes and refer back to the literature as appropriate.

**Table 5.2** School design general findings

| Area | Themes from Data Analysis | Findings |
|---|---|---|
| School Buildings | Building | • Political influence on building new schools<br>• DoE is taking GIS into consideration when planning new schools<br>• Template for schools not altered, but DoE would like if any alterations required were included<br>• Problem with an embargo on recruitment in DoE<br>• Peak soon at post-primary level and then at 3$^{rd}$ level so problems not resolved in the foreseeable future |
| | Cost and Time | • Spend on providing new schools at present<br>• Next will need to spend on the upgrading of existing schools<br>• Contractors and consultants available to do the work will decrease<br>• Most of the schools built during recessionary times so VfM was achieved |
| | Relations | • Not reinvent wheel as the design is set<br>• Consultants work well together as spent time getting projects off the ground<br>• Gaining approval for changes to GRD difficult |
| | Design | • DoE slow to make changes to the design due to the amount of relevant stakeholder involvement<br>• DoE is trying to ensure consistency in the design<br>• GRD criticism is that going with the standard design did not speed things up<br>• D&B criticism is lack of end user involvement |
| | Contractor | • D&B approach with contractor involvement has beneficial consequences<br>• Coming out of recessionary times will have an impact on these projects |

A school can meet all the requirements for a new school *'building'* but who gets to top of the list, in the provision of that school, can also be determined by influential local politician in the area. The DoE uses GIS mapping to show where peaks are happening, but this does not determine whether a new school is built in an area as parents have freedom of choice in where they send their children to school. What is required is that it is more transparent who gets to

top of the list and why. The template for the new school is not altered, but a suggestion would be that any common sense alterations be taken into consideration. Another issue is the problem with an embargo on recruitment in DoE following recessionary times. The drafting in of other civil servants from other area who are not proficient in school design is a criticism that can be laid and should be a temporary arrangement and not continued into the future. The peak will soon come about at primary level, but this swell in numbers will then continue on at post-primary level and then at third level; therefore the need to provide VfM will continue into the foreseeable future (Department of Education and Skills, 2015b). What this means is that if enhanced VfM can be achieved at primary level this can be moved on to post-primary level and eventually at third level.

As discovered about *'cost and time'*, the DoE are spending time at present on providing new schools and then they need to spend on the existing stock of school buildings. A significant finding is the fact that the availability of contractors to carry out the work will decrease. These buildings were provided during recessionary times so both the contractors and the consultants were willing to do an enormous amount of extra effort to win work in the first place and to get these projects completed on time and within the budget allocated to it. As the economy begins to pick up (Society of Chartered Surveyors Ireland, 2016b), this will see a dynamic change in the way both contractors and consultants approach these projects. This is why the DoE is moving away from traditional build and PPP to methods of procurement where economies of scale are taken into consideration. It implies, that the D&B method of procuring schools, where projects are bundled into large groups is the most beneficial option to choose when endeavouring to provide VfM.

As consultants do not have to design each building from first principles the benefit of this to the *'relations'* between consultants is good. Consultants work well together to get these projects off the ground, which is an important consideration in relation to achieving VfM. As discussed by Liu and Leung (2002), to create a more holistic approach to VE in a project, both the technical tasks (as guided by processes and tools) and the human resource variables (as manifested in conflict and commitment) are equally important. Therefore, in essence, by stakeholders working well and communicating well with each other, this helps to achieve a more holistic view of value. One aspect that needs to be improved on however, is gaining approval for changes. By using the GRD design, approval for changes is time consuming, which means that both consultants and contractors have to spend time chasing approval. This

infers that VfM is somehow being eroded by this as the relationship between the consultants and the DoE and the contractor and the DoE is not as good as it should be. This is one area that needs to be addressed in going forward by the DoE.

The DoE is also very slow to make significant changes to the standard *'design'* due to the number of relevant stakeholder involved in school projects. This needs to be explained to all relevant stakeholders, so that they have an understanding why certain decisions were made about the design. Approval for large changes is difficult to introduce due to the legislative background, acts, school design documents (from the DoE), pedagogical brief for primary schools, and school unions who each have a strong influence in the design of any school. What needs to be reinforced to all stakeholders is that the DoE is trying to maintain consistency in the design. This needs to be explained to stakeholders so that significant changes will not be allowed in a school design. In relation to the design of GRD, the criticism is that going with the standard design did not speed things up. If this is the way to go then a Section in the DoE needs to take responsibility for this design. In relation to D&B, the criticism is the lack of end user involvement. If a dedicated Section in the DoE was introduced in GRD schools and end users were consulted when building a D&B school, then a more harmonious project would be created; thus ensuring that better VfM was achieved.

Finally, in relation to the *'contractor'* having their involvement in the early stage design has beneficial consequences. As explained in Chapter 3 section 3.6.1 communication among all stakeholders is important to project success. As Landin (2011) explains the long term performance of any construction project and its ability to satisfy stakeholders depends on decisions made and the care taken by decision makers. What will however have an impact on the number and availability of main contractors to undertake this work in the future is the availability of more profitable work in the private sector as the country emerges from recession (Bruce Shaw Handbook, 2016).

## 5.4 Data analysis and findings analysis of Generic Repeat Design schools

As well as data emerging from stakeholders about the school building prograsmme, which was not specific to the case study that was undertaken, information also came from interviews regarding GRD school design, specifically. The data contained here is that material that was obtained from stakeholders about other GRD projects that they have carried out that was not

specific to the case study that was undertaken. It is necessary to also include the findings from the analysis of the data in order to gain an understanding of how GRD projects work and how enhanced VfM can be achieved going forward at a strategic level rather than at a project level.

The initial phase of the analysis again involved producing a word frequency cloud in order to interpret what data is being carried through the interviews. As can be seen from Figure 5.5, words that come to the fore is the *'design'* of GRD schools which all stakeholders are concerned with. It is a term that comes through again and again. What this implies is that if the design is right and correct, then everything else falls into place. The other area that is of concern to stakeholders is the *'project'* itself. Again, *'time'* comes up, which is the length of time required to construct the project and the time it takes to get the project off the ground. The *'principal'* also comes up as being an important aspect in relation to GRD projects. Finally, *'areas of concern'* include changes that need to be made to the design if the project is to be successful.



**Figure 5.5** Word frequency GRD schools

Producing the word frequency cloud aided in rearranging the data under themes. As can be seen from Figure 5.6 there are a number of themes that were elicited on GRD school designs. Again, the findings will be presented separately in the next section and include the areas of; *'time'*, *'areas of concern'*, *'design'*, the *'principal'* of the school and the *'project'* itself.
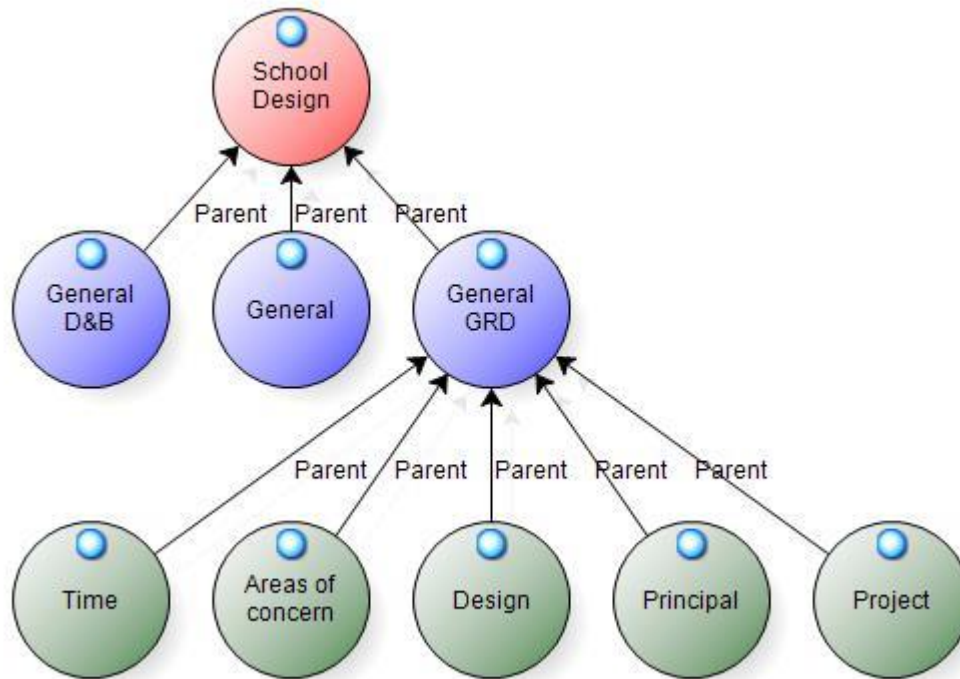


**Figure 5.6** Key themes for GRD projects

*5.4.1 Time*

In relation to time one of the biggest issues as stated by the GRD QS is gaining approval for changes from the DoE. There is no standard time limit within the department when changes have to be approved which stakeholders find difficult when working on projects. Also, as it takes time to gain approval this has a knock on effect on the contractor and the design team, which could lead to exposure to cost overruns. This needs to be addressed so that there is one point of contact within the DoE and a time limit on approving changes on any given project is agreed. As GRD projects should not have a large amount of changes this should be a simple task for one designated person within the DoE to make an executive decision. By doing this, the final loop will be closed off in relation to time on GRD projects so that enhanced VfM can be achieved:

> *"The approvals for changes is very slow. You cannot issue an instruction until you have approval from the DoE. The reporting is quite onerous."* [GRD QS]

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Another issue as detailed by GRD QS is the time of year when change orders are sent to the DoE. In relation to most primary school projects on site, the programme of work is to have pupils in classrooms by the 1st week of September. This also means that the time when approval is needed is usually the summer months where holidays are taken. This needs to be addressed so that there is a dedicated person in the DoE who is responsible for getting these projects completed on time and approval in relation to any changes that are required are swift:

> *"If you are changing the furniture you need to send off a change order request which, depending on the time of year may take too long which means you could miss a window."* [GRD QS]

What appears to be the case is that once approval is given to commence the projects, the majority of stakeholders are satisfied that the project will run to a good timescale on site compared to a one off designed project. This should be the case as the design is set and the only issues are getting the project completed on that particular site. However, what stakeholders are not satisfied with, is that if any issues arise on the site, then approval to make changes is slow. It is as if the attitude within the DoE is that once they have given the standard design to the consultants then no changes need to be made. This needs to change going forward so that the standard design is updated on a regular basis to take any required changes in the design into consideration for the next project so that the time it takes to make changes is reduced.

### 5.4.2 Areas of concern

Areas of concern include the fact that information obtained from the DoE is not absolute and sometimes drawings and documents need updating, which is not happening. As GRD QS explained consultants working on GRD projects sense that the DoE do not update their files in relations to changes or errors that are in the documents, which is frustrating for the design team. It also means that any errors or updates that require to be made to the design are not implemented and updated in the documents from project to project:

> *"I have checked through our files here and I do not believe that we got a GRD bill of quantities... What we used was a Bill from a previous project. They are assuming that their document is correct."* [GRD QS]

Not having up to date information has been fine up until now where the only changes that had to be made to the drawings were minimal with a few changes to the glazing in the reception area and updating of specifications for certain materials. Due to the new building control regulations (S.I. No. 365 of 2015) where a more robust system of building control is now in

place and an assigned certifier is now required at the construction stage, changes to the GRD design need to be implemented. This has not been included in the GRD documentation at present and as stated by GRD QS the additional work that is required to be carried out by the assigned certifier requires an additional fee to consultants undertaking this responsibility which has not been paid. This has led to a bit of a standoff at this stage with the DoE not wanting to back down and pay an additional fee rate to consultants. It is an issue that will need resolving if more schools are to be built using this standard design. Furthermore, now is the time that the standard GRD design is reevaluated so that any required updates and changes are taken into consideration in the standard design. This should ensure that all updates and regulatory changes are included in the generic design going forward which should make for a more appropriate design:

> *"We are doing a GRD at the moment and we have been informed and instructed to go to 2b and there is a standoff in relation to fees."* [GRD QS]

The opinion of the consultants is that the DoE's only priority is getting these schools complete on time. Consultants believe that the DoE have ignored the issues that the standard design is now bringing out as explained by the GRD QS. Consultants are beginning to become aware that they are now doing additional work on these GRD projects that they are not being reimbursed financially for. If the DoE is willing to keep using the design the way it is, then consultants may start to move away from these types of project where the profit margin is reduced and they are expected to do a lot more than they usually do for their fees. In section 5.3.5 it was shown that contractors are beginning to move away from carrying out schools work as workloads increase and they begin to have the ability to choose more profitable work. Added to this, is also consultants beginning to move away from carrying out this work as fee margins are low and there now is the added responsibility of being the assigned certifier at the construction stage. All of this has the potenetial to erode the attractiveness to contractors and consultants to undertake school building work in the future which will reduce the availability of consultants who are available to undertake this work, thus eroding achieving VfM:

> *"Nothing wrong with the design, but if there are changes in regulations it needs to be tweaked which is not a big exercise to do. Should have brought out a revised GRD design at this stage, but has not happened which is purely down to resources within the DoE."* [GRD QS]

*5.4.3 Design*

The design of the GRD school not only takes the DoE recommendations into consideration (Chapter 3, section 3.3.2) but it has also examined the cost benefit of using certain materials as detailed by DoE July 2012. The other aspect of the overall design of GRD schools is that only a certain amount of energy efficient technology was used in the building as these schools are only used for nine months of the year. It was stated by the DoE that nothing overly innovative was used in the GRD design, however, it should be noted that technology moves on quickly and something that might have been new and innovative in 2012, could be mainstream today. Again, this reinforces the argument that the overall GRD design needs to be reviewed and updated on a regular basis to harness the knowledge not only about the construction of the building but also the materials and technology included in the design:

> *"Had done a lot of energy research so brought a lot of that on-board as well. Did not trial anything overly innovative or cutting edge as knows it needed to be replicated with this school."* [DoE July 2012]

The design is simple with no over complicated design elements or materials incorporated into the building. The ability, however, to make changes to the choice of materials is limited, which could have an effect on whether true VfM is being achieved in relation to GRD school projects. This is due to the fact that in certain areas materials have the potential to be significantly cheaper than other materials for example certain types of stonework or paving slabs. In this way by harnessing local materials in the area it can add to the ability of achieving VfM on a school building project.

*5.4.4 Principal*

What has been found is that the involvement of the principal of the school in the one stakeholder that can have a positive influence on the outcome of the building process. As stated by GRD MC, when you have a principal of a school involved in the design and construction stage it means that they take ownership of that project at an early stage and area involved with any decision that is taken about the school at the construction stage:

> *"The biggest shortfalls that we have seen and this is right across the board is you have very good principals of schools who are very good educators, very good managers of people who are all of a sudden becoming project managers."* [GRD MC]

The downside of this is that if you have a principal of a school who has little knowledge about the design and construction of a school then this can lead to a construction project that does not work well and both the consulting team and the main contractor become frustrated with the inability of the principal to make a decision on an aspect of the project. This was emphasised by GRD QS when it was stated that:

> *"You have to have a principal who is committed to this project. Principals are being forced into roles that they may be unwilling to take on."* [GRD QS]

When building using the GRD method, it is important that the principal of the school takes this process on board and is motivated to champion getting the construction stage complete otherwise it is unlikely that the project will progress effectively on site. This is a considerable ask for a principal as some are not prepared or unable to take on this extra work where they are already stretched to the limit in their daily work.

*5.4.5 Project*

What is interesting is that because there are a number of schools that have been built using this GRD design issues with the design details should not be occuring. As stated by GRD QS one of the main benefits is that if a contractor has difficulty understanding a detail they can visit another GRD school that has already been built using the design and where all design details have been thoroughly thought through. This ensures that issues and claims for extras for the design detail are eliminated:

> *"Architects can say to contractor look at school over there that is what we want."* [GRD QS]

Consultants are of the opinion that the DoE is achieving VfM in relation to the GRD designed project, but they consider that this is due to industry not having a significant amount of other work to choose from when they tendered for these projects as identified by GRD QS. As there was limited work available for both consultants and contractors, profit margins were slim and in some cases non-existent which meant that VfM or more correctly cost cutting was achieved:

> *"Yes, these GRD projects are giving better VfM. It might not be quantifiable but it is better than a similar school that is designed and built traditionally."* [GRD QS]

The DoE May 2015 perception of what VfM is more to do with whether cost reductions have been achieved. As stated in Chapter 2 section 2.3.4, the organisational behaviour of human

beings is equally important when trying to achieve VfM (Leung et al., 2003). The perception that value is about cost reduction needs to change if true; VfM is to be achieved in relation to the school building programme:

> *"In 2004-2005 GRD built in Lucan for €4.5million. In 2012 another identical GRD 16 classroom school was built with similar siteworks but on a different site was built for slightly less than €3million. That was a reflection of the downturn in the marketplace."* [GRD May 2015]

*5.4.6 Interpretation of findings on GRD schools*

Table 5.3 demonstrates that in relation to GRD schools the issues that have come to the fore include *'time'*, *'areas of concern'*, the *'design'*, the *'principal'* of the school and the *'project'* itself. This table identifies the main themes on GRD projects and the key findings in relation to these themes.

**Table 5.3** School design GRD findings

| Area | Themes from Data Analysis | Findings |
|---|---|---|
| General GRD | Time | • Gaining approval for changes takes time<br>• There is a problem with the time of year that change orders are sent to the DoE |
| | Areas of concern | • Information from DoE not absolute<br>• New building regulations and assigned certifier construction stage so discussion over fees<br>• Consultants/contractors moving away from this work |
| | Design | • Cost benefit analysis undertaken in relation to materials<br>• Used tried and tested technology only<br>• Design simple, but ability to change certain materials is limited |
| | Principal | • The key stakeholder who needs to champion the building process<br>• Needs to take ownership of the project at the design stage |
| | Project | • If there are detail issues then can go look at another school<br>• Achieving VfM, but may be the times when the projects are undertaken<br>• DoE VfM is about cost reduction, which needs to change |

On GRD projects one area is that the *'time'* it takes to gain approval for changes needs to be addressed. The recommendation is that going forward, like D&B projects, GRD projects have a dedicated section within the DoE. Another issue is when these change orders are sent to the DoE. Most schools have a timeframe that pupils are in the school for the 1st week of September, which means that the majority of change orders are sent to the department during the summer

months. This needs to be facilitated in the DoE with time off for holidays so that change orders are not taking an enormous amount of time and delays ensue.

Under *'area of concern'* it has been identifed that information from the DoE is not absolute. If GRD is to be used again for school buildings or expanded then all information contained in the drawings needs to be complete and every time a project is completed a form is signed to ensure that if any changes need to be made to standard drawings then this is included. In essence, a feedback loop needs to be closed off so that on GRD projects the DoE are learning from one project to the next. One of the most important outcomes in relation to GRD schools is that there is a bit of a stalemate at the moment in agreeing to pay extra money to changing legislation in relation to the assigned certifier construction stage and the implementation of the new building regulations. This is an area that needs to be addressed going forward if more of these schools are to be built using the standard designs. The standard design needs to be altered to take these issues are taken into consideration. In the interim stage a change order or change to plans needs to be sent to consultants in order that these changes can be taken into consideration. Finally, one issue that needs to be tackled is the fact that as the economy in Ireland is beginning to improve. Alternative ways of encouraging all consultants and contractors to carry out schools work need to be encouraged. This is due to the fact that all consultants and contractors perceive government work as not being as profitable as other private work, as the risk associated with taking on the government forms of contract is seen as being quite onerous on the contractor and the consultants (see Chapter 2 section 2.3.3).

One item on the *'design'* of GRD schools is that the DoE have undertaken a cost benefit analysis of certain materials used. This is to be encouraged, but this also needs to be reassessed going forward as some finishes are not up to the standard that is required of them. What has been discovered is that only tried and tested technology is included in these buildings with research conducted by the Design, Awareness, Research and Technology (DART) Programme (Department of Education andd Skills, 4th June 2014). All of this means that the design is straightforward and simple and there is only a limited capacity to change certain materials. Going forward, this might need to change so that materials along with the design are updated to take account of new materials and technologies as they advance.

One benefit of using the GRD way of procuring a building is the involvement of the school *'principal'*. From a value perspective, if this stakeholder is on board with the project, then it

has the potential to run more smoothly on site, as this is the one stakeholder that has an understanding of how the layout is going to work once occupied. (Bourne and Walker, 2006; Rowlinson and Cheung, 2008). The opposite is also the case if the principal is not someone who wants the involvement of the school. One of the issues with this is that not all principals have the expertise and are willing to give extra time to these projects. Finally, one of the benefits of the standard GRD design is that if the consultants and contractors have any problems with the details they can visit another school that has been built using the standard design.

On GRD *'projects'*, all stakeholders believe that VfM has been achieved, but again this might be due to the time when these projects were carried out. The DoE sees these projects as achieving VfM as they believe that the costs are reduced. In going forward, in order for enhanced VfM to be achieved, stakeholder involvement needs to be encouraged not only at the construction stage stakeholders but also by the post occupancy stage stakeholders. Which was identified by Bourne (2016) that stakeholders seek to maximise their representation in the project solution.

## 5.5 Data analysis and findings of Design and Build (D&B) schools

In tandem with data emerging from stakeholders that have worked on a number of GRD project information also emerged from stakeholders that have worked on a number of D&B projects. These stakeholders included consultants who have been involved in a number of D&B schools and the DoE themselves. Initial analysis of the data involved the creation of a word frequency cloud (Figure 5.7) which demonstrates the words that were used by stakeholders when conducting interviews. Again, the *'design'* of the school is seen as one of the most important factors in order for VfM to be realised which is the same as on GRD projects. The other item that has come to the fore is the *'relations'* between stakeholders involved in the project, the *'contractor'* involved in the project and the *'build'* itself.

**Figure 5.7** Word frequency D&B schools

Following the generation of the word frequency cloud, data was rearranged under themes in order to gain more clarity of the information. As can be seen from Figure 5.8 there are certain themes that have come from the analysis of D&B schools and this includes the *'build'* itself, the *'contractor'*, the *'design'* of the school and the *'relations'* between stakeholders. Each one of these will now be discussed separately.

**Figure 5.8** Key themes for D&B projects

*5.5.1 Build*

It appears there is VfM in relation to efficiency of building the same design a number of times. This includes savings achieved on consultants fees in using the design again and again. This is one of the great benefits of building on a volume basis. There are a number of contractors and consultants that build these schools so there is also consistency as you learn from building one to the other. This is different to GRD schools, where contractors and consultants are not just building one school, delivering it and then tendering for the next, but on D&B projects are tendering for a block of five to ten schools and building these schools one after another. As D&B QS indicated that by building on a volume basis, both the consultants and the contractors are learning and implementing that knowledge from one school to the next. This should increase the ability to achieve VfM on these types of projects. Efficiencies are also achieved as both the consultants and contractor learn from one project to the next:

> *"The fact that design teams both on our side and on the contractor's side are getting volumes of work that they would not be able to get anywhere else, that is really what gives us the efficiency over anything else."* [D&B QS]

This opinion was enhanced by the D&B PM2 who has worked on a number of D&B bundles, where from one project to the next you are also endeavoring to improve either the way they are constructed, the subcontractors that are working on them, the material suppliers that are used, or any other approach in order to achieve better VfM from one project to the next. This is a benefit of using the D&B approach which cannot be achieved when using the GRD design as

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with this option consultants and contractors may only work together on one project and not a bundle of projects:

> *"Better the last ones and better relative to others in the design competition. It has led to some good thinking in terms of the design and the finishes."* [D&B PM2]

One of the central issues up until now is that all of these schools were built during recessionary times. Fees were spent early on in the project and only for the fact that there was a volume end to these projects, then it is unlikely that contractors and consultants would continue to build them in the future. As D&B QS stated this is due to the increasingly reduced ability to achieve an acceptable level of profit for the contractors engaged in schools work. It is one point that needs to be taken into consideration going forward in order that VfM can still be achieved. This was also stated on GRD project and it may make the DoE reevaluate how these projects are procured in the future:

> *"We probably have spent a lot of time on these projects and have spent our fee quite early on… It begs the question that would the programme be so successful if it was brought in at a different time?"* [D&B QS]

On the subject of achieving VfM on the build, all stakeholders are of opinion that the VfM on D&B projects is achieved due to the volume of work that is being undertaken by a team of consultants, contractor and project manager. Both D&B QS and D&B PM2 sense that better VfM is achieved on these projects due to the volume of work and this is achieved due to the speed at which these projects can proceed on site:

> *"We are working on other commercial projects which are of a similar capital value that are taking a whole lot longer… Even though the basic building cost is going up they still are getting great VfM as they are getting great value as they are happening very quickly."* [D&B QS]

> *"From the time that they appoint ourselves to the time they finish can be as little as twelve months to 24 months, whereas traditionally it could be 10 years before it is finished."* [D&B PM2]

Due to the speed benefit, the fact that these are being built in recessionary times and the volume of school that are built together, this in turn, leads to another benefit. This benefit is the belief that there are savings in relation to fees paid to consultants than there would be on a traditional tendered project. This is due to the fact that as D&B PM2 stated consultants when putting in their fee bid are not only tendering for one project they are now tendering for a number of

projects which should guarantee them work over an extended period of time. This is one benefit of D&B project which could be promoted in the future to encourage consultants to work on them as it guarantees work for an extended period of time:

> *"If you looked at the fees that we charge along with our team and add that to the fees of the contractor, design team add them all together that is probably less than they would pay on a traditional tendered project."* [D&B PM2]

One issue in relation to work on the site is that payments sometimes are a concern. Between the time of certifying the money and making payment a significant extra amount of work is sometimes completed as the programme of work is so tight. As D&B PM2 identifies that contractors are unwilling, and sometimes, unable to undertake a significant workload on credit as a lot of material suppliers and subcontractors had credit issues during the recession and suppliers are unwilling to extend credit over a significant period of time. What needs to be done is that payments need to be issued as soon as possible following certifying a payment so that any issues on site with subcontractors or suppliers are avoided:

> *"From a payment point of view, valuing the work done to date is difficult as it can change significantly even over a day…. It was very important that the money went into the contractors account as soon as possible."* [D&B PM2]

Where they are spending an amount of time is at the tender stage and the pretender stage in order to get all glitches and complications with the build dealt with before commencing on site. Indeed the D&B PM2 who works on D&B projects even stated that they were not spending a lot of time on the site, which is unusual as there are normally changes, variations, issues on any project of this size:

> *"Generally was not there a huge amount of time. It was easier out on site but design and build generally is because the contractor is taking responsibility."*
> [D&B PM2]

Another advantage of the D&B approach is that the project manager may tender for 4-5 bundles of projects. Each of these bundles could have a number of projects within them. This means that they could employ a group of consultants for one bundle and then mix it around and employ a different group of consultants for the next bundle or even change some but not all the consultants. By doing this as D&B MC states this ensures that competition is achieved and that it does not become a laissez fair attitude among consultants in gaining work:

*"An example would be that we had a school where the engineer designed the school too heavy and with too much steel in it which was throwing up our tender prices. So we brought a different consultant engineer on board and frame with less members and more spacing and that drove down the tender price."* [D&B MC]

### 5.5.2 Contractor

On D&B projects the information that comes from the DoE is very sparse on the design, so that the main contractor has the ability to influence the design and rearrange details to better suit them. This is unlike the GRD design where the DoE are perscriptive in what they require. This means that the main contractor has the ability to interpret the constructability of the design and how it can work for them. This has beneficial effects in that the main contractor is not stuck with a design that does not work for them, thus ensuring that the contractor is also adding value to the projects as it progresses. This was explained by the D&B QS where it was stated that the layout given to the main contractor is nothing more than a space planning exercise and it is up to them to interpret how the spaces within the school building work together:

> *"Essentially what happens is the layout that we get from the DoE are nothing more that a space planning exercise so that we have something that gives the right schedule of accommodation, that it fits on the site and we can get access in and out."* [D&B QS]

In this way, sending out the information to consultants to tender for and design, the DoE are achieving better VfM than if the design was given to them. This was described by the D&B QS2 when it was stated that site specific attributes can be taken into consideration:

> *"Then you send this out to the contractor to price. They then employ their own consultants to make up the designs for the schools. They take that school and then see what they can do with it."* [D&B QS2]

The most important aspect from the DoE point of view is getting pupils into the schools as quickly and efficiently as possible and they need a contractor that can achieve this. In order to does this, the DoE has a small dedicated team that works together to ensure that these projects are completed on time on site. This is a departure from the norm and is a welcome addition, as one of the criticisms of working on traditionally procured projects and GRD projects is the inability of the DoE to make timely decisions on variations, changes or issues that arise as discussed by D&B QS:

> *"The one thing that I would say is that credit to the Department on the rapid programme they realise that it has got to be turned around rapidly. It is a relatively small team that have been dealing with it from the start and there hasn't been a huge turnover of staff which has been a big help. They have got a good technical grasp on what is needed and what is going to work."* [D&B QS]

Again, these projects are still built to cost limits, but that might still not be the case going forward as the construction industry is starting to get increasingly busy and contractors begin to preference more profitable work, which has been reiterated by D&B QS:

> *"Yes, it is still built to cost limits, but that is partly because of the way the tendering situation is at the moment. Prices are very competitive."* [D&B QS]

At the present time the main contractors are designing and building these schools which do not exceed cost limits, but going forward as explained by D&B MC this will not always be the case. As the markets start to open up for main contractors in the private sector and the level of profit obtained for these projects continues at an unsustainable level, then the main contractors may decide not to undertake schools work going forward. Now is the time that the DoE will need to address this issue so that they make these school projects attractive for main contractors in the future:

> *"The trouble I think with D&B is there is a lot of risk loaded onto the contractor from the get go. The fact that you have to take on any inflationary increases over the period of the building, cost of materials, etc. It is very, very difficult."* [D&B MC]

Another issue with the rising market is explained by D&B MC is that contractors can spend a significant amount of time and money tendering for D&B work with no guarantee of work or no reimbursement for time spent tendering. This is another reason to address the availability and interest of contractors in schools work in the future:

> *"Personally, I would think that at the minute with a widening market a lot of people stand off this process because there is no guarantee of work. You put a huge amount of fees into your respective consultants. Built in a very short space of time which is heavily weighted against the contractor. Also in relation to cost terms you would need to be securing a job every time you price. There is too much time tied up in it to be honest."* [D&B MC]

One major difference between D&B projects and GRD projects is stakeholder involvement. In praise of GRD projects was the involvement of the school principal, which ensures that end users have involvement in the building process, thus ensuring enhanced VfM is achieved. This

is lacking on D&B projects where there is no involvement of any end users and it is something that is not even encouraged. One reason for this, is the fact that there is a sense that the main contractor are building the school for the project management team rather than the school itself which is one of the drawbacks of using the D&B approach which should be addressed going forward to ensure that enhanced VfM is achieved.

### 5.5.3 Design

One of the advantages of building using the D&B method as explained by D&B QS is that the design can change to reflect changes that occur from one project to the next. Systems are not in place on GRD projects for this to happen as the design is set and changes cannot be made to it. In having the capability to implement lesson learned from one project to the next, ensures that enhanced VfM can be realised:

> *"... there are some very useful lessons that we have learned from it which will be incorporated as there will be at least another three of these coming down the line shortly which we are involved in."* [D&B QS]

Added to this is the ability to incorporate any lessons learnt on the design before the next project commences on site. This not only means that less time is spent by the contractor and the subcontractor trying to find solutions to problems, as there is a learning curve from one project to the next, but also that any design changes can be implemented into the next project. An example of this was given by D&B QS:

> *"The curved section has caused a number of problems that needed to be overcome... That is probably going to get sorted out on the next one that is built."* [D&B QS]

One thing to remark on is that these projects run quickly and smoothly once they get on site, as eluded to by D&B PM2. The other side of that is that more time needs to be spent at the tender stage; putting the documents together in order to get the projects off the ground. The time that is spent at pretender stage is not just on one project but it is on multiple projects, which does have an advantage. Once documents are produced for one school, these documents can then be reproduced for the next school and on and on thus ensuring efficiencies of the design are achieved:

*"There was a lot of work involved as it is D&B. So getting the contract documents together took time. The schools are also similar. The documents are all the same, but the paperwork that it generates is a lot in order to get what is required right. In saying all that we do tend to get them out relatively quickly."*
[D&B PM2]

Construction stage stakeholders in relation to D&B projects, are interested in getting the project up and running and completed on time and within the required budget, as penalties for delays are considerable. One thing that was noted is that at no time have any of the consultants in the design or construction stage taken any interest in the aesthetics of the building or whether the stakeholders at the post occupancy stage are taken into consideration. They believe that what needs to be constructed is what the DoE tells them needs to be constructed. In doing this, these stakeholders do not take ownership of the building before they move in, which is a problem as lacking a sense of ownership means that some negative feeling can be brought into the new building . Even if stakeholders were consulted in relation to small options that are available, then they would feel that they have some ownership of the building. In not doing so, the DoE is opening themselves up to more problems at the post occupancy stage with stakeholders having issues and believing that their needs were not taken into consideration. What is required is for a member of the design team to be nominated to liaise with the school principal in keeping them informed. A simple meeting at three stages of the project would suffice. One before going on the site, one when they are on site, and one in the final stages of the project before the building is handed over to the school. By doing this the post occupancy stage stakeholders will feel ownership of the building even before they move in. They will also understand the reasons that decisions were made on the design and why compromises had to be taken into consideration. A suggestion would be that a manual would be put together in the DoE explaining why certain decisions were made and the consequences these decisions will have on the completed school building.

### 5.5.4 Relations between stakeholders

As stated earlier in Chapter 3 section 3.6.1, the ability of the project manager to engage with all stakeholders is critical to the success of the project and ultimately achieving VfM. One feature of D&B projects is that relations when dealing with the DoE is very effective. This is different from GRD projects where dealing with the DoE is difficult as they have different people responsible for different issues that may arise. On D&B projects, the fact that they have a dedicated team responsible for these projects means that there is a different mindset  from the

DoE perspective, particularly in relation to getting these projects on site and completed within the required timescale, which was described by D&B QS:

> *"They have a clear structure about who does what. There are a number of maybe between six and eight people within the department who are assigned to this rapid programme. They are the interface between me and my team and the principal. For each of the schools we have a single point of responsibility."* [D&B QS]

Not only is the working relationship with the DoE good as there appears to be a different mindset in relation to these projects, but also there is beneficial working relationship between the design team and associated contractors. Both the design teams and contractors do this work on a continuous basis, so synergy is built up and all stakeholders at the construction stage as they begin to understand how each team member works together. One aspect that these projects have, which is beneficial, is that since the contractor is involved in the design this ensures that the attitude of "them versus us" does not exist in relation to these projects as descrived by D&B QS. Instead of the contractor knowing that there is an issue with the design and putting in a claim once they are on site, the contractor has taken ownership of the design on these projects. Ultimately, VfM is therefore enhanced as conflict between parties is reduced:

> *"I think the relationship with the contractor is different because the responsibility for the detailed design lies within the contractor team. A frequent source of conflict in traditional contract is lack of design information which does not happen here."* [D&B QS]

The principal of the school has limited involvement with the construction of the school, which is different from GRD projects where the principal is heavily involved. There is no end user stakeholder involvement, which is one of the criticisms that could be laid in relation to D&B projects, as explained by D&B QS:

> *"We don't have the principal at the site meeting ever or the board of management. It is completely separate. The DoE deals with the principal and we deal with building the school. The school is not involved in the process that we are involved in."* [D&B QS]

The D&B MC goes on to state that they feel that because there is a client representative (project manager) in relation to these projects, this counteracts the involvement that is required from a school principal. The main contractor is also of the opinion that you do not require principal involvement in relation to these projects and that the client representative is undertaking this

role successfully. However, the project manager lacks the local knowledge that a principal will have:

> *"In relation to this project you do have a client representative which counteracts any involvement that you might have in relation to dealing with the principal of the school or the board of management."* [D&B MC]

Not only is there no interaction with the school principal who is taking over the school there is also no interaction with the end users of the schools, as outlined by D&B QS. The D&B team are of the attitude that this is an advantage, but as stated earlier, if the end user has no interaction with the school when it is being designed and constructed, then how can the consultants ensure that they get what they need? This is a major criticism of having a client representative on D&B projects. While there is a dedicated team in relation to D&B schools, the interaction between the client representation and the end users is missing so they are unaware what the end users specifically requires from the project:

> *"Does it conform to users' expectations? Good question, but I don't know what the users' expectations are. We don't even question the schedule of accommodation that we are given by the DoE. That is above our pay grade."* [D&B QS]

This was reinforced by the D&B PM in relation to D&B projects where it was stated that interaction with end users was not their responsibility as it was for the DoE to get involved with them and interpret their requirements. So the links between the end users and the contractor is non-existent:

> *"I think it is more the responsibility of the DoE to speak to the school and then come back to use at the site meeting and relay that information. I find that in relation to the rapid builds that link with the school is gone. A lot of the times you are building on a new greenfield site which is far away from the existing school."* [D&B PM]

*5.5.5 Interpretation of findings on Design and Build schools*

On D&B projects, as summarised in Table 5.4 a number of findings have come to the fore which need addressing if appropriate VfM is to be achieved in relation to these projects. The table includes each theme and a summary of the key findings for each.

**Table 5.4** School design D&B general findings

| Area | Themes from Data Analysis | Findings |
|---|---|---|
| General D&B | Build | <ul><li>Volume benefit for consultants and contractors in building in quantities</li><li>Built in recessionary times so consultants and contractors loath to build them going forward</li><li>Volume basis, so VfM is achieved</li><li>Savings in fees paid is achieved</li><li>Payment issues due to speed of the project</li><li>An amount of time is being spent at pretender and tender stage</li></ul> |
| | Contractor | <ul><li>The contractor has an opportunity to have an influence on the design</li><li>Attitude and ability to get these projects completed on time, within the DoE as a dedicated team exists</li><li>Going forward need to make these projects more attractive to main contractors</li></ul> |
| | Design | <ul><li>Lessons learned in relation to the design can be implemented in the next design</li><li>Runs smoothly on site due to the main contractor influence on the design</li><li>Consultants not interested in the aesthetics of the building</li></ul> |
| | Relations between stakeholders | <ul><li>DoE has a dedicated section in-house for these projects</li><li>Relations between consultants and contractor is good due to the volume of work</li><li>Relations with the school principal non existent, which may be a criticism</li><li>No interaction with end users so they do not feel ownership</li></ul> |

Under the theme *'build'* one of the advantages of D&B is that projects are bundled together. This has sustained contractors and consultants during recessionary times as contractors can be guaranteed a number of projects over an extended period of time. In addition, the speed that projects are built means that learning takes place from one project to the next. Coupled with this is the savings in relation to fees that have been spent on the project as a result of using the same consultants and contractors on a number of projects. This has the potential to sustain interest in the long term when the amount of work in the construction industry continues to rise. One of the criticisms due to the speed of the work is the payments that are made on site. By the time certified and payments are paid a significant amount of new work has been carried out. A system needs to be put in place to ensure that payment is made as soon as possible or that, rather than monthly payments, weekly payments are made at peak periods towards the end of these projects in order for contractors to pay subcontractors the value of work completed and ensure that they have a steady cashflow on the project.

One of the advantages from a *'contractors'* perspective is that they are not working from first principles all the time and the contractor has an opportunity to influence the design from one project to the next. The approach within the DoE where there is a dedicated team involved in D&B project needs to become the norm, so that all projects are completed on time and on budget to the agreed standard specification. If this was the case, then all consultants and contractors would appreciate that in order to be a truly successful project relationships need to be managed appropriately (Thomson, 2011). Projects at the present time are still completed to cost limits set down by the DoE (Department of Education and Skills 0010/2016) but this will change in the future as the economy begins to accelerate (Society of Chartered Surveyors Ireland, 2016b), and these cost limits will need to be increased. One item that is lacking in relation to D&B is stakeholder involvement. INVOLVE (2005) suggested a number of benefits of stakeholder involvement, which can be achieved by explaining in simple terms what they are getting and why changes cannot be made to the design due to the requirements in relation to unions, specification, financial or other influences. If this was explained to stakeholders then non-satisfaction with the completed building would be avoided or could be reduced.

Most stakeholders, in general, are quite satisfied with the *'design'*. From the analysis and findings, the majority of consultants are of the opinion that they are not interested in the aesthetics of the building, they are more concerned that it meets the requirements laid down by the DoE. In essence, what consultants are doing is not taking ownership of the design as they are of the opinion that it is the DoE's responsibility to take ownership of the design. This may lead to changes to the design that would enhance the aesthetic appearance of the building not being introduced from one project to the next and is something of a lost opportunity to achieve VfM on these projects.

*'Relations between stakeholders'* shows one interesting fact, that there is a dedicated Section within the DoE in relation to these projects. If there is a dedicated Section then there is a different mentality within the DoE to get these projects finished. However, this should not be the case and the staff should always be working to the best of their ability in getting these projects finished. This shows a lack of motivation within the department, which needs to change in relation to all projects if true, VfM is to be achieved on all projects. On D&B projects, the relations between consultants and contractors is very good as the contractor has a say and an input in relation to the design and is therefore taking ownership of that design. The good relationship that existed in relation to GRD projects with the school principal is non-existent

in relation to D&B projects. It was one of the advantages of achieving VfM; therefore some level of relationship needs to be formed with the principal so they can take ownership of the design and sense that they have some kind of an input within the project.

## 5.6 Discussion on school building programme

Figure 5.9 demonstrates the overall themes from the data analysis on school building projects along with the findings that were revealed.
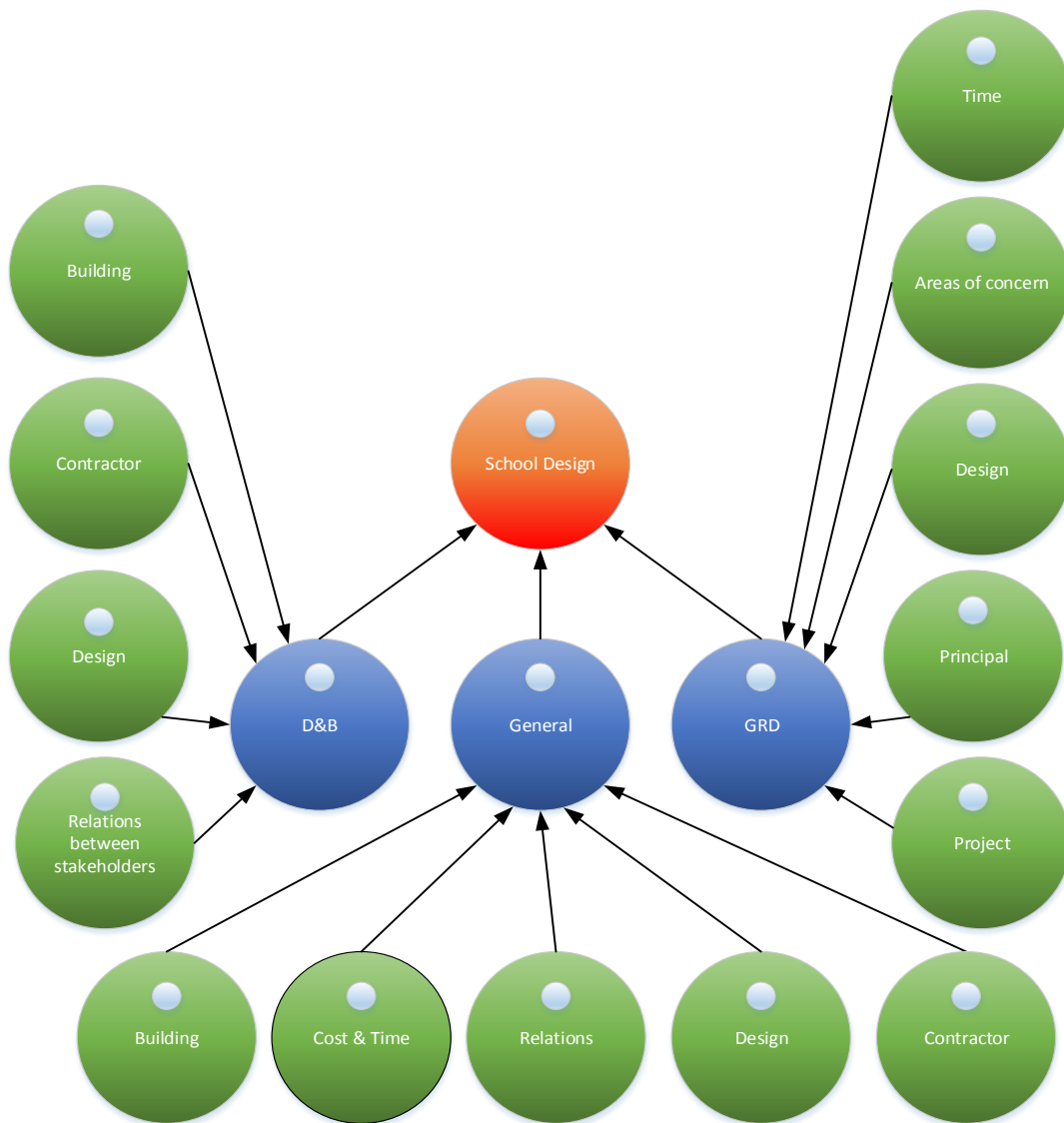


**Figure 5.9** Nodal tree of school building programme in Ireland

What has been discovered from the analysis is that in order to get VfM the consultants and the contractor can have a significant influence on this. The general findings indicate that the

consultants and the contractor available to do school project work will decrease which will mean that there will be less competition in the marketplace and fees and tender bids will likely increase. The general findings on GRD projects also indicated that as the country moves out of recession both consultants and contractors are moving away from undertaking this type of work as they see private work as being more profitable. This was also revealed in the D&B general findings where it was stated that both consultants and contractors will be loath to build government projects like these going forward. All of this implies that in order to maintain the number and availability of consultants and contractors to work on these projects these school projects need to be made somehow more attractive to them to undertake this work.

What has also been revealed is that the GRD design has not been updated recently, so projects are now taking as long as traditional built schools as consultants continue to argue that the design does not comply with building regulations and an assigned certifier construction stage has not been agreed. Moreover, the DoE believes that the way forward is D&B and that by packaging schools into large bundles it ensures that VfM is achieved. It can be seen that D&B seems to be their preferred option in order to get schools built as quickly and efficiently as possible. Indeed, the dedicated section in the DoE reinforces this argument.

On the design of these schools what has been found is that the DoE are slow to make changes to the design due to the amount of relevant stakeholders. This has a knock on effect on the design of GRD schools where it was found that the design is simple and the ability to make changes to certain materials is limitied. This is also the case on D&B projects, but there is however, the ability to implement lessons on one project to be implemented on the next project that is undertaken. All of this means that at the design stage there is limited ability to enhance VfM so other stages in a project need to be addressed in order to provide this.


## 5.7 Summary

This chapter has presented the analysis and findings through the core themes that have emerged from stakeholders in relation to school buildings programme in Ireland, GRD schools and D&B schools. In relation to school buildings, *'cost and time'*, *'relations between stakeholders'*, the *'design'* itself the *'contractor'* and finally the *'building'* were the core themes to emerge. For GRD schools the themes that have emerged include the *'time'* it takes to get these projects complete, the number of *'areas of concern'* that are growing in relation to these projects, the

*'design'* of the schools, the *'principal'* involved in the construction, the *'project'* themselves and how VfM can be achieved. Finally, in terms of D&B schools a number of core themes were identified, including the *'design'* of the buildings, the *'relationship'* between stakeholders, the *'build'* itself, and finally the *'contractor'*.

The chapter created an overview of how VfM can be realised on school projects in Ireland. As revealed that at the design stage there is limited ability to create enhanced VfM, therefore other areas need to investigated. The next chapter investigates the construction stage of a GRD and D&B school project and how VfM can be realised at this stage. It concentrates on the information obtained on a specific GRD school and a D&B under construction and the issues that affect how VfM is achieved on these case study projects.

# Chapter 6 Analysis and findings of the construction stage

## 6.1 Introduction

Chapter 5 created an overview of how VfM can be realised on school projects in Ireland. This chapter continues to observe how VfM can be achieved but it focuses on the construction stage of a project. The case study project explored here in this chapter is how the softer approach which is the people side can be added to the traditional way of achieving VfM at the construction stage of a project. The chapter commences with an overview of how the data analysis at the construction stage was carried out. It goes on to analyse and interpret the data under the themes that emerged from the literature review. These include information under the themes stakeholder satisfaction and sustainability. Finally, a discussion of the findings at the construction stage is included.

## 6.2 Undertaking data analysis at the construction stage of schools project

As was discussed during the literature review in Chapter 3 section 3.6, areas that came to the fore requiring further investigation at the construction stage of a school project include stakeholder satisfaction and sustainability. Figure 6.1 shows a screenshot of the responses that have been captured through Nvivo10 in relation to the analysis of the data conducted at the construction stage of these school projects under these themes. It shows that there were 135 references (comments or answers) made from the 20 sources (stakeholders) who commented on stakeholder satisfaction. In relation to sustainability, there were 37 references (comments or answers) made from 16 sources (participants).
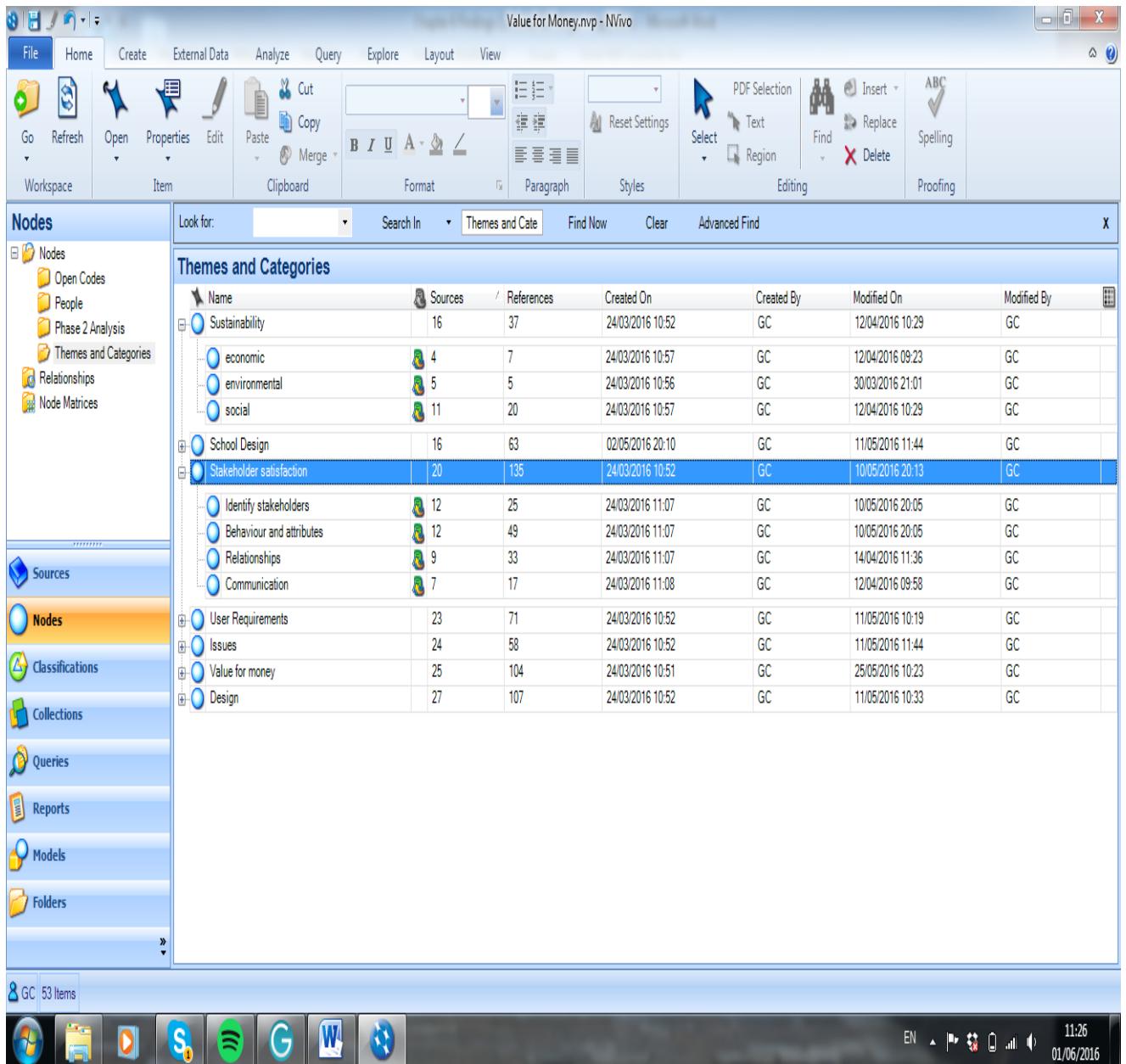
**Figure 6.1** Screenshot from Nvivo of sources and references at the construction stage

As demonstrated in Chapter 4 section 4.9.4 there were a number of stakeholders that were identified to be interviewed at the construction stage of a school project in order to understand how enhanced VfM can be achieved. Table 6.1 illustrates that five stakeholders were interviewed at the construction stage of a GRD project. There were four stakeholders that were interviewed, while constructing a D&B project. The DoE was also interviewed on two occasions in relation to eliciting overall information on how they perceive the construction stage of a school project should be undertaken. Finally, two quantity surveyors were interviewed who have worked on the construction stage of a number of school projects be they undertaken using the GRD approach or D&B approach. This table also shows the affiliation

attached to each stakeholder, along with an abbreviation applied to each stakeholder and finally which type of project they were involved i.e. GRD or D&B. This aims to assist with the flow of the quotations in relation to presenting the analysis of the findings from the construction stage. It also assists in identifying where GRD projects and D&B projects provide the ability to obtain enhanced VfM.

**Table 6.1** Stakeholder abbreviation and category at construction stage

| Stakeholder | Abbreviation | Category |
|---|---|---|
| Department of Education July 2012 | DoE July 2012 | General |
| Department of Education May 2015 | DoE May 2015 | |
| Generic Repeat Design Quantity Surveyor General | GRD QS (2) | |
| Design and Build Quantity Surveyor General | D&B QS (2) | |
| Generic Repeat Design Main Contractor | GRD MC | GRD Construction Stage |
| Generic Repeat Design Quantity Surveyor | GRD QS | |
| Generic Repeat Design Architect | GRD A | |
| Generic Repeat Design Mechanical and Electrical Consultant | GRD M&E | |
| Generic Repeat Design Structural Consultant | GRD STRUC | |
| Design and Build Main Contractor | D&B MC | D&B Construction Stage |
| Design and Build Quantity Surveyor | D&B QS | |
| Design and Build Project Manager (1) | D&B PM1 | |
| Design and Build Project Manager (2) | D&B PM2 | |

As previously stated, the construction stage information was assessed under two themes which include stakeholder satisfaction and sustainability at the construction stage. The analysis and findings from these two areas are now discussed.

## 6.3 Stakeholder satisfaction

One of the themes to emerge from the review of the literature was to investigate stakeholder satisfaction. By achieving stakeholder satisfaction then this goes a way to achieving VfM on projects as once stakeholders are satisfied with the project this in turn enables stakeholders to sense that all of their requirements for a new school have been met. The review of the literature identified that the subthemes which need to be investigated in relation to stakeholder satisfaction includes; the *'behaviour and attributes'* of stakeholders, *'communication'* between stakeholders, *'relationships'* between stakeholders, *'identifying'* who the main stakeholders are and *'communication'* among stakeholders. As these themes emerged from the literature rather than the analysis it was not appropriate to include a word cloud for this information which was included in Chapter 5.

As shown in Figure 6.2 in relation to stakeholder satisfaction there is emphasis following analysis of the information in a number of areas. The majority of comments are concerning the *'relationship'* (32%) between stakeholders. This was followed by the *'behaviour and attributes'* (28%) of stakeholders followed by the *'identification'* (23%) of who the stakeholders are. Finally, the subtheme that had the least number of comments on was the *'communication'* (17%) among stakeholders. Each of these areas will now be discussed in more detail.
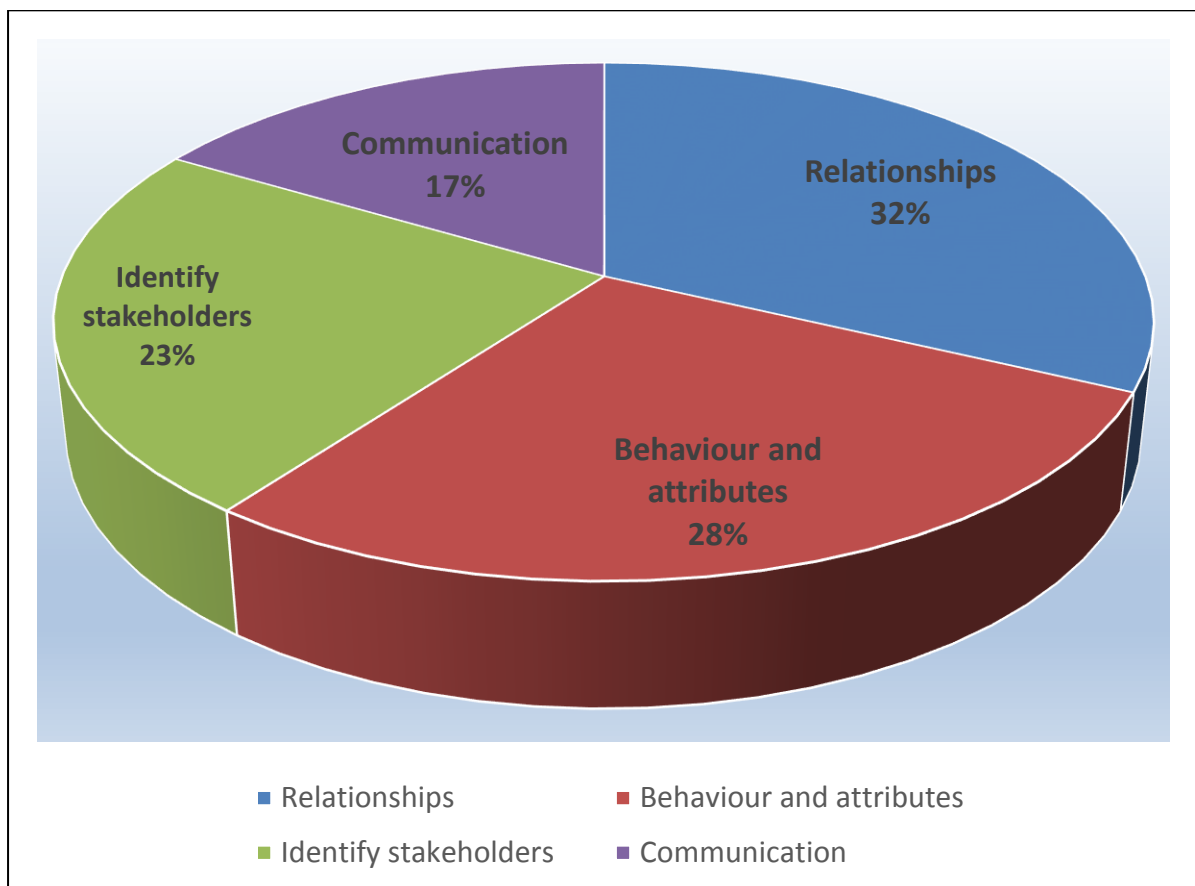


**Figure 6.2** Dominant subthemes under stakeholder satisfaction theme

### 6.3.1 Relationships

This subtheme contains contributions from participants' views on *'relationships'* at the construction stage of a school building project. It is a subtheme of stakeholder satisfaction. The subtheme contains information from eight participants in total. Three in relation to D&B projects, four on GRD projects and one from the DoE. As can be seen from Figure 6.3 a number of words have been discussed during the interview stage. These include terms such as the project, time, team, the principal and the contractor which have been derived from the word frequency cloud.

**Figure 6.3** Word frequency relationships

<u>Project</u>

Under the subtheme of relationships, there appears to be conflicting reasons as to why there is a good relationship between the consultants and the contractor. All consultants are of the opinion that the good working relationship is down to the fact that these school projects do not have a "them versus us" attitude and that some of the consultants have worked together for a long time in order to get the project to construction stage. The contractor also indicated that the philosophy of their company, which is not claims conscious, is one of the reasons for the good working relationship. The DoE is of the opinion that the good working relationship is due to the fact that conflict does not exist between the consultants and the contractor as the design is tried and tested. Whatever the reason behind it, a good working relationship exists in relation to the construction of schools, which needs to be encouraged and supported as it means that stakeholders at construction stage are satisfied and feel that the project is a success.  The GRD A echoed this view by stating that it was the design team working on the project that contributed to the good working relationship:

> *"Even at the end of May when things should be heating up in relation to project as coming towards the end there seems to be no issues. Feel that it is not because it is a GRD school, but because of the design team working on the project."* [GRD A]

This was also echoed by the GRD M&E consultant working on the school project. Again this reinforces the finding that a simple repeat design with good detailing and specification leads to a good working relationship between consultants on any project:

> *"Everything is going well on-site. There seems to be very little conflict. The school is not making a lot of changes so it's plain sailing. The design team works well together. Reason why this project works is that everyone just got on."* [GRD M&E]

Time

A different ethos within the DoE in relation to D&B projects was found. As stated in Chapter 5 there is a dedicated section within the DoE to deal with D&B projects, which ensures that the relationship between the consultants and the DoE is cooperative and beneficial to both parties. Thus, also ensures that any issues that occur during the construction stage are dealt with in a timely manner. As D&B QS stated this may be due to the fact that there is a need for schools and this needs to be satisfied as quickly as possible. What this also does is to ensure that consultants at the construction stage of these projects can still bring suggestions, issues, and alternative solutions to the DoE for consideration where the dedication section within the DoE can make informed decisions on these proposals:

> *"The rapids team (D&B) in the DoE work very well together. They have a clear structure about who does what. There are a number of maybe six to eight within the department who are assigned to this programme. ... For each of the schools we have a single point of responsibility."* [D&B QS]

Team

The relationship between teams is perceived to be good on D&B projects as interaction between stakeholders is defined in the contract. The main contractor interacts with the project manager who, in turn, liaises with the DoE. An interesting point to note is that the working relationship is good in relation to D&B projects as the stakeholders consider that the source of conflict has been eliminated, which usually is the design element. This is the same in relation to GRD projects as the design is provided by the DoE. One of the benefits that D&B QS sees is the interaction with the main contractor who they see as being an integral part of the project in order for VfM to be achieved:

> *"The point to point contact is better defined. Contractor talks to us and then we talk to certain people in the DoE."* [D&B QS]

The D&B QS went on to state that as the main contractor is responsible for the overall design of the school, the issues that normally present themselves about the design not working, or details being required now does not happen as the main contractor is involved in the design of the school from the start and teamwork between all stakeholders is ensured:

> *"I think the relationship with the contractor is different because the responsibility for the detailed design lies within the contractor team. A frequent source of conflict in traditional contract is lack of design information which does not happen here."* [D&B QS]

Principal
When working on GRD school projects it is imperative that the principal is involved if they want to get the project complete. This is not the case in relation to D&B projects and this is one of the fundamental differences that has emerged between the two ways of procuring school projects. On GRD projects, this means that the principal has to champion the project and a relationship needs to be developed between the principal and the main contractor. This was echoed by GRD MC where there was a sense that it was unfair making the principal the client's unofficial representative for the project as they do not have the knowledge or experience to make informed decisions:

> *"Either have a client representative in the department responsible for this job or give the autonomy to an employer's representative. Felt had to be extremely sympathetic to principal as so out of his depth. No idea what letting himself in for. The principal should be looking after the kids. DoE should have liaison officer."* [GRD MC]

The GRD MC went on to state that it is unfair making the principal of the school responsible for the construction stage as the principal is not an expert in the construction process. This has the potential to effect the smooth progress of the project when a principal is involved who spend time making a decision on an issue that comes up:

> *"Principal of the school carries so much weight in relation to these schools and it is wrong because they would not know a block if it fell on their toes as it is not their job."* [GRD MC]

This was echoed by GRD STRUC when he stated that the principal of the school needs to be proactive if they want the construction stage to run smoothly. What this implies is that the principal of the school is the dominant stakeholders that can have an influence on how VfM is achieved at the construction stage of a project:

*"Client action and interaction important as saying goes a dumb priest doesn't get a parish. If the principal is that way inclined, he won't ever get a new school. Needs to be proactive. A real collaborative approach."* [GRD STRUC]

Contractor

On D&B projects the relationships works well as the main contractor engages the consultants. This means that a good working relationship is built up over a number of school projects that they work on together. The D&B MC confirmed this by stating that there is more cohesion at the construction stage of projects as it is in essence the main contractors design team:

*"It is more cohesive when you have your own design team you are controlling them and you are controlling things on the site. Generally works better than GRD."* [D&B MC]

The D&B MC went on to state that as the consultants work with the main contractor over a number of projects a good relationship is built up between them on each project that is undertaken. They explained that this is different to a traditional school project where a team is only put together for each individual project that is undertaken. It was also explained that the team might not even work with each other again as each project is subject to separate tendering procedures:

*"You would build up relationships over the years with guys that you would work with. We usually use one architect two structural engineers, two sets of m&e guys. Outside of that we would not expand any further. The problems that you find on one job you can have lessons learnt on the next."* [D&B MC]

For D&B projects the main contractor is responsible for the consultants and the subcontractors on the project the relationship between all parties is good. There is a real sense of a learning experience from one project to the next which can only be built up over time, as explained by D&B MC. It was also explained that since the main contractor tends to work with the same subcontractors over and over again a good working relationship is also achieved with them:

*"Good ambience. Good ethos of partnership between everyone. Everyone is trying to get the job done. ... Even with the subcontractors we generally use guys that we have worked with in the past."* [D&B MC]

This learning experience from one project to the next is explained to the DoE through monthly meetings, which they then incorporate into the next project as required. As explained by D&B QS, these meetings are a mechanism for knowledge transfer from the main contractor to the DoE, which should be incorporated into subsequent school building projects. This is of huge benefit to the DoE and ensures that only ideas and designs that work are brought forward to

the next project. It also means that contractor knowledge on a project is harnessed from one project to the next:

> *"We do have monthly meetings with the DoE. We had an initial session and we are going to go down there again next week. With this information the DoE will then refine the layout and make sure that the specification that is issued out incorporates some of the lessons learned."* [D&B QS]

### 6.3.2 Behaviour and attributes

The subtheme *'behaviour and attributes'* contains contributions from stakeholders' and is a subtheme of stakeholder satisfaction. It contains the analysis from the verbatim transcripts of nine participants in total, including; five on GRD projects and four on D&B projects. As can be seen from Figure 6.4 the words that have come to the fore this subtheme, following analysis from the verbatim transcripts of the nine participants, include time spent on the projects, the design of the school, changes that need to be made and the responsibilities of the contractor.



**Figure 6.4** Word frequency behaviour and attributes

Time

What emerged in relation to time is that on GRD projects all consultants are spending an enormous amount of time on these projects, more than they have included in their fees. It appears there is a willingness to get these projects complete at any cost with consultants indicating that they were dedicating time to these projects in order to gain repeat work in the

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future. The DoE is therefore getting VfM in relation to the consultants' fees at the moment, but this might not always be the case when there is an upturn in the construction industry in Ireland, which is beginning to start. Some of these projects were started during recessionary times; indeed, the GRD QS suggested that they are doing additional work on these GRD projects more than their fees included which is down to the industry at the present time:

> *"A lot more time has been put into this project due to industry at the moment. I am not being paid for all my time. I am taking a lot more care."* [GRD QS]

During the recessionary times it was put forward by GRD M&E that these projects were not about generating profit but were about securing additional government work in the future in order to sustain cash flow in businesses during recessionary times:

> *"Due to the recession we are able to give this project more time. .... Not looking at this project as being a massive fee generator for the company more just to get work on other school projects."* [GRD M&E]

However, the time that is set aside for tendering purposes the D&B contractor feels is too short which has an influence on how VfM is achieved at the construction stage in relation to these projects. If more time was available to spend on deciding whether to go with a particular form of construction or way of putting the project together, then this could lead to better VfM being achieved at the construction stage of the project. The D&B MC suggested that if additional time was given then more informed decisions could be made which could have a positive influence on the construction stage of a D&B project. It seems unusual that in some instances schools have waited an enormous amount of time for a new school to be built but once funding is in place the tendering process is shortened which can have the effect of not including good ideas and suggestions as the push is to commence these projects on site as soon as possible:

> *"One thing I will keep going back to is, the tendering time is too short. It is very, very short. You are usually given 6 weeks. I think 6 weeks is fine if you are getting a tender out the door, but with a D&B job when you are taking on the architect and the engineer it really is not long enough."* [D&B MC]

Moreover, one thing to note is that the time spent on these projects is that by using the D&B option, this might be slow on the first project, but as the projects begin to snowball there is an advantage in having done a project previously where lessons learned can be implemented on the next project. It was identified by D&B PM1 that providing the first project using D&B may

be slow but as a number of D&B projects are bundled together this has a positive effect on the project once it commences on site:

> *"At the start, we are doing a lot more setting up, but as the job progresses they tend to run themselves."* [D&B PM1]

What appears to be straightforward in relation to GRD and D&B projects is the time it takes to agree final accounts. The contracts that are used on these projects ensure that systems are in place to agree final account figures as swiftly as possible, which was identified by D&B PM1. This is due to the fact, that there are strict notification procedures in place to ensure that claims, variations and extras are agreed as the project progresses on site and is not left to the very end of the project:

> *"Yes. We tend to get final accounts agreed very quickly in relation to the schools. It is really very simple because we have very strict construction costs, we tend to agree the final accounts fairly easily. We also know at any given date where we are at."* [D&B PM1]

Design

Another area that emerged under the subtheme of *'behaviour and attributes'* is the fact that even though a GRD was used some project drawings still had to be altered as some information was missing from the drawings. The drawings also had to be altered to take account of recommendations made by individual fire officers and disability access officers. This should not be happening in relation to this GRD design and it appears that a loop has not been closed. With over 40 schools already constructed using this design these small issues should have been resolved at this stage; therefore it is important that the DoE takes this into consideration before more GRD drawings are issued. It is a small issue, but one where time is taken up analysing the issue, approving the change and implementing the change on the site. The GRD A explained that they had to alter the drawings at the construction stage which should not be happening:

> *"From the start, we were told that GRD drawings are golden and are not to be altered. This caused some confusion early on. DoE said you are barely getting them on AutoCAD not to touch them, revise them or do anything. Then found issues… same problems must be coming up again and again on other GRD schools."* [GRD A]

On D&B projects, what is seen as being a benefit is the consortia are normally the same from project to project so trust is built up between the consultants and between the consultants and the main contractor. This implies that a synergy is taking place as they learn from one project

to the next what is working and more importantly what is not working. The D&B PM1 indicated that this is one of the benefits of D&B process when undertaking the construction stage:

> *"In the way they design them, and the way that we evaluate them, we are always looking for enhancements in relation to them. Better the last ones and better relative to others in the design competition. It has led to some good thinking in terms of the design and the finishes."* [D&B PM1]

Changes

This area involves the mechanism to approve alterations and changes. As all changes have to go through the employer's representative who is the architect on these projects, this takes time. Not only is the architect on GRD projects the single point of contact with the DoE but within the DoE there are individuals with responsibility for different changes. Therefore, there is no single point of responsibility in the client organisation. All of this takes time and in some instances approval has been given to the contractor by consultants to carry out work which cannot wait until approval is given by the DoE. This has potential to create contractual problems on projects where relationships are not strong as the main contractors carry out changes and are not reimbursed for doing so. The GRD QS indicated that he has given the approval to do work but has not gained the approval from the DoE for carrying out this work. This could become a contractual issue if the DoE makes the decision not to reimburse the contractor for doing such construction work:

> *"… problem with land drainage came up with a proposal to deal with it. Still haven't come back with approval for it, but it is done now. Getting on to DoE and getting approval takes so long could not wait for that so told Contractor to go ahead. The process of dealing with DoE is quite slow."* [GRD QS]

Both the GRD A and the GRD STRUC stated that even though the changes are simple the mechanism for gaining approval for these changes is difficult:

> *"Any changes that were made to the job were common sense changes. Channel to get the changes in place are quite difficult."* [GRD A]

> *"The issue wasn't the error which was minor. It was the fact that it was not picked up following previous projects."* [GRD STRUC]

On D&B projects the approval for getting changes is quite onerous. Even though there is a dedicated section within the DoE to deal with D&B projects, the DoE does not like to set a precedence and spend more money on one project than another, so they rarely sanction

additional construction work on school projects. If the DoE could put procedures in place, to deal with gaining approval for any changes that might occur, then projects would run even smoother than they already do at the construction stage. It seems to be the only real issue with the progress of work on site and if it was addressed then less time would be spent trying to gain approval. This time could then be spent channelled into a more productive area while on site. For example, the main contractor is buying the material and installing the items and it still might be six months before they are gaining payment for it. This again might not suit smaller contractors whose cash flow may be an issue and cannot hold back on paying their subcontractors and suppliers for that length of time. Thus, the pool of available and willing contractors to tender for and construct school projects may be reduced. This was reinforced by the D&B MC when they complained about the length of time that was spent gaining approval for any changes that occur at the construction stage of a project:

> *"The onus is on us to notify the client so we do so quickly. Anytime something happens we are very proactive in relation to getting things in. Again, it is just the approval process that is slow. It is a bit of a bugbear for us at the moment. You have taken the pain of buying the stuff and it is maybe 6 months before you get paid for it when the change order is approved."* [D&B MC]

Responsibilities

Views concerning responsibilities of the main contractor in relation to D&B work include the sense that the majority of the risk is transferred onto the main contractor. Whereas, the definition of appropriate risk is that it is transferred onto the person who is best able to deal with that risk (see Chapter 2 section 2.3.3). This has the implication that going forward, as the availability of construction projects increases, contractors, if they are tendering for school project work may include a premium to prices as a means of allowing for these risks. The D&B MC are already complaining about the inflationary increases and material increases that they need to include in their tender prices which eventually will also be included in their tender prices for work going forward:

> *"The trouble I think with D&B is there is a lot of risk loaded onto the contractor from the get go. The fact that you have to take on any inflationary increases over the period of the building. Cost of materials, etc. It is very, very difficult."* [D&B MC]

An example of how onerous these construction contracts are was given by the D&B MC when it was explained that the responsibility for unforeseen items of work lies with the main contractor to have allowed for at tender stage:

> *"An example would be that there are services buried in the ground, which should be included in your tender price. So if you hit cables under the ground or if you hit cables that were unforeseen, then you will get nothing for it as you will be expected to have priced it at the initial design bid. So it is onerous."* [D&B MC]

Due to the increased risks that need to be taken on by a contractor, this in turn means that smaller contractors are moving away from this type of work as they are unwilling, or unable to take on the added risks. All this leads to only the larger contracting organisations are undertaking D&B school building work at the present time. Going forward, again as the economy begins to gain momentum, the worry is that these large contractors will start to move away from this type of work. Indeed, the D&B MC alluded to this when he stated that:

> *"There is too much time tied up in it to be honest. It is definitely not suited to the smaller contractor. It is more suited to the larger contractor who has the money behind them. We are a medium sized contractor and we had to go in with a joint venture in order to secure this type of work as we would not have the financial limits to do this type of work."* [D&B MC]

The flip side of risk transfer is that from a quantity surveying perspective, D&B projects work easier on site as the main contractor has to take responsibility for the work, as explained by the D&B PM2. This implies that the quantity surveyor is less busy at the construction stage, as once the design is set, cost limits are set, then it is all about getting the project built and not about claims, variations and extras on site:

> *"Generally was not there a huge amount of time. It was easier out on site but design and build generally is because the contractor is taking responsibility."* [D&B PM2]

D&B projects out on site are extremely busy as the main contractor and all the subcontractors are working to a very tight schedule, even more so than GRD projects as the programme on site is reduced. This has the consequence that from a payment perspective, as work is progressing quickly, the time between valuation of the work done and payment could see a huge amount of additional work carried out on site. The effect of this is that the main contractor is carrying the financial burden for a long period of time before payment is received. Again, this means that smaller contractors may have an inability to be able to carry these costs, so they are unwilling to consider this type of work. As discussed by the D&B PM2, the site can get extremely busy with trades at times which means that the logistics of everyone working together on site needs careful consideration:

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> *"One thing that I would say about the rapid schools (D&B) is that from a payment perspective because they are happening so quickly the site is incredibly busy more so than you would see on your traditional built schools."*
> [D&B PM2]

One of the advantages of the D&B option is that the knowledge the main contractor may gain from one project can be implemented on the next project, thus ensuring continuous improvement. However, a new framework has been set up with a number of new contractors on it. This means that the prequalification list of suitable and available contractors, who can carry out work for the DoE, has been updated and extended to now include additional contractors that have not undertaken work of this nature before. This has the potential to change the way things are done and thereby eliminate the knowledge that contractors have gained from one project to the next. A system needs to be developed by the DoE to harness any knowledge gained from main contractors who have undertaken a number of projects. The quantity surveyor sees these new tendering contractors as having the potential to add value to the projects as new contractors may approach the projects in a different way. However, the learning curve and knowledge gained by contractors who have undertaken this type of work previously means that they may have a competitive advantage, as explained by D&B QS:

> *"Have a new framework that has just been set up and roughly 50% of the contractors on that framework are new. These contractors have qualified on the basis of doing projects of similar size before but not necessarily schools. That is going to be a real test. It might make things a little bit harder, but also there is the potential for new ways of thinking etc."* [D&B QS]

*6.3.3 Identify stakeholders*

This subtheme contains contributions from participants in relation to identifying stakeholders. It is a subtheme of the core theme *'stakeholder satisfaction'*. It contains analysis from the verbatim transcripts of nine participants, four in relation to GRD schools, four in relation to D&B schools and one from the DoE. As illustrated in Figure 6.5 following the analysis, the areas that came to the fore, for the subtheme identify stakeholders, include the principal of the school, the contractor that is employed to do the work and other stakeholders that are involved in the projects. These areas that emerged following the analysis will now be discussed.

**Figure 6.5** Word frequency identify stakeholders

Principal

With the subtheme of identifying stakeholders an area that has come to the fore on GRD projects is the principal of the school. This is the one stakeholder that can have a significant influence on the construction stage of the project. If the school principal is not willing to champion the project, then the project will not get past approval stage and onto construction stage. This was explained in Chapter 5 section 5.4.4 where it was identified that the school principal is the one person that can have an influence on getting the school to construction stage as they are the one person that can yield political influence on the project. Furthermore, once on site this is the one stakeholder that can channel the whole project in the right direction. The implication of this is that if you do not have a school principal who is willing to do this, then, this could affect how VfM is achieved on the project as the project is not tailored to that particular school. The GRD QS explained that the principal comes to all the meetings and is involved in all aspects of the project at the construction stage:

> *"The principal comes to all the site meetings which is a little bit unusual. He is heavily involved."* [GRD QS]

The DoE May 2015 reiterated this by stating that the principal needs to drive the design team at the construction stage to produce a building. It is unreasonable for the DoE to expect a non-

expert to advocate the project on site as it should be the DoE's responsibility to nominate a representative on site to champion the project:

> *"If they want a school, then the principal needs to drive the design team, keep an eye on the design team"* [DoE May 2015]

This is in contrast to D&B projects whereby principal involvement is discouraged as the contact between the main contractor and the principal is very limited. The downside of this is that in excluding the principal of the school that the main contractor is building for this erodes the sense of ownership of the building that can be got from including them in the construction stage. By not feeling a sense of ownership of the project, the principal then may sense that VfM was not achieved as the decisions taken to provide the project in such a way has not been explained to them. However, D&B MC appreciate the non-involvement of principals so they are not burdened with site tours and explanations that are required on a project that there is a very tight schedule on site:

> *"You normally find with D&B projects here that the principals of the schools and the board of management generally do not get involved. However, in relation to the GRD they are in your face. They poke their face in the door, they will bring kids down, which we do not like as a contractor. Generally in relation to D&B they tend to stay off site so that we can get on with the job."* [D&B MC]

Contractor

On both GRD and D&B projects, it appears that the number of main contractors that are willing and able to work on these projects is small. There are only a number of main contractors that are geared up to undertake these projects due to the onerous amount of risk that the contractors have to take along with the restrictive timescales involved. As work in the private sector begins to get busier the number of contractors prepared to do this type of work is diminishing, as explained by the D&B PM1:

> *"No. There is a framework of suitable consortia which have been prequalified for this type of project. Not every contractor will be geared up for the delivery timescales it almost forces off-site construction."* [D&B PM1]

This is one of the main challenges that exist going forward on school building projects in that a steady number of good and interested contractors need to be encouraged to carry out this type of work:

Two stakeholders that can have a detrimental effect on the success of any project are the fire officer and the disability access officer. Not only can they not issue a fire certificate and a disability access certificate, thus preventing the school from being able to open, but they can also insist on changes been made to the designs. This is due to the fact that different fire officers can have different interpretations of the building regulations in different local authority areas. Indeed, there have been situations where the DoE has brought a particular fire officer to court over the restrictive interpretation of regulations in one local authority area. This is an area that needs to be resolved so that all local authority fire officers and disability officers have the same consistent interpretations of the regulations and how the design resolves these regulations. The DoE July 2012 are aware of this issue and the additional cost that can be involved but are slow to implement the necessary steps so that issues are not occurring during the construction stage:

> *"Getting fire certs have been an issue. We encountered some problems with some local authorities not able to satisfy individual fire officers so designs have to be modified… obliged elsewhere to totally enclose the void at the stairs, an extra cost of €90,000 which is scientifically not necessary."* [DoE July 2012]

The D&B MC who is aware of this issue sense that government departments need to come together to resolve this issue so that all schools have the same interpretation of regulations. It is as if each government department is working in isolation from each other and the local authority and the DoE are not there to assist each other:

> *"The local authority in Cork is taking a particularly strong view in relation to public access stairs. There seems to be an interdepartmental battle between planning and education at the moment."* [D&B MC]

On D&B projects the amount of consultants that are involved in the project is excessive as there are layers of consultants adding to the design. There are consultants working for the DoE who have an influence on the initial design and specification submitted for planning permission and given to the project management team. There are also consultants working for the project manager who refine these initial designs in order to allow the contractor to tender for the project. Finally, there are the consultants working directly for the D&B main contractor who expand these designs for construction purposes. All of this was explained by the D&B PM1. These layers of consultants involved in the project all influence the design and how VfM is achieved. A structure needs to be implemented so that all consultants are aware of the priorities

of the project and how these can be met so that overlapping and repeating the same work is not undertaken:

> *"What is happening is that we are appointed as PM and we also have a consultant team of architects and engineers to prepare the output specification for issue to the tendering contractors. Then the tendering contractors as it is D&B each of them has their own design team."* [D&B PM1]

It is interesting to see that the D&B QS notes that the design is reviewed by a number of consultants at a number of stages before work commences onsite. They are of the opinion that this ensures that the design has be scrutinised so no issues or problems should occur once work commences at the construction stage of the project:

> *"Start with the architects. The DoE has architects in-house who will pay a fee for. The department is not doing any more than they would normally do with any school. They are really doing a brief design. After that there is then a two steps process where we do something with it and then the contractor architect does something else."* [D&B QS]

Finally, the DoE July 2012 and DoE May 2015 appreciate and encourage stakeholder involvement in projects; however; this has not been articulated to all main contractors who are carrying out this type of work. By encouraging end user involvement this, in turn, makes these users obtain a sense of ownership of the school, even at the construction stage. The recommendation is that what the DoE says about end users involvement needs to be articulated to all of the consultants and contractors working on these projects:

> *"Stakeholders like to be involved, maybe simply in relation to picking the paint colours."* [DoE July 2012]

> *"We would have had one of the architects who has built 6 or 7 schools now would have had same grey colour in all of them. We urged all the schools to go and visit some of the schools that have been built. They were only after that visit were they asked to sign on the dotted line into what they have bought into."* [DoE May 2015]

### 6.3.4 Communication

This subtheme contains contributions from participants in relation to communication. It is a subtheme of the core theme *'stakeholder satisfaction'*. It contains analysis from the verbatim transcripts of six participants. Three in relation to GRD schools and three in relation to D&B schools.

Communication flow on GRD schools projects is acknowledged as being effective between stakeholders on the supply side. The difficulty is communication between the supply side and the DoE. The DoE is of the view that as this is a GRD design the involvement of the DoE should be minimal as schools have been built previously using this standard design. The consultants, on the other hand, acknowledge that if this is the case, then more autonomy should be given to the employer's representative on site to make decisions without having to gain the approval of the DoE at all times. This would ensure that the project was progressing efficiently at the construction stage of the project. The GRD MC echoed this by stating that:

> *"Effective communication goes into a vacuum as do not have the real stakeholder, the paymaster at the table. Have payment on change order still outstanding. Ask the question on it and are told have not got DoE approval yet. Between all of us it is fine, but between us and paymaster no."* [GRD MC]

The GRD QS was even more critical of the DoE when they state that the DoE back away from some issues that are occurring at the construction stage of these projects. It is difficult to find the individual in the DoE who will take responsibility for making any decision:

> *"The DoE have their head in the sand in relation to issues that are occurring."*
> [GRD QS]

The lack of communication with the DoE was in sharp contrast to the efficient communication that was between the architect and the engineer on GRD projects, which was reinforced by the GRD A. Effective communication between consultants ensures that decisions are made swiftly and effectively as work progresses on site:

> *"Engineer on site is very good. Wasn't a day that went by and he wasn't on the phone checking this or that. When I rang him he was always back within five minutes to sort out whatever problem I had. It was the same with the whole design team."* [GRD A]

Good effective communication on the supply side of GRD project was also commented on by the GRD M&E working on the project which ensures that information and questions were answered swiftly:

> *"The design team works well together. Consultants are responsive to questions and information Reason why this project worked is that everyone just got on."*
> [GRD M&E]

On the D&B schools, the fact that the DoE has a dedicated team within the department to deal with these projects means that communication between the supply side and the DoE is effective. This is different to GRD projects where there is no dedicated team. This is one of the systems that was put in place in the DoE specifically for D&B projects, which should be rolled out on GRD projects as well, as discussed by D&B QS:

> *"Good and very direct with the DoE as they have a group in place of technical officers who only deal with the rapid school programme."* [D&B QS]

> *"Feel that there is better communication in relation to these D&B schools than in other schools. It is different because it has to be and it probably is better as it is more direct."* [D&B QS]

## 6.4 Sustainability

Under the theme sustainability a number of subthemes emerged from the literature. These include *'social'* sustainability (62%), *'economic'* sustainability (22%), and *'environmental'* sustainability (16%). These three subthemes were developed from the literature (Chapter 3 section 3.6.2) and data was analysed based on these subthemes. Figure 6.6 depicted these subthemes of sustainability and it shows that the dominant subtheme based on the data analysis was the social side of sustainability, followed by the economic side and the environmental side. This is interesting to observe as traditionally the environmental aspect of sustainability would be the dominate influence. This is partly due to the fact that, as stated in the literature review (Chapter 3 section 3.6.2) the environmental side of sustainability is what is prescribed by the DoE and is what is incorporated in the specification of materials and workmanship and deviation from what is prescribed is usually very small. Consultants and contractors are not concentrating on the environmental side from first principals. Rather, what is included in the buildings is what is set out by the DoE and included in the specification of works. One the economics side of sustainability, data was also limited as stakeholders were of the opinion that the economic side was curtailed by the cost limits that were put in place by the DoE for all school designs. It should be noted that a word frequency diagram was not appropriate to produce for the theme sustainability as the subthemes were developed from the literature rather than from the analysis showed only a limited amount of comments from the analysis.
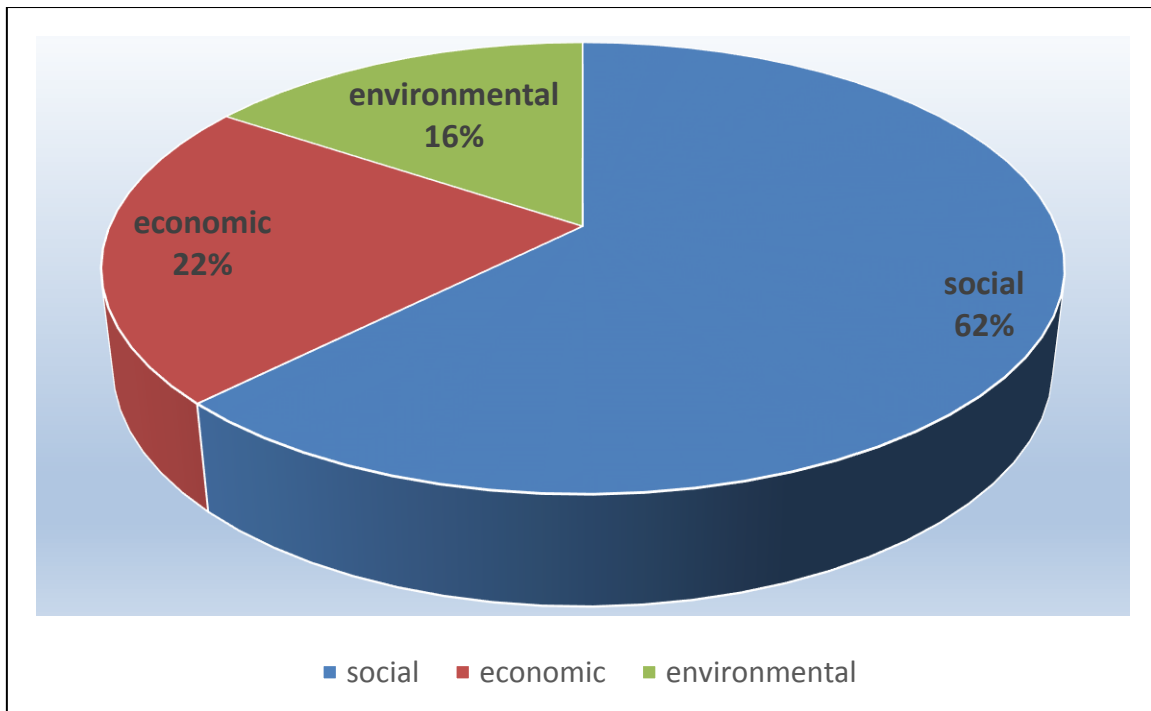
**Figure 6.6** Dominant subthemes under sustainability theme

Data analysis on each of these subthemes will be addressed separately.

*6.4.1 Social*

This subtheme contains contributions from nine interviewees at the construction stage. It is a subtheme of sustainability and contains analysis of the verbatim transcripts of interviews on both D&B projects and GRD project. Five participants were in connection with D&B projects, one participant was the DoE and three participants were in connection with GRD projects.

What is important from a social aspect of sustainability is that when the project is being constructed that the stakeholders and the community at large are invested in the new building and get a sense that they are part of the construction of the new building. If this happens then the building of the school becomes more sustainable and ultimately VfM is being achieved as stakeholders become invested in achieving a successful project. On GRD schools, this is taking to some degree as the principal of the school is the stakeholder that is invested in the project at the construction stage and is thereby taking ownership of the project. It is not only the principal of the school that is invested in the project but this enthusiasm is taken up by the staff and pupils in the school as they begin to feel a sense an ownership of the project even at the construction stage. This is what social sustainability is, and it should be encouraged. The GRD

STRUC explained this energy that has been developed by the principal of the school, when he stated that:

> *"Everyone is feeding off the principal and his enthusiasm. At start contractor gave a talk to kids on health and safety and gave them a booklet. The joke going around design team is that there will be a lot of engineers produced from fifth and sixth class."* [GRD STRUC]

Not only is the principal of GRD schools more involved at the construction stage, but the main contractor is encouraged to be more involved with the school and the community in the area. This is outside the remit of what the main contractor is required to do on the site but it means that not only are pupils learning about a construction site but they are also learning how a project is constructed. Ultimately, again the project is seen as being more sustainable in the community. This involvement was achieved by the main contractor's involvement in a "Funday" with the pupils who will be moving into the new school, as explained by GRD MC:

> *"No better way to teach children about construction sites then at the basic level of what a site is. A "Funday" with kids was carried out with no homework after and some prizes. It worked wonders."* [GRD MC]

The enthusiasm on GRD school projects was taken one step further from a social perspective where pupils and parents alike were urged to help move furniture and books into the new building. This again showed a sense of ownership of the new school throughout the construction stage. It also encourages stakeholders, however small, to have an influence in the completion of the new school. Again, all of this encourages the social inclusion of the community in the new school. Even the GRD QS, who normally is only concerned about the costs, got swept away with this enthusiasm:

> *"The principal said get their chairs and every pupil will walk into the new school with their own chair. Parents have been invited to move desks, books, etc. BoM and the school has to move everything. Getting kids involved in it adds to the excitement."* [GRD QS]

As found previously, D&B main contractors perceive that they do not require principal involvement in the construction of the school. This, in turn, leads to the principal not feeling invested in the construction of the school, which sometimes is counterproductive in that one of the main stakeholders of the project do not believe that they are part of the project. This non-involvement of the school principal on D&B projects was explained by the D&B MC as:

> *"Generally in relation to D&B they tend to stay off site so that we can get on with the job."* [D&B MC]

On D&B projects, not only is the link with the principal of the school non-existent but the link with other stakeholders is also not encouraged. This was highlighted by the D&B MC where the reason behind this detachment was explained that it is their understanding that it is the DoE's responsibility to interact with the end users:

> *"I think it is more the responsibility of the DoE to speak to the school and then come back to use at the site meeting and relay that information. I find that in relation to the rapid builds (D&B) that link with the school is gone. A lot of the times you are building on a new greenfield site which is far away from the existing school."* [D&B MC]

Again, from a social aspect of sustainability, the D&B PM1 is also stepping back from any involvement with end users when it was stated that it was the main contractor's responsibility to talk to the end users. However, this is only done in relation to hand over of the school so there is no direct involvement and a feeling of ownership is gone:

> *"The contractor might liaise but that is usually in relation to the site on a logistical level. They would also do a hand over to the school in terms of fire alarm etc."* [D&B PM1]

As D&B QS stated it was considered by stakeholders working on the project that it was the responsibility of the DoE to consider the social side of sustainability. They went on to state that they would only be willing to take it into consideration if they were contractually obliged to do so. Again, all of this explains that all stakeholders on D&B projects at the construction stage are of the opinion that it is only the DoE's responsibility to take the social side of sustainability into consideration:

> *"In relation to the social side of sustainability we are not really dealing with that at all. The only time when that comes into the equation is when if as part of the brief the department have identified some reason, some element which maybe a neighbour or a landowner."* [D&B QS]

There is a perception that on D&B projects that by bringing the principal on the site it only make things difficult and they are bothersome. It was stressed by the D&B QS that there is no point in listening to the principal of the school as they do not have the ability to change any of the design. However, this should not be the attitude as having the principals involved in the

construction stage ensures that the social side of sustainability is achieved and the project becomes embedded in the community:

> *"Yes, we bring them (principal) around the site and listen to them, but nothing can be done to change things. They can have some say in choosing the colours but not in relation to other things. .... The DoE deals with the principal and we deal with building the school."* [D&B QS]

In contrast to GRD schools, the D&B PM1 stated that they have no personal involvement with the end users and no interest with how they use the building on a daily basis. Their brief is to deliver a school on budget and on time when they fulfil that brief they do not get involved with the building. This attitude comes about as they are not contractually require to engage with the end users of the school:

> *"Do not get involved in any post occupancy evaluation. I am done with the schools. Have been invited to open days in the past, but I am too busy to go."* [D&B PM1]

As discussed, D&B schools do not want any involvement from the school principal or the end users which is in contrast to GRD schools where involvement is encouraged and liked. The DoE sees these buildings as having a wider community involvement and not merely a school. Therefore, as the DoE May 2015 explained what it expects it to be is a sustainable building once it is finished, but not while it is being constructed. This is unfortunate as decisions made for the wider community once the building is occupied might need design changes which could have been implemented at the construction stage as the building was progressing on site:

> *"Have encouraged for many years when school boards and management can permit community use of the building outside school hours. DoE is merely a funding agency to allow voluntary boards of managing build that school lease then. Requires at local level commitment and interaction with other voluntary organisations. If that works the building is there. It is only used 180 days a year 9-3 5 days a week. So it is a taxpayer investment in the community."* [DoE May 2015]

*6.4.2 Economic*

This subtheme contains contributions from participants in relation to the *'economic'* side of sustainability and is a subtheme of the core theme sustainability. From an economic standpoint in order to keep consultants enthusiastic about the project the D&B MC explained that they try to change the consultants that they work with on a regular basis. This ensures that stagnation does not happen with consultants as they are constantly trying to improve on the design element

and endeavouring to achieve better VfM from the assembled team. What is being explained here is that the ability to decide what consultants and contractors work on D&B projects can be beneficial to the overall project. In this way good workmanship and design decisions can be rewarded on a project as they can be appointed on the next project:

> *"We have found that if you run with a particular architectural practice and engineering practice that you might shift them about a bit to keep an eye on the pricing element. An example would be that we had a school where the engineer designed the school too heavy and with too much steel in it which was throwing up our tender prices. So we brought a different consultant engineer on board who designed a frame with less members and more spacing and that drove down the tender price."* [D&B MC]

On the economic aspect of sustainability, there were limited comments from stakeholders even though it was seen as a core subtheme in the literature. This may be due to the fact that stakeholders; sense that these school projects are economically sustainable due to the fact that on projects, be they GRD or D&B, only tried and tested technology as recommended by the DoE are used and that cost limits are included not only for the project itself but also for the consultants that are employed to work on the projects. As D&B MC explained the economic aspect of sustainability as being achieved due to the consistency in standards achieved across all schools:

> *"The DoE is trying to maintain a consistent standard across all the schools that they are working on. Otherwise, you will have the principal twenty miles down the road complaining that he did not get something in his school that somebody else did."* [D&B MC]

*6.4.3 Environmental*

This subtheme contains contributions from participants on *'environmental'* issues. It is a subtheme of the core theme sustainability and emerged following the literature review. The data analysis contains analysis from the verbatim transcripts of participants on the D&B project and the DoE themselves. Under the subtheme of environmental it was explained that only tried and tested technologies are implemented on school projects, which limits the ability of consultants and contractors to include innovative technology in new school buildings. As the DoE July 2012 explained the research that has been undertaken in the DoE ensures that time and money is not being spent on technology and materials that do not add to the environmental sustainability of the school:

> *"We have done a lot of energy research so brought a lot of that on board as well. Did not trial anything overly innovative or cutting edge as knew it needed to be replicated on other school projects."* [DoE July 2012]

The DoE is responsible for the environmental sustainability of school projects. It is there sole responsibility to investigate areas where this can be achieved. Indeed, the DoE has its own section within the department called energy in education (www.energyineducation.ie) which promotes energy efficiency in schools and provides information for designers, boards of management and contractors. In doing this, the DoE are taking on the sole responsibility for the environmental side of sustainability, as stated by the DoE July 2012. This has the effect that even if the main contractor or the consultants have a technology that they know could have a beneficial influence on school projects they are restricted by the DoE in included them and thus a potential for enhanced VfM is eroded:

> *"Had done a lot of energy research so brought a lot of that on-board as well. Did not trial anything overly innovative or cutting edge as knowing it needed to be replicated this school. Knew if got something wrong did not want to replicate so it was tried and tested technology."* [DoE July 2012]

One aspect of environmental sustainability that the main contractor can have an influence on, however, is the airtightness that is achieved on the school. The D&B QS considers that the standard achieved is better now than it was five or six years ago. This may be due to the level of professionalism and service that is being provided by both consultants and contractors who are working on these projects which needs to be harnessed to ensure that this is achieved on school projects in the future:

> *"I would say that we are achieving a higher energy level rating than standard these days. It is really very high even compared to five or six years ago particularly in relation to airtightness."* [D&B QS]

## 6.5 Implication of findings from the construction stage

Figure 6.7 demonstrates the overall themes from the literature, the subthemes from the literature and the findings from the data analysis in relation to the construction stage of school project.
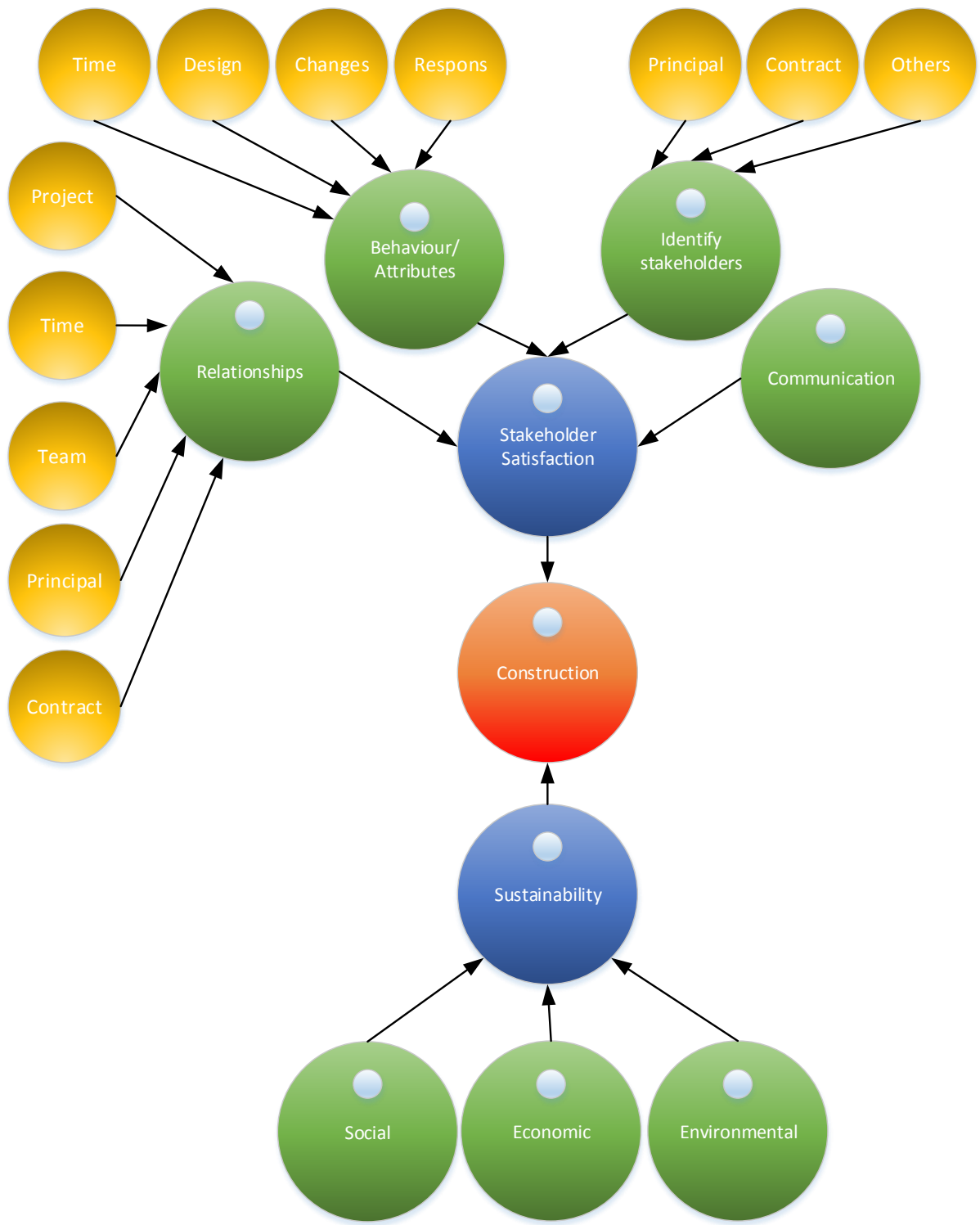
**Figure 6.7** Nodal tree at construction stage of schools

As can be seen from Table 6.2 under the area of *'stakeholder satisfaction'* and *'sustainability'* a number of themes came from the literature that were further investigated when the fieldwork was carried out. Each theme produced a number of findings, which if implemented, can

enhance how VfM is achieved on school building projects. Each one of these subthemes and the findings associated with each will be discussed in detail below.

**Table 6.2** Construction stage findings

| Themes from Literature | Subthemes from Literature | Findings |
|---|---|---|
| Stakeholder satisfaction | Relationships | • Consultants have worked together on GRD projects for a long time<br>• Time is the most important item in relation to D&B project, different ethos in DoE<br>• In relation to teamwork it is good as DoE is responsible for the design<br>• Involvement of principal is required for GRD projects, but not on D&B projects<br>• Benefit of contractor on D&B projects is choosing consultants so learn from one project to the next |
| | Behaviours and attributes | • Spending a lot more time than fees allow in order to gain repeat work<br>• GRD drawings need updating. On D&B consortia learn from one project to the next<br>• Changes take time on both GRD and D&B project which needs to be addressed<br>• The majority of risk is transferred to the contractor |
| | Identify stakeholders | • Principal involvement in GRD project and not in relation to D&B projects<br>• The contractor will be more likely to favour private work in the future<br>• The fire officer and disability officer have an influence in relation to these projects<br>• The DoE likes and encourages stakeholder involvement. |
| | Communication | • The supply side is good in relation to GRD but with DoE it is not effective<br>• D&B communicating changes and getting approval is instantaneous as a dedicated unit in the DoE |
| Sustainability | Social | • GRD schools the input of the principal, pupils and parents is seen as beneficial<br>• D&B projects no input of principal or end users, so not taking ownership of the design |
| | Economic | • D&B projects more consultants around to keep it competitive<br>• Limited comments from stakeholders as comes from DoE with cost limits and fixed fees |
| | Environmental | • Used tried and tested technologies only<br>• Air tightness taken into consideration |

Under the theme stakeholder satisfaction the *'relationships'* between stakeholders is important to ensure that VfM is achieved. Both on GRD and D&B projects consultants have worked together for a long time. On GRD projects this has come about as it appears to take time to move through the stages of the project (Department of Education and Skills, 2015b). On D&B school projects a bank of consultants are used who then work on a number of projects together.

All of this ensures that VfM can be achieved as trust and commitment among stakeholders can be built and maintained by an efficient relationship management (Karlsen et al., 2008). Teamwork on school projects is also good as the DoE is ultimately responsible for the design so the issues that tend to come up with one off design are not happening with these projects. This relationship between the project and its stakeholders was seen as a vital ingredient in the successful delivery of projects and meeting stakeholder expectations (Jergeas et al., 2000; Panahi et al., 2016). An item that is dominating all others is the relationship with the school principal. On GRD projects, a good working relationship and involvement of the school principal is essential in order to see these projects complete in an efficient manner. The opposite is the case for D&B projects where the main contractor prefers no involvement of the principal at the construction stage of the school. It has been shown that in order for VfM to be achieved the subjective nature of value also needs to be cultivated. This can only be achieved if everyone is able to contribute to an individual vision of the concept, including interaction, emotion, feeling, personal judgement, etc. (Neap and Celik, 1999; Thomson et al., 2003; Wandahl, 2005). One of the benefits of using the D&B method is the learning that consultants, who work for the main contractor, can do from one project to the next. This does not happen on GRD projects as each school is tendered as a separate project and can have any combination of consultants, main contractor and subcontractors working on it, who may or may not have worked with each other before.

One of the *'behaviours and attributes'* of stakeholders is that all consultants at the present time are spending a lot more time than their fees allow in order to secure repeat work. This is one of the reasons that consultants, when the economy begins to improve, will start to move away from school projects. A system needs to put in place that as the economy gains momentum, consultants and contractors see the benefits of undertaking this type of construction work and the DoE are not left paying a premium to contractors to carry out school project work. Another finding is that if GRD drawings are to be used in the future then they need updating. This is unlike D&B projects where the drawings can be used and updated as the consortia learns from constructing one project to the next. One of the attributes that is affecting how VfM is achieved is the approval procedures on both GRD and D&B projects, which takes time. On the government forms of contract (Chapter 2 section 2.3.3) the majority of the risk is transferred to the main contractor. Going forward, this onerous concept needs to be addressed if the number and availability of suitable consultants and contractors is to be maintained.

Many of the scholars in relation to stakeholder management (Karlsen, 2002; Olander, 2006; Walker et al., 2008; Jepsen and Eskerod, 2008) have pointed out the significant importance of *'identifying stakeholders'*. In order for VfM to be achieved on these projects, it is imperative that the main stakeholders who have an influence on the project are identified. As mentioned earlier, the one stakeholder that has a significant influence on the success of getting the project to the construction stage and championing the project is the principal of the school. On GRD school projects this happens as the principal champions the project, but on D&B projects this does not take place and the principal is not invested in the construction stage of the project. The effect of this is that the perception is that the DoE and not the D&B principal is the client on the project. This is a missed opportunity and should be changed so that not only can the principal feel ownership of the project, but it can then be passed down to other end users of the school. Two other stakeholders that can have an influence on the success of the project are the fire officer and disability officer. Approval needs to be gained from these stakeholders, which in some cases was very slow in coming. This meant that schools were not opened at the required date and in other cases changes had to be made to design elements. It is central that these stakeholders are consulted at the appropriate time and are kept abreast of any changes or alterations that could affect these aspects of the project. As stated, the principal is involved in GRD projects at the construction stage but not involved with D&B projects at all. The DoE has stated that they want to encourage end user involvement so that all stakeholders have an opportunity to sense that they have a stake in the project and are satisfied with it. Satisfaction is defined by Nzekwe-Excel et al. (2009) as a measure of how the needs, desires, requirements and expectations of clients or participants are met. This is not happening at the present time, so a change needs to be made to include the end users on all school projects.

When stakeholders were queried about *'communication'* at the construction stage of a project, all stated that it was effective at the supply side, but not between stakeholders and the DoE. As stated by Butt et al. (2016) it is important to project success that communication is timely, accurate and relevant. Again, as stated earlier, this needs to change so that these projects run more smoothly on site thus ensuring enhanced VfM so that any problems or issues with the project are dealt with effectively and efficiently.

On the *'social'* side of sustainability the input of the principal, pupils and parents is seen as being hugely beneficial. This happens on GRD schools where the project is embedded in the community as it is being constructed. One of the criticisms that can be laid on the way D&B

projects are procured is that this embedding within the community is difficult to achieve. On the *'economic'* side of sustainability D&B projects have more consultants willing to undertake the work going forward as there is an advantage of bundling a number of projects together into one package. It is interesting to note that there were limited comments from stakeholders during the course of interviews about the economic aspect of sustainability. This stems from the fact that as the DoE ensures that projects are built to cost limits and tenders are fixed price lump sum, both consultants and contractors are of the opinion that the economics of the project are not their responsibility. Finally, in relation to the *'environmental'* side of these projects, what has been established is that only tried and tested technology is used in the building of these schools. What should be encouraged is that there is an incentivisation scheme in place for the consultants to bring new technology where appropriate into the buildings. What is ensured in relation to the environmental side is that airtightness is achieved to a high standard. This can only be achieved if the main contractor is working to a high standard. Going forward, as the availability and number of construction projects in Ireland begins to increase this may reduce the availability and willingness of good quality contractors to undertake school building work.

## 6.6 Summary

This chapter has presented the findings for the construction stage of school projects delivered using either the GRD or D&B process. At the construction stage the findings demonstrate that the design needs approval from all local authority fire officers and disability access officers prior to handing over the completed school to the end users. Any issues in relation to the design itself need to be addressed so that on future projects the same issues are not coming up again and again. The DoE needs to have a person in the organisation assigned to each individual project in order for communication and relationships to work. In relation to sustainability the link between the local authority, the DoE and the school principal needs to be stronger in order to ensure that a truly sustainable project is achieved in the community. The next chapter presents the analysis and findings for the post occupancy stage and how VfM can be provided at this stage.

# Chapter 7 Analysis and findings of the post occupancy stage

## 7.1 Introduction

The construction stage of a schools project was investigated in Chapter 6 to demonstrate how the softer approach to obtaining VfM can be added to the harder approach in order for a more holistic view of VfM to be achieved. This chapter continues to focus on the softer side of obtaining VfM, but, rather than investigating the construction stage, it explores how this can be achieved at the post occupancy stage of a school project. The chapter commences with the themes that were discussed during the literature review, namely user requirements, design and issues. It then goes on to put forward the subthemes that emerged during the data analysis stage before, finally discussing the findings that have emerged at the post occupancy stage.

## 7.2 Undertaking data analysis at the post occupancy stage of schools projects

During the literature review the themes that came to the fore at the post occupancy stage when endeavouring the provide VfM included user requirements, design and issues. These themes were addressed during the data analysis stage in order to evaluate how enhanced VfM can be achieved on school building projects. Figure 7.1 illustrates that there were 71 references (comments or answers) made from the 23 sources (participants) who commented on user requirements. On the theme design, there were 107 references (comments or answers) made from 27 sources (participants). Finally, in relation to any outstanding issues there were 58 references from 24 sources. These comments demonstrate that even when end user stakeholders begin to occupy the school there are still some outstanding issues that were not taken into consideration at the construction stage. If these issues were addressed, then a more holistic process of delivering VfM on a schools project could be attained.
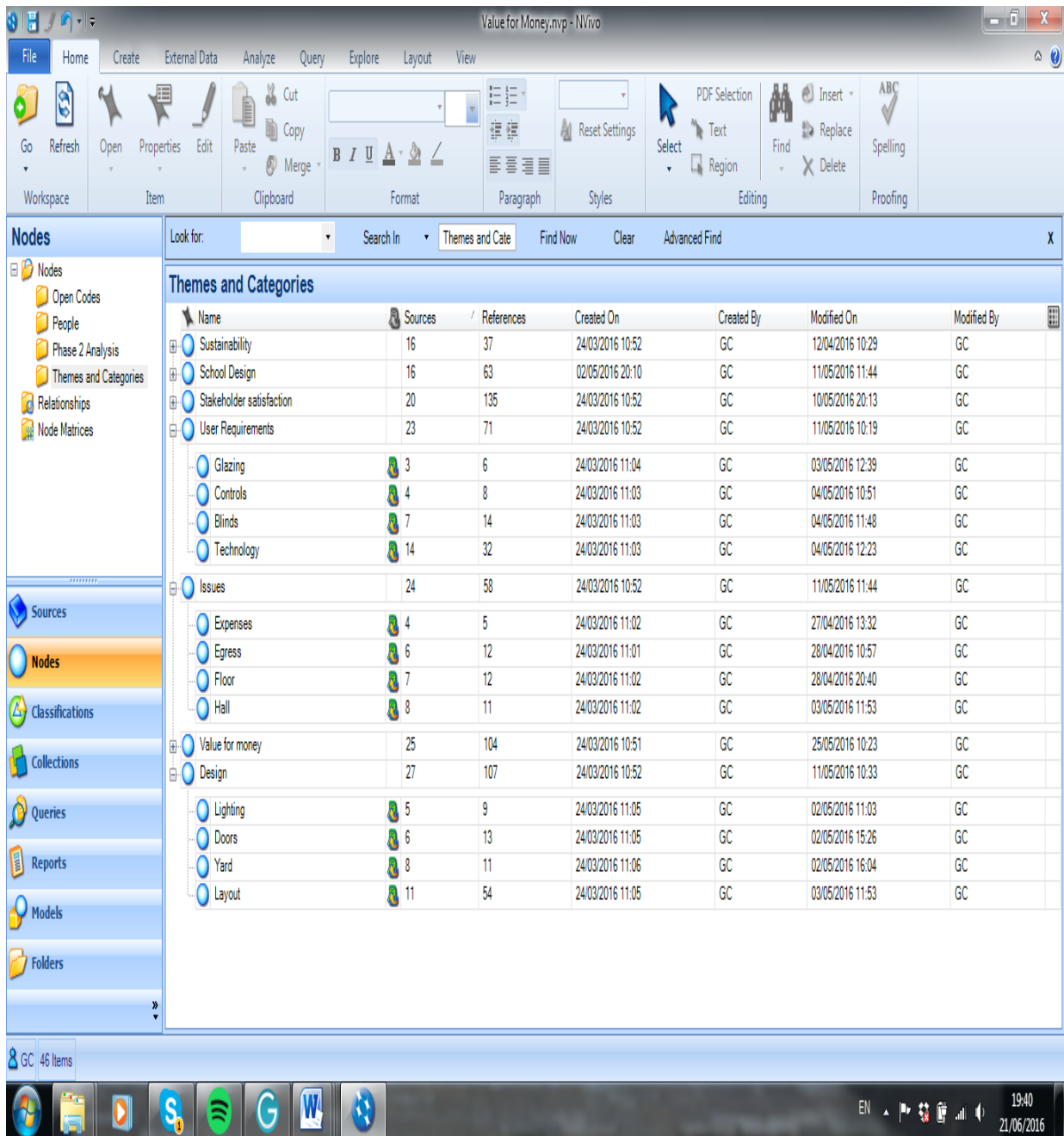
**Figure 7.1** Screenshot from Nvivo of sources and references in relation to the post occupancy stage

Table 7.1 shows the seven stakeholders were interviewed on the GRD project post occupancy stage and eight stakeholders interviewed at the D&B project post occupancy stage. The name attached to each stakeholder along with an abbreviation applied to each stakeholder and finally which type of project they were involved in be it GRD or D&B are presented. As was the case in Chapter 6, this aims to assist with the flow of the analysis of the information obtained at the post occupancy stage. It should be observed that once end users occupy the schools, the significance of whether those schools are procured using the GRD method or D&B method

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diminishes as all that the end users are interested in is whether the school fulfils their requirements or not.

**Table 7.1** Stakeholder abbreviation and category at post occupancy stage

| Stakeholder | Abbreviation | Category |
|---|---|---|
| Department of Education July 2012 | DoE July 2012 | General |
| Department of Education May 2015 | DoE May 2015 | |
| Generic Repeat Design Quantity Surveyor General | GRD QS (2) | |
| Design and Build Quantity Surveyor General | D&B QS (2) | |
| Generic Repeat Design Principal | GRD P | GRD Post Occupancy Stage |
| Generic Repeat Design Teacher | GRD T | |
| Generic Repeat Design Parents Association | GRD PA | |
| Generic Repeat Design Special Needs Assistant | GRD SNA | |
| Generic Repeat Design Administration | GRD ADMIN | |
| Generic Repeat Design Caretaker | GRD C | |
| Generic Repeat Design Board of Management | GRD BOM | |
| Design and Build Principal | D&B P | D&B Post Occupancy Stage |
| Design and Build Teacher 1 | D&B T1 | |
| Design and Build Teacher 2 | D&B T2 | |
| Design and Build Teacher 3 | D&B T3 | |
| Design and Build Teacher 4 Learning Support | D&B T4LS | |
| Design and Build Special Needs Assistant | D&B SNA | |
| Design and Build Administration | D&B ADMIN | |
| Design and Build Caretaker | D&B C | |

## 7.3 User requirements

One of the themes that emerged from the review of the literature was the requirements that users have in carrying out their day to day work in the schools. A definition of user requirements can be found in Chapter 3 section 3.7.1. As Endsley (2016) advocated rather that information being centred around the sensors and technologies that produce it, a user-centred design integrates this information in a way that fits the goals, tasks and needs of the users. Figure 7.2 displays the word cloud of user requirements and the subthemes that emerged following the data analysis, which include the *'technology'* in the school, the *'blinds'*, the *'controls'* in each room and the internal *'glazing'* system.

**Figure 7.2** Word frequency user requirements

Figure 7.3 shows that the main subthemes that emerged from the user requirements theme was the *'technology'* (60%) in the school. Requirements in relation to the *'blinds'* (20%) within the classroom and ancillary spaces is also a user requirement. The *'controls'* (11%) and finally, the internal *'glazing'* (9%) in the reception area is also a user requirement. As stated earlier, if consultation with the end users had been carried out at the design or construction stage, then these requirements might have been met and stakeholders would be ultimately satisfied, which in return, would ultimately mean that a more holistic interpretation of VfM was achieved in relation to these projects.
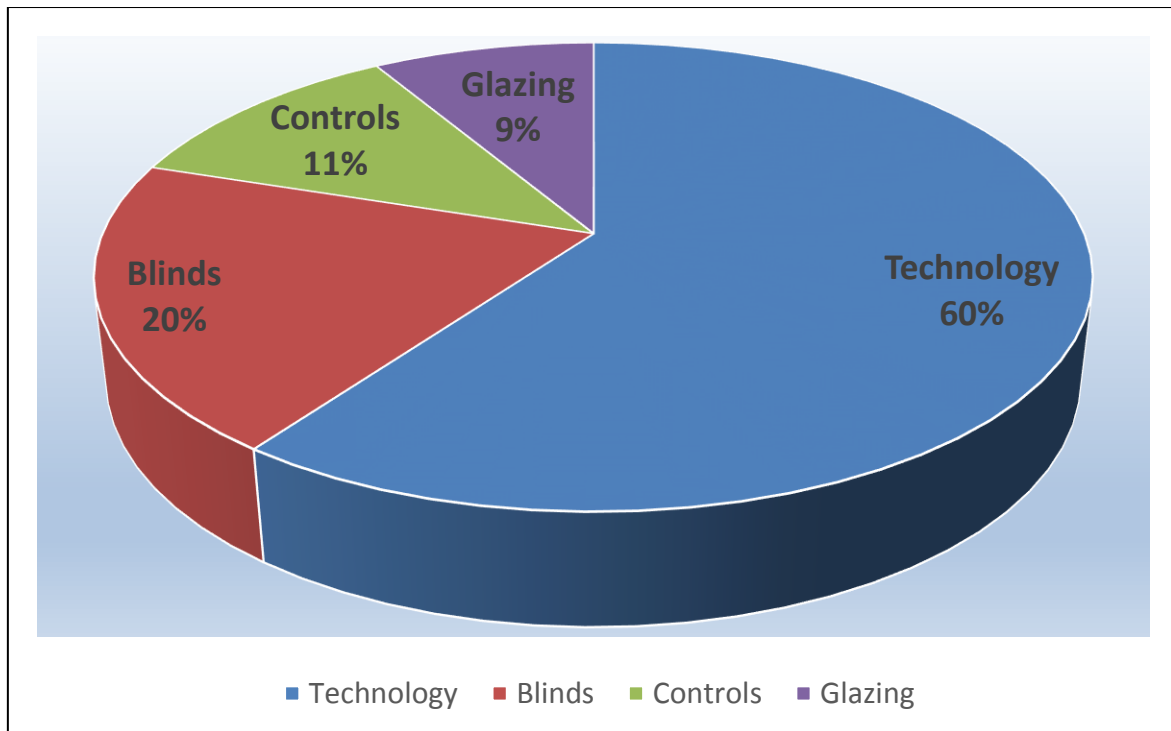
**Figure 7.3** Dominant subthemes under user requirements theme

Distinct from the construction stage where the subthemes emerged during the literature review, these subthemes did not emerge until the data analysis was undertaken. The literature review demonstrated the overall theme of user requirement but, as the subthemes were specific to the post occupancy stage of a school project in Ireland these subthemes could not be elicited from the literature. In order to bring about these subthemes it was necessary to analyse the verbatim interviews that were conducted.

*7.3.1 Technology*

This subtheme contains contributions from participants in relation to *'technology'*. It is a subtheme of user requirements in relation to the post occupancy stage of the projects. It contains information from twelve participants. Seven in relation to D&B schools and five in relation to GRD schools. As stated earlier in section 7.2, the majority of the comments are universal and can be applied to both GRD schools and D&B schools. Under the theme user requirements, the biggest concern for the majority of stakeholders is in relation to the technology in the school. As technology advances it is becoming an essential user requirement in the education of pupils. It appears that in relation to the primary school project, it was not considered a top priority during the design stage and ultimately then the construction stage of a school project.

Internet connection

One of the biggest concerns in relation to technology is the internet connection in the majority of the schools which is slow and not reliable. With access to the internet becoming an essential consideration in the education of primary school pupils, good internet connection is an essential requirement in all schools. It should not be case that good service is down to luck as the D&B SNA in one school stated. Sufficient internet connection is fast becoming an essential requirement for any teacher to teach and should be given the consideration it deserves at the design stage but more importantly the construction stage where any issues with the speed of the connection come to light:

> *"The internet connection is fine and the broadband connection is fine. I know some schools that have difficulty with it, but we are very lucky."* [D&B SNA]

The GRD P of another school even went as far as stating that they were in the process of putting up a mast in order to gain better internet access. This should not be happening in a school that is not even a year old where additional work is required so that a fundamental user requirement is delivered:

> *"Internet access could be better… in the process of putting up a mast so that coverage can be improved."* [GRD P]

Phone Coverage

Similar to concerns with internet connection, are concerns with mobile phone coverage within the schools. As classroom spaces do not have phone systems in place there is sometimes a requirement for teachers and special needs assistants to contact parents about a problem or a concern. In order to do this, staff sometimes have to use their own mobile phones. If coverage is lacking then this requires a teacher to leave the classroom to go down to the office in order to make contact. All of this takes time which is attention taken away from teaching and it should not be occurring. It was stated by D&B SNA that they also use their phones to access additional help and support from SNAs and teachers in the school for a pupil when there is an issue in class:

> *"We use our mobile phones. If I am downstairs and a pupil upstairs is giving hassle then the other SNAs call me on my mobile phone to come up and help."* [D&B SNA]

The lack of mobile phone coverage was even brought up by the IT contractor at the construction stage as being a potential problem. Unfortunately, an extra charge was proposed in order to

include a phone system in each classroom. This could not be included within the limited budget for the construction of the school so it was excluded, which was explained by D&B SNA:

> *"The private IT contractor who did work with me proposed that they put in an internal phone system, but it was considered too costly for us. In 2014/2015 I do feel that a telephone system is essential in a school. Rather than sending a kid out of a class with a message."* [D&B SNA]

Even though a phone system does not exist in the classroom a one-way intercom system exists where the secretary can contact the teachers, but the teachers cannot contact the secretary. If an intercom system is in place it should be a two-way system. As D&B T2 stated, the intercom system would be beneficial if it was a two-way system so that the secretary (administrator) could be contactable if problems arose in the classroom space. This was also reinforced by the D&B ADMIN:

> *"The intercom is not a two way system. The secretary can contact us, but we cannot contact her. It would be great if we could contact the secretary if something went wrong. What I tend to do is either run to the teacher next door or use my mobile phone."* [D&B T2]

> *"I can contact them, but they cannot contact me. I think they should have a phone system so that they can contact me. Technically teacher are not supposed to have mobile phones in the classroom, but it would still be handy in case something happens."* [D&B ADMIN]

The D&B T4LS in one school even went as far as stating that the intercom system is redundant as they do not even use it. What this implies is that the system should not have been installed and if better VfM is to be achieved on primary school buildings then a system should be included that is two-way or even a phone system should be installed in each classroom:

> *"I have never used it."* [D&B T4LS]

There are now more advanced types of technology that may be introduced into a school setting. These new technologies could be significantly more cost effective to install and maintain. It appears that this is not being used and installed as the DoE are unaware that the technology that may have worked effectively in the past is not working now. From this it can be seen that more consultation is required between the end users of the building and the DoE if enhanced VfM is to be achieved. If consultation took place then issues with the phone system could be flagged and addressed at an earlier stage of the project.

<u>Lift</u>
Still under the subtheme technology was the lift that was specified for the schools. All stakeholders stated that it makes sense to have a lift in the school, but they do not trust the particular lift that was installed in the school. In both GRD and D&B schools the lift has broken down a number of times over the past few months to the extent that people have managed to get stuck in the lift. It is a requirement under the Building Regulations that a lift is installed in the school but the specification needs to be altered so that, as the D&B C identified, the type of lift installed is suited to the level of use required in schools:

> *"The lift was a big issue. This is a hydraulic ram lift and if the hydraulic ram gets out of position, it gets stuck."* [D&B C]

This was supported by both the D&B SNA and D&B T1 in one school who indicated that not only did the lift not work but there were numerous maintenance callouts for the lift. As well as overuse of the lift causing wear and tear, underuse of the lift also causes the lift to cease on occasions and not work correctly. Again, this should be noted by the DoE so that a lift is specified that does not have numerous issues with it:

> *"The big problem that we have is the elevator has only worked for a week or two since we have been here. Several call backs and several problems with it. It is now working, but it took a long time."* [D&B SNA]

> *"The lift did not work for nearly three years. It was some new lift brought in from Italy. It is working now, but it is very slow but it is great to have it."* [D&B T1]

Another GRD SNA criticised the size, speed and number of occupants that the lift will take. All of this adds to the suggestion that the stakeholders of the school should be consulted so that any issues or problems are addressed going forward when specifying the lift requirements in subsequent schools. If consultation had taken place then an understanding that the use of the lift may be only used four times a day and on some days not at all as it is dependent on the school that the lift is provided for:

> *"Lift looks nice, but if you send the rest of the class up the stairs by the time you get into the lift and by the time it comes up it takes time and you do not know what the class are doing as nobody is supervising."* [GRD SNA]

A lift is a requirement in any school but the specification that has been provided for the lift needs to be revised in order to provide a lift that fulfils the user requirements for a primary

school. It is a user requirement that can cause stress to end users when it is not working which erodes VfM being obtained from it:

<u>Public Address System</u>
Finally, under the subtheme *'technology'*, the location of the public address system within the school needs to be adjusted to take the stakeholders into regard. In some schools, the principal requires the public address system to be in their office, whereas, other schools require the system to be in the secretary (administrator) office. As indicated by the D&B ADMIN, in one school there was a cost involved in changing the system from the principal's office to the secretary's office, which should not be the case if stakeholders were consulted at the construction stage of the school project about who will use the public address system in the school. Be it the principal or the administrator:

> *"The one silly thing that was done was that the PA system was down in his office, which made no sense as all the announcements are made from here. They charged us to transfer it. We paid €3,000 to transfer it to my office instead."* [D&B ADMIN]

Again, consultation with end users would ensure that the public address system was located in the appropriate area within the school. This reinforces the argument to include the end user stakeholders in the design and construction stage of the project so that they can influence the unique way in which their school operates:

*7.3.2 Blinds*

This subtheme contains contributions from participants in relation to the *'blinds'*. It is a subtheme of user requirements in relation to the post occupancy stage of the projects. It contains data analysis from the verbatim transcripts of six participants. Four in relation to D&B schools and two in relation to GRD schools. The blinds for every single stakeholder came up again and again as being a necessary user requirement which require modification. It appears that while there are shades/blinds in the classrooms, they are not fit for purpose as they tend to let in too much light when they require the rooms to be dark. This was identified by a number of teachers including the GRD T. Again, it appears that consultation with stakeholders at the post occupancy stage is not occurring and stakeholders are sensing that the fundamental requirements for teaching in a space are not being addressed by the DoE in the new school. If consultation did occur then the teachers' negativity about the space would not be occurring and the sense would be that the way they teach the pupils in the space was taken into consideration at the design and more particularly at the construction stage of the school project:

> *"The blinds leave in the sunshine as they are not black out. Would pull down the shades if they are watching something, but it does not block out the sun properly"* [GRD T]

It was also identified by GRD PA that pupils leave the classroom in the summer months feeling really hot as the sun came in the window of the classroom space. What this demonstrates is that not only are teachers having issues with the blinds in the classroom but this is also affecting the pupils in the space:

> *"Sun comes through the windows which could be an issue. Can get very hot and some of the kids might complain about it depends on where they are sitting."* [GRD PA]

What was identified by D&B T2 and D&B T3 is that blackout shades were provided in some rooms where they were not required and in other spaces that required blackout shades they were not included. What this shows is a lack of understanding on the part of the construction team about how the classroom space is used and how the room requires darkness at certain times of the day:

> *"That was such a nightmare. You could not use the interactive whiteboard in this room from 11am onwards on a sunny day. What is ironic is that they put blackout material on the blinds in the staff room which was not required at all."* [D&B T2]

> *"The blinds were fine on one side of the school, but because the sun comes in this way they had to be changed. In this room we get a blast of sun in here all day long… the poor kids could not see because of the glare was on top of them."* [D&B T3]

A potential solution to this problem is to use blackout shades in classroom space where required. A schedule of blinds needs to be produced, which takes the sun into consideration and provides blackout shades in rooms that require it. As stated by D&B T1, this was done retrospectively in that blinds were changed once the problem was brought up and the end users were using the space. This required an additional cost which should not have been the case if time was taken at the construction stage of the project to provide appropriate blinds in rooms. The DoE know that blackout shades are required in some rooms but what is lacking is the linking between knowing that they are required and informing the contractor/project manager where they are required to include them. Again, the involvement of the end users at the construction stage would ensure that this requirement would be addressed:

> *"Unfortunately, we had to change the blinds because the DoE issued ones that did not block the sunlight. The sun is practically all day coming through the windows. I get practically no release from it."* [D&B T1]

> *"I think we were here a good year or so before the blinds were changed. I think the DoE conceded in the end. Not sure if they paid for all of them or part of them. In all fairness, they were useless."* [D&B T1]

A fundamental user requirement is the ability to teach pupils without the hindrance of too much light coming into the space where pupils cannot see the whiteboard or the projector. Again, the issue with the blinds is a simple problem, but one that has left stakeholders feeling that they were not taken into consideration when the building was being constructed. The wider implication being that stakeholders are slow to take ownership of the building once completed as they sense that issues and problems are not their fault and should have been dealt with at the design or construction stages of the project.

### 7.3.3 Controls

This subtheme contains contributions from participants in relation to controls. It is a subtheme of user requirements in relation to the post occupancy stage of the projects. It contains data analysed from verbatim interviews from four participants in relation to D&B schools and two participants in relation to GRD schools.

<u>Thermostats</u>
During the data analysis it was found that individual temperature controls in each room were not an essential requirement as the teachers do not use them. One of the schools has decided instead to get the administrator to control the whole system from their office. It appears from this that the expense of putting these controls in each classroom was not a necessary user requirement for teachers and special needs assistants. As the GRD P explained that teachers do not use the controls that are provided for them in the classroom space. Temperature controls in each classroom space may have been a consideration for the DoE but if they had consulted with end users then a different system may have fulfilled the same requirement:

> *"There are thermostats in every single room. Teachers can change temperature, but they did not change them."* [GRD P]

As D&B T3, as well as GRD T, stated they do not even use the controls to regulate the temperature in the room:

> *"There are controls on the wall over there, but I do not touch them. I let the caretaker use the controls. I am not technical so I do not use the controls. I just tend to leave it alone."* [D&B T3]

> *"Have individual controls in each room but nobody came to explain them."* [GRD T]

In some schools the caretaker has taken the responsibility for controlling the thermostat. In other schools it is the secretary/administrator that has taken on the responsibility. Teachers in the classroom need to be able to open the windows at some stage in order to get air flowing in the classroom. It appears that this cannot happen if the heating is on as opening the windows in the classroom only drives the boiler to come on again, as explained by the D&B C. What this implies is that there may be individual thermostats in each classroom, but this control should not be a requirement as it is not being used appropriately. A better system would be where control of the system was only achieved through one central source operated by one individual. Once again, the DoE did not take how the end users use the thermostats in the classrooms when they put the specification for the heating system in place:

> *"You have thermostats in all the classrooms, but the teachers do not seem to use them. They do not use them because they do not understand them. I prefer to change them. It defeats the purpose of having thermostats in the first place."*
> [D&B C]

In summary, the DoE have included the user requirement to have individual temperature controls in each room but all stakeholders are of the opinion that it is not required. Individual controls do not seem to work, but if it is a requirement, then an explanation of what happens when you turn the temperature up or down should be explained to the teachers within the classroom space once the building is handed over to the school by the contractor so that an understanding of how the system works is achieved. This would then ensure that better VfM was being achieved from the heating system that has been installed in the school.

Sockets
What is lacking in classroom spaces is the number of sockets. As the amount of electrical equipment used in the teaching and learning of pupils increases, so too does the number and location of sockets within the space. Not only should there be a requirement for more sockets within the space but the overloading of sockets and extension leads along the floor should not be happening in a school that is not even a year old as it is a potential hazard to pupils. As D&B T2 and D&B T3 explained, sockets need to be placed in the areas where they are required.

Fundamentally, what is required is not an increase in the number of sockets but a redistribution of sockets around the classroom space to take the way the teachers use them into consideration:

> *"More power points definitely. If you wanted to do anything at the end of the room you could not as all the plugs are up here. Some sockets down near the sink area would be great. If the sockets were spread around more evenly then it would make more sense."* [D&B T2]

> *"In relation to the sockets we have them over by the door between the classrooms and the cupboard which are pointless. Where we need them, we don't have enough of them."* [D&B T3]

As D&B SNA explained, once the teachers commenced teaching in the classroom space they realised that the interactive whiteboard was in the centre of the room which required a socket. They had to pay an additional cost to get trunking and sockets in the centre of the spaces so that an extension cable not have sockets to be used. This is another example where end users requirements were not taken into consideration which caused additional expense to be incurred once the school was occupied:

> *"With the interactive whiteboard it is placed centrally in the room, but the sockets are all to the side of the wall. So we had to pay an extra cost to get trunking and some sockets to the centre of the wall."* [D&B SNA]

This user requirement could of easily been taken into account at the construction stage, if the knowledge of the way in which teaching and learning of pupils is carried out in the space was achieved. This could have easily been achieved if the DoE had engaged with end users to understand how they use the space and the technology that they require to use in order to do this. By doing this, it would ensure that sockets were placed in appropriate areas around the classroom space.

### 7.3.4 Glazing

The subtheme *'glazing'* contains contributions from participants at the post occupancy stage of the project. It is a subtheme of user requirements and contains information from two participants. One in relation to D&B schools and one in relation to GRD schools.

<u>Reception area</u>
The amount of glazing in the reception area where the administrator sits comes up as something that is becoming a concern for the stakeholder that are using the space. There are three large glazing sections in the reception area. Obviously the amount of glass was expensive, but it was

something that they did not need to have to three sides as it is difficult to obtain any privacy in the administration area. As the GRD ADMIN stated, this means that the reception area has to be left unattended for small periods of time in order to carry out some duties where privacy is required:

> *"You cannot sit in front of this big glass box counting money. Sometimes would have to go down to the staff room to count for 20 minutes to half an hour. Would be nice in an office if had a little section that was not on view."* [GRD ADMIN]

The glazing in relation to the secretary/administration office is a user requirement that should be addressed. The secretary deals with private documents, private telephone calls and money that comes into the school in the office. It would be important that information can be viewed privately and should have been taken into consideration during the design stage. Again, this is one of the areas where consultation with end user stakeholders would again have been beneficial in understanding how the administrator uses the space. This was explained by the D&B ADMIN and the GRD ADMIN. Since all schools have this space and glazing it is an issue that is coming up again and again on schools so should be addressed in subsequent designs for schools:

> *"Everything is very public. Sometimes it is difficult to do work when you are so much on view. It feels sometimes that you are in a goldfish bowl. You are on show."* [D&B ADMIN]

> *"Would be nice in an office if had a little section that was not on view just a small sectioned. I have glass around all sides could have done with half the amount of glass. Screen when counting money."* [GRD ADMIN]

Window principal's office

One item that was changed during the construction stage was the window in the principal's office. The principal's office looks out onto the playground and the principal felt that it would make more sense to bring down the location of the window so that the principal could sit at his desk and view the pupils playing in the yard. This has the effect that the pupils sense that, as the principal is observing them, they need to be on their best behaviour and any issues are being observed. This is an example where end user involvement can have a positive effect on a project. It was introduced on a GRD project where the principal was involved in the construction stage. It again reinforces the requirement to have end user involvement at the construction stage in order to introduce small changes or suggestions to the standard design so that it is tailored to the specific school. These small changes should then be addressed by the

DoE so that they could have a positive effect on the overall project, which was implied by GRD P:

> *"I dropped some of the windows because I felt they were small. When sitting in my seat in my office, I can look out onto the yard. Did the same in the staff room."* [GRD P]

The glazing should be addressed going forward in order that stakeholders are satisfied with the design of the classroom and office spaces and any suggestions that could have a positive effect on the end user involvement in the project are introduced. These suggestions have limited cost involvement but can have an enormous positive effect on the overall daily working of the school once occupied.

## 7.4 Design

Another theme that come to the forefront from the literature that was addressed in Chapter 3 section 3.7.2 at the post occupancy stage was the overall design of the school building in Ireland. As can be seen from the word frequency diagram, Figure 7.4, discussion in this area includes the *'layout'* of ancillary spaces and classroom spaces. The design of the *'doors'* within the school, the *'lighting'* of the outside space and the *'yard'* space are all areas that emerged during the data analysis of verbatim interviews.
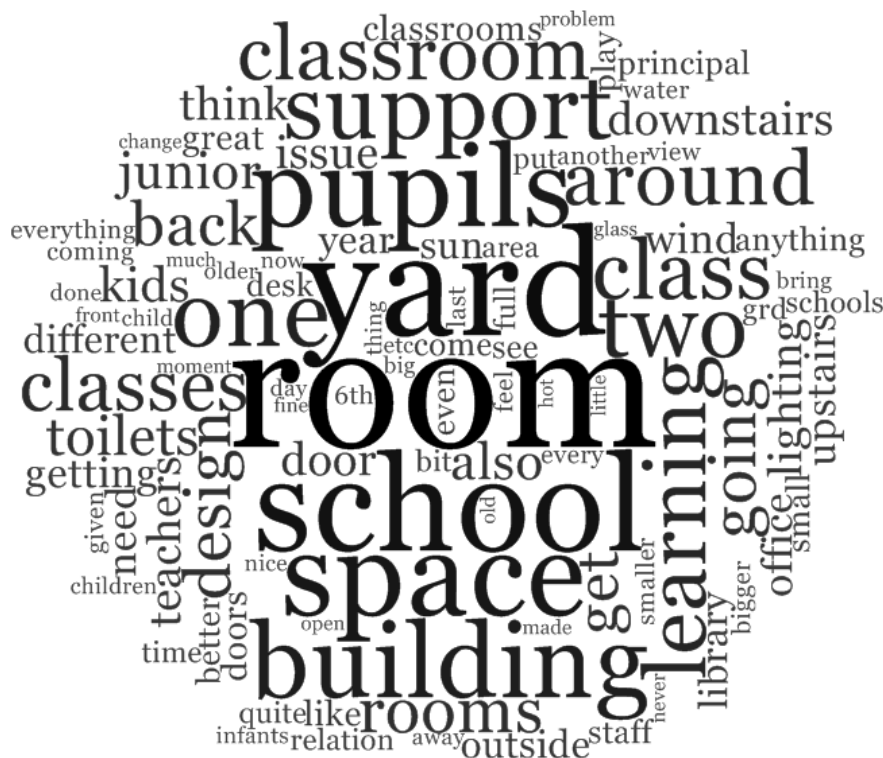


**Figure 7.4** Word frequency Post Occupancy stage design

As illustrated in Figure 7.5 the prevalent subtheme in relation to the design of the building are the *'layout'* of the space followed by the *'yard'* area, the *'doors'* within the building and then the *'lighting'* of the building.
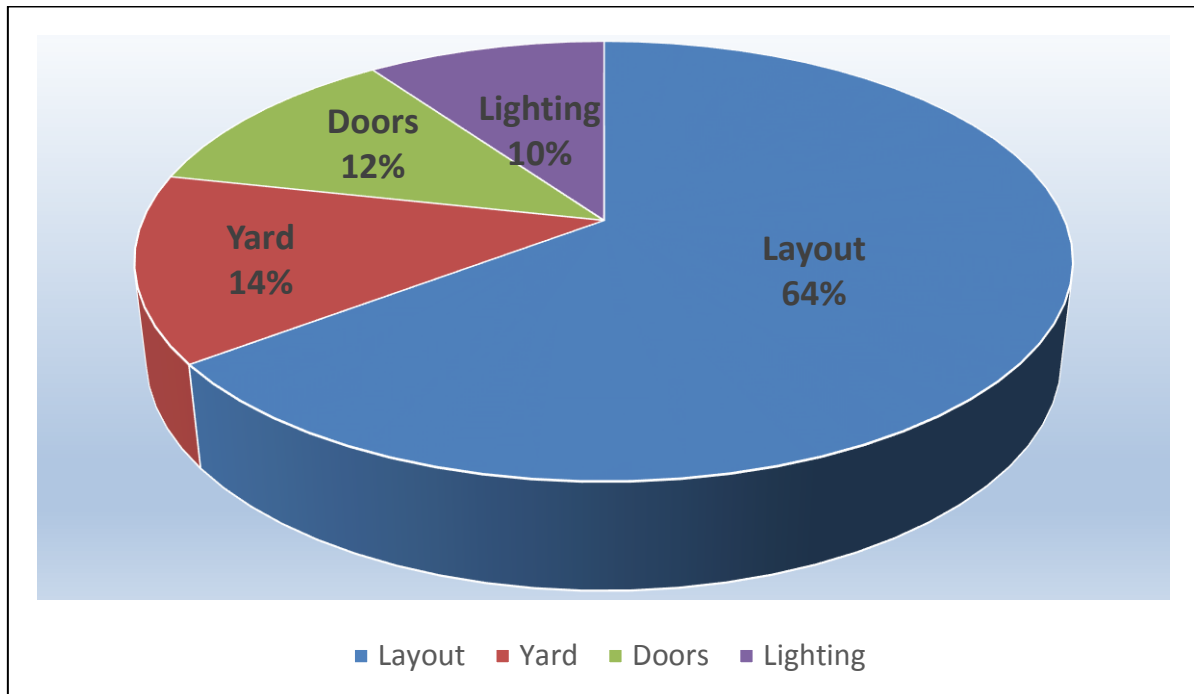


**Figure 7.5** Dominant subthemes under design theme

The DoE has undertaken their own research in making sure that the design is set and that all requirements are met. However, there are a number of additional areas that need to be taken into consideration in the future design of the primary school accommodation in order for the stakeholders to be fully satisfied with the building and enhanced VfM is achieved. These areas will be discussed below in the next four sections.

### 7.4.1 Layout

This subtheme contains contributions from participants in relation to the post occupancy stage of a school building built using GRD design and D&B design. It is a subtheme of design and contains data analysed from verbatim interviews about the *'layout'*. The data is from ten stakeholders in total, seven stakeholders from D&B schools and three stakeholders from GRD schools.

<u>Classroom size</u>
From the teacher's perspective what appears to be on the agenda is that the floor space is small as all classrooms are all the same size. However, classrooms do not need to be the same size as

there is a big difference in size between a five year old and a twelve year old pupil. Also, the activities that are undertaken with junior classes and senior classes are different. The design should have taken this into consideration with an option to make some classrooms smaller in order to make some classrooms larger. As D&B T and D&B SNA explained this is a new school you would not consider that there would still be challenges with the size of the classroom space:

> *"With the junior classes you seem to fit them in the pupils are smaller, the desks are smaller, the chairs are smaller. Ideally 24 or 25 pupils would be great."* [D&B T]

> *"It is deceiving if you walk into the junior classes the space looks fine, but if you walk into sixth class then it is a different story. We can see that the numbers are going up, but this was not taken into consideration."* [D&B SNA]

As explained by the D&B SNA not only does the space need to cater for the teacher and the pupils, in some cases, it also needs to cater for a special needs assistant in the classroom. This is due to the fact that special needs assistants need to sit beside the pupil they are assigned to in order to assist them with their work and in so doing can take up valuable space in a senior class which is full to capacity:

> *"Two teachers in the room so space is an issue. When we are sitting down next to a pupil we are caught for space."* [D&B SNA]

As the pupil/teacher ratio is beginning to increase it appears that the new school projects are not applying this increase in the number of pupils to the size allocated in the classroom. The D&B T3 explained that the space is sufficient for approximately 26 pupils but some classes are as big as 34, which means that when this is a senior cycle space (pupils age between 9 and 12 years) can be very tight. It appears that future pupil numbers were not taken into consideration which means that these school buildings may require extensions for additional spaces in the future:

> *"Classrooms are designed for the older pupils for a comfortable 26 pupils. I have 31 this year. I had 34 last year and given that class sizes are going up the classrooms are not big enough to cater for that size."* [D&B T3]

Location of offices

Another layout concern is not locating the administrator and the principal beside each other. In the old school they were next to each other, but in the new school the principal is located towards the centre of the school, whereas the administrator is located towards the eastern corner

of the school. This was done by the DoE so that the administrator is not only performing the duty of the school secretary but is also the guardian of the front door in who is allowed into the school space and who is not. This issue might not be the same for all principals and administrators that work together, but it is something that should have been asked at the design stage so that the internal layout of room spaces could be adjusted. As GRD ADMIN explained the close working relationship that did exist in the old school is being eroded by the distance that now exists between the two offices:

> *"If I was very busy in the old school, I could say to principal answer the phone there because I am typing or counting money. In new school everything comes to me as the principal is so far away from me."* [GRD ADMIN]

Ancillary space

One issue that was felt by most that should not be happening in a new school is that the lack of ancillary spaces. This was particularly felt by the special needs assistant as there was not sufficient space provided for them to undertake their work effectively. In order to do their job properly it is sometimes necessary for a special needs assistant to remove a pupil from the classroom space and provide one-to-one support. This is difficult to do when there is lack of appropriate space in the school to meet that pupil. Due to this, the additional spaces like sensory rooms, library and doctors surgery are being encroached on in order to carry out this one to one support which was explained by D&B ADMIN. This has the effect that in the not too distant future an extension or prefabricated building will need to be added to the school building in order to provide this additional space thus eroding the VfM that is achieved. Again, it appears that present needs were addressed in these school buildings but future needs were not:

> *"The room where the learning support is now that was supposed to be for visiting doctors, nurses, etc. At the moment there is no room for a visiting doctor or nurse which means that the learning support teacher has to wander around to find another room for that day."* [D&B ADMIN]

The DoE provides sufficient classroom space for the number of pupils in the school as they either build an 8, 12 or 16 classroom school. Eight classrooms are sufficient for one stream of pupils each year. Sixteen classrooms being sufficient for two streams of pupils each year and twelve classrooms being sufficient for one stream of pupils with capacity to take more as pupil numbers increase. What the DoE does not provide is the increases requirements for ancillary spaces as they only provide for one learning support room regardless of whether the school is an 8, 12, or 16 classroom school. As D&B T3 explained there is a need for between five and

six learning support teachers in any school and sometimes more depending on the area that the school is built in:

> *"In relation to the GRD they have not enough learning support rooms. They have one learning support room and one multipurpose room. Under the whole learning support criteria a school our size is going to have 5 or 6 learning support teachers, including an additional language teacher and it stands to reason that we are going to need more rooms than what was given to use."*
> [D&B T3]

The conclusion from this is that teachers, and particularly learning support teachers are of the opinion that the present needs were taken into consideration when the schools were being built in relation to pupil numbers. However, the future needs were not taken into consideration. As numbers increase more ancillary space will be required and this has not been provided for. As GRD T4LS explained, the amount of additional space in the school is being eroded as libraries, doctor's surgery and been taken over in order to carry out learning support work:

> *"Felt that DoE building side were oblivious to the educational side for pupils. One of the rooms is a medical consulting room; one is a library that has been converted into a learning support room. …. Another room which is a classroom where they do not have a double stream, but that will change in the future."*
> [GRD T4LS]

It was also a concern for D&B T3 to find space to meet parents during school hours where they have found that all rooms are busy. This erodes the ability of the teachers and staff to undertake their duties in a professional manner. This has the implication that the end users sense that the design of the school building does not fulfil all their requirements and the DoE did not take these end users into consideration when designing the school building:

> *"We are using every single space given to us at the moment. For example, I do not have an office. I am the deputy principal of a 400 strong school. If I have to meet a parent on a discipline issue or anything, it is in my classroom or on the corridor."* [D&B T3]

This issue is not going to diminish going forward as pupil numbers continue to increase based on population projections from the Central Statistics Office (CSO). Even though some schools are still quite new the need for additional space will mean that prefabricated buildings will have to be introduced on site in the not too distant future. This is what the DoE has wanted to steer away from as there is a significant cost in providing such accommodation. There is also the GRD T4LS perception that if they are teaching in a prefabricated building that it will eventually

become a long term solution to the problem of providing space. Prefabricated accommodation is expensive to provide due to the high cost of leasing such accommodation. If attention was paid to this potential lack of space then additional expense would be spared in the future by designing a building fit for purpose in the first place:

> *"More learning support rooms. We are going to have to look at getting prefabs in the future. Even getting around the desks in some of the rooms is very tight compared to the space we had in the old prefabs."* [GRD T4LS]

As the D&B P explained, they had more space in the old prefabricated buildings that they had before the new school was built. It was felt by the principal of one school that the DoE knew the profile of the school and the requirement for learning support space but they did not take this into consideration with the design and just used the design that provides the standard accommodation:

> *"They knew the profile of the school when they were building, but they still did not take into consideration that we had 4 learning support teachers."* [D&B P]

Toilet facilities
The location and layout of the staff toilet facilities is also a design issue that needs addressing. Staffroom toilets need to be located close to staffroom as teachers only have a limited amount of time on their break to use the facilities. Again, this is something that end users should have been consulted on before the decision was made on the location of the staff room toilet facilities, as explained by D&B P and D&B SNA:

> *"Toilets for the staff are also too far away. The secretary should be nearer the office and the toilets should be nearer the staff room."* [D&B P]

> *"Also the designated staff toilets are at one end of the building downstairs ... people outside the school setting do not realise the hands on approach and the responsibility that is required with children."* [D&B SNA]

The DoE are trying to be equal in relation to the gender of teachers, but the reality is that the majority of teachers in the Irish education system in Ireland are female. This needs to be reflected in the design, particularly in relation to the number of female toilet facilities to male toilet facilities. At the present time, as explained by D&B T2 there is an equal number of male toilets to female toilets designed for the school which should not be the case:

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*"Also, two toilets for all the female teachers and two toilets for all the male teachers (all three of them) is not fair. You would be saying to yourself, do I go to the bathroom or do I go on my break?"* [D&B T2]

There is no extra or additional cost associated with these requests, as rather than having two male and two female toilet facilities, there would just be one male and three female toilet facilities. If this was taken into consideration at the construction stage, end users would sense that their opinion was being taken into consideration in relation to the individuality of their school compared to other schools. They would also get the sense that the design of the school was tailored to their specific requirements.

*7.4.2 Yard*

The *'yard'* subtheme contains contributes from participants in relation to the post occupancy stage of a school building built using GRD design and D&B design. It is a subtheme of design and contains data in relation to the yard. The data analysed from verbatim interviews is from seven stakeholders in total. It contains information from the four stakeholders in relation to D&B schools and three stakeholders in GRD schools.

What comes through in relation to the yard space is that stakeholders states that the significance of the orientation of the building was not provided for in the design. Previously, it was stated that the sites that schools were given in relation to building on were not the best sites and this has a knock on effect of the location and cost of providing a yard space, as explained by D&B PM1:

*"The land acquisition people in the DoE were struggling to get decent construction sites. Long skinny sites, short fat sites, rectangular sites. Sites that nearly have cliff faces on them. We have just had to deal with them."* [D&B PM1]

What has emerged during the data analysis stage is that stakeholders at the post occupancy stage are of the opinion that an appropriate location of the yard was not understood by the consultants during the design stages. This was explained by D&B P were it was explained that the site of a school is located next to the sea and when the wind comes up the valley it is difficult to let kids play outside in the yard space. If the school was orientated in a slightly different way than the yard space would shelter the prevailing wind and driving rain in the winter and the pupils would be able to play outside more often. This would ensure that energy and frustration by pupils could be released during playtime and would not be carried over into the classroom:

> *"Yes, totally different place here when the wind is blowing. Wind is particularly bad here out the back. When the wind is blowing then we cannot let the children out to play in the yard like today."* [D&B P]

As D&B T1 explained, more thought needs to go into the positioning of the yard space in any school. This is due to the increasing emphasis that is being placed by teachers on the fitness and health of pupils and a requirement that the yard is used as often as possible. As one teacher explained, the yard is very exposed to the elements which should have been taken into consideration during the design of the school:

> *"The yard gets full on sun and full on wind. There is no release. Our yard should be to the front of the building. The minute you turn around the building it is a different climate. You are met full on with the wind and full on with the sun and there is no break from it. There is no shade and it can get quite hot."* [D&B T1]

This whole issue of the importance of play has been reinforced by GRD P when he stated that:

> *"You need a yard. Need to have tarmac. I believe the whole issue of play and running is vitally important. Watching basketball game for third class who are a difficult group. Referred themselves and some of them were learning. Learn as much doing as the teacher telling them in the yard."* [GRD P]

The size of the yard and the actual design of the yard space were also discussed at some length by the teachers who use the space. Again, as there is an increase in pupils per classroom, this increases the overall numbers in the school but an increase in the size of the yard space was not included as stated by the D&B T3:

> *"When you have 400 pupils and have 200 pupils in each yard, then we needed it extended. We actually need another yard so we have to look at getting that. The yard is so exposed. ... The yard is very bland."* [D&B T3]

The location of the yard space was one of biggest design issue for the majority of stakeholders. The thought from the principal was to keep the yard away from the front of the school so that when pupils are playing they are not visible by passing cars. This decision was taken unilaterally; by the principal and was not discussed with other stakeholders. The problem with this is that the back of the school is north facing, which means that during the winter months when there is a lot of frost, the yard cannot be used because it is quite dangerous. This is an important design consideration for any school as play is becoming a core factor in the education of pupils. Indeed, this was reinforced by the Primary School Curriculum (1999) where structured play was stipulated for junior and senior infant classes and having beneficial effects

for both learning and development. It does not make any sense that pupils are unable to play outside all year round. This was also echoed by GRD PA with pupils in the school:

> *"The sun shadows the yard from getting sunlight. If I come up at two o'clock to collect the yard is still frozen which means that they cannot play on it."* [GRD PA]

The GRD PA also feel that the weather in the local area was also not taken into consideration when putting the yard in place.

> *"Because it is a two storey school the sun shadows the yard from getting sunlight. If I come up at two o'clock to collect, the yard is still frozen which means that they cannot play on it because it is dangerous and very slippery."* [GRD PA]

The orientation of the school has also become a concern for parents in relation to how the pupils access the school. The pupils are dropped by the bus at the front gate of the school where they walk around the side of the building to the back of the school and the yard. This is fine in the summer months, but during the winter when it is cold and raining it is a problem as parents do not want their children getting wet before entering the school. Again, this ties in with the unilateral decision by the principal to locate the yard to the rear of the school and not discussing or understanding the implication that this decision will have on other stakeholders and pupils, as explained by GRD PA:

> *"The bus drops the kids at the front gate and the kids walk up the path and around the side of the building and to the back of the school. If it is a really wet morning, then they are running a fair distance to get into the school."* [GRD PA]

*7.4.3 Doors*

Another subtheme under the overall theme design that emerged during the data analysis stage was regarding the *'doors'* in the school. This subtheme contains data analysed from verbatim interviews from five stakeholders on both GRD and D&B schools.

<u>Classroom doors</u>
The D&B T felt the introduction of doors between classrooms on the first floor of the school was a positive addition. However, downstairs they do not have the doors between the classrooms which the teachers felt was a missed opportunity as the junior classes need more watching than the senior classes. Again, this is a small issue, but it is something that should be included in the future in relation to primary school buildings as it can have a major influence

on whether stakeholders sense that the design took their needs and ability to use the classroom space into consideration:

> *"Doors in between the classrooms are fantastic upstairs. If you need to go to yard duty you can open the door."* [D&B T]

Both the D&B T1 and GRD T feel that there was a missed opportunity to install doors downstairs. The junior cycle classes (age 5 to 8 years) tend to be downstairs in the building and as the teachers explained, these pupils need more watching than the senior cycle classes (age 9 to 12 years) so doors should also been included there. What this also demonstrates is that teachers and end users do not work in isolation. There is a huge amount of interaction between teachers and this needs to be provided for in the design:

> *"In high insight I think they would have been great. Downstairs even if two teachers want to liaise then they have to come out onto their corridor to do so. I would not have thought so when they were going up as you are losing wall space, but they are very handy."* [D&B T1]

> *"Downstairs they have no doors between which would need it more than the rooms upstairs because you cannot leave the infants by themselves, but could leave the older kids for a short while. Would make it easier if doors between being downstairs as well."* [GRD T]

What is interesting to note is that the doors between classrooms were not in the original design of the school and were only included on the request of the fire officer. It appears that this change that was made to the original design had consequences that were not what was originally intended. It was intended that the doors would be of benefit if a fire broke out upstairs in the building. The doors now between rooms also had the consequence that teachers in the school get a sense that the way they work and interact with teachers in the neighbouring classroom was taken into consideration. This was demonstrated by D&B T1 who is using one of the classrooms on a day to day basis:

> *"They were not on the original design. The fire officer made us put them in. They are very handy for days like today for supervision because you can just open the doors. Very handy if you are on yard duty."* [D&B T1]

Class bathroom facilities

Other design concerns are the class bathroom facilities for the senior cycle classes. These bathroom facilities which are in the classroom are shared between both male and female students. With these students ranging in age from nine to twelve years the sharing of bathroom

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space is not appropriate. As D&B T3 explained this is not appropriate in senior classes where pupils are becoming more self-aware:

> *"The other issue is in relation to the toilets. We have one door going into two cubicles. Fine in the junior classes, but not in the senior classes."* [D&B T3]

As the D&B SNA stated this was even brought up when they walked the site at the construction stage but it was not changed. Again, this has implications in that issues that were flagged at the construction stage were not altered as the request to alter items came from the end users and not the DoE. It also demonstrates that even when the main contractor is made aware of design flaws on site, the procedure to change the design is not simple so the majority of times it does not happen:

> *"We walked through the building a month or two before it was opened and we found that the bathroom upstairs in the senior classes was the same as downstairs in the junior classes. It had a communal door going into two cubicles and I said it to the builder as I walked around and he said that is the way it is shown on the drawings."* [D&B SNA]

Doors to outside space
Finally, one of the requests from D&B T3 was that doors directly from classroom space to outside space would be of benefit to them, particularly in the whole area of structured play. This was achievable in the prefabricated building and meant that particularly in the junior cycle classes structured play with sand, water etc. could be undertaken a lot easier in outside space. It should be noted that this is not included in any new primary schools and it may be something that the DoE should investigate the introduction of in the future as teachers feel it would be a beneficial addition to the classroom space:

> *"Also in the prefabricated structure we had access to the yard, which we do not have here, which is a shame."* [D&B T3]

*7.4.4 Lighting*

Under the theme design what has also emerged is the subtheme *'lighting'* of the school. This subtheme contains data analysed from verbatim interviews from four stakeholders in total who include the caretaker, teacher, principal and the parents association.

While the design of the primary schools took natural daylight into consideration as much as was practical the lighting of spaces needs some fine-tuning as to the length of time the lights stay on after exiting the classroom is too long. This is important particularly as the cost of

electricity is going up year on year. As the GRD P explained the lighting remains on for about ten minutes when you leave the classroom, which should be reduced. This was also commented on by GRD PA:

> *"The lights stay on for about 10 minutes when you leaves the classroom. I asked if this could be reduced."* [GRD P]

> *"For security I think it is good to have lights on at night. There are a lot of lights using a lot of power. Not necessary to have that many lights on."* [GRD PA]

The outside lighting around the school also remains on all night, which the parents and the caretaker consider was excessive and should be changed. As the D&B C states that external lighting stays on too long, which again costs money. The facility to change this needs to be explained to the end users so that the lighting remains on an appropriate length of time:

> *"The problem with the outside lighting is that we are paying for the outside lighting directly on the main street."* [D&B C]

This was echoed by D&B T3 and GRD P of the school:

> *"You would think that it should be energy efficient, but I am not sure that it is. I feel if they did take account of the local area then that would be much better."* [D&B T3]

> *"Like an airport at night because all the outside light is on around. Maybe if they went off at 12 midnight that would be nice."* [GRD P]

In certain inner city areas there may be a requirement for the lights to remain on at night for security reasons. This is not required in all schools as a country location does not require lighting to remain on. There should therefore be the ability to adjust the external lighting as required to take account of the local area that the school is in so that the costs of providing lighting are kept to an appropriate level.

## 7.5 Issues

As can be seen from the word frequency (Figure 7.6) there are a number of subtheme that have emerged from the data analysis that was carried out on issues. These subthemes on the overall theme issues include the *'hall'*, *'floor'*, *'egress'* (fire) and *'expenses'* (money).

**Figure 7.6** Word Frequency Post Occupancy stage issues

Figure 7.7 represents the dominant subthemes that came from the data analysis. The prevailing subtheme is *'egress'* (25%) from the school followed by the *'hall'* (22%) and the *'floor'* (21%). Finally, the issues with *'expenses'* (14%) has come up along with some *'general'* (18%) issues that stakeholders are concerned with. Each one of these subthemes will now be discussed separately.
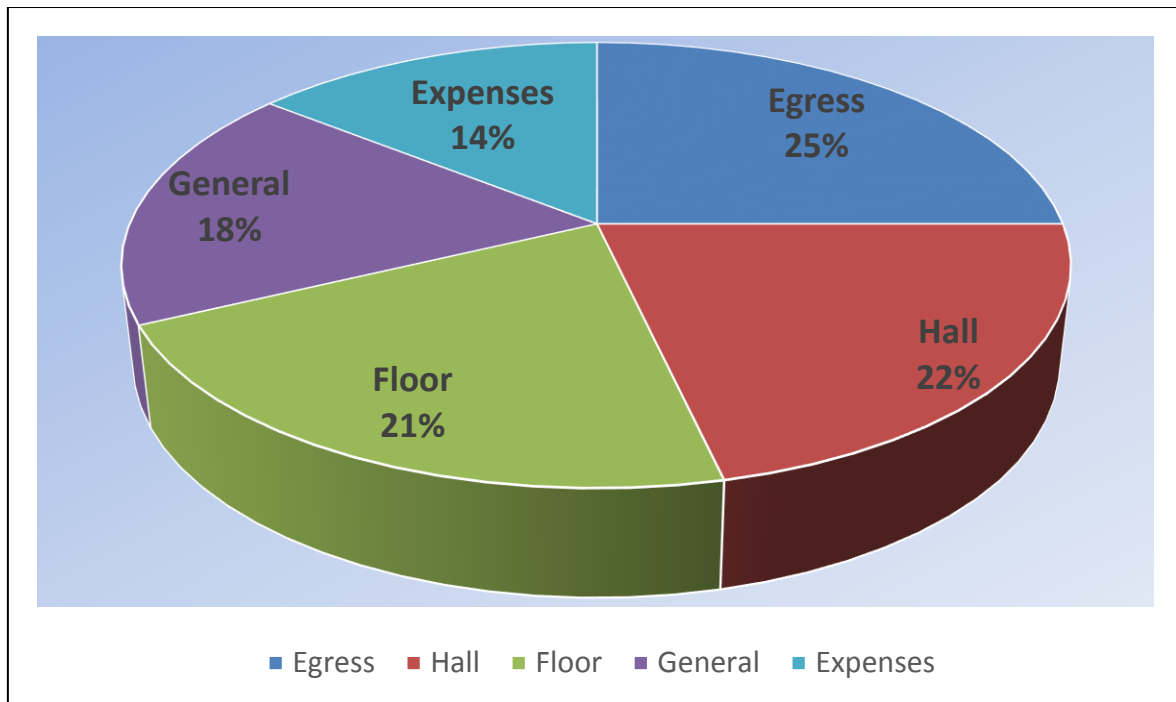
**Figure 7.7** Dominant subthemes under issues themes

### 7.5.1 Egress

This subtheme contains contributions from participants in relation to egress from the school. It is a subtheme of issues in relation to the post occupancy stage of the projects. It contains data analysed from verbatim interviews from five participants; four in relation to D&B schools and one in relation to GRD schools.

There are a number of issues with the entrance and exit from the school buildings that need to be addressed. This includes exiting from the school primarily in relation to fire drills. With young pupils trying to exit the school it can take time. A proposal came from a number of sources including D&B SNA that a door from the classrooms downstairs to the outside would be of benefit to the school when trying to evacuate the building. This again reinforces the suggestion from the teachers to have doors from the classroom on the ground floor to the outside space:

> *"With 400 pupils and 20 staff everyone exits through the fire doors at break time and funnels out. What struck me is that the 8 classroom doors could have had a door in order to exit the classroom. If you did then you would have had 240 pupils out in a 1 minute or less."* [D&B SNA]

This was echoed by a teacher from the junior classes were even trying to get out the door of the classroom is a problem as the pupils are small (5 years old) and unable to hold the door

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open as it has an overhead door closer on it. As D&B T1 explained it tends to close quickly once opened. Again, what can be seen from this is that how the junior cycle classes use the space and the problems that exist in these junior cycle classes was not addressed by the DoE when they put a design in place to provide for a new school building:

> *"It is a huge disadvantage for things like the fire drill. The doors here close automatically and the pupils are too small to push the doors open. So when you are trying to supervise and clear the room you cannot be ahead, holding the door open and behind, making sure that everyone has got their stuff and they are out."* [D&B T1]

Another complication is that when pupils actually leave the classroom they are then met by the senior cycle classes coming down the stairs. With the junior cycle classes aged between 5 and 8 year and the senior cycle classes being bigger (aged between 9 and 12 years) this has the potential to cause knocking and pushing between groups. This was explained by GRD T in one school. Again, this demonstrates that egress from the school is an issue that needs resolving. It is not a simple evacuation of people from a building it is about how to evacuate small pupils as well as larger pupils safely from a school environment. This is the same for all school buildings that have been built and should be explained to the fire officer so that a simple achievable system of evacuation is put in place for all new school buildings:

> *"When the fire alarm goes these doors close automatically. My children have to get out that door push their way through and push the other door. They are then met with the children of fifth and sixth class coming down the stairs. If we had a door outside of the classroom, then could have gone straight out. We have had a few issues with kids getting their fingers caught in the doors this year."* [GRD T]

There is also an issue with the number of exits that are in place for the school. All teachers know that pupil's safety and welfare is of the utmost importance, but they are not using the fire doors correctly as pupils are entering and exiting from these doors. The reason that teachers are doing this was explained by D&B T2 when they stated that as time is limited at breaks they tend to try and get the pupils outside as quick as possible therefore they use the emergency doors. This is a problem for all teachers who are in the school, regardless of whether they have a junior or senior class. Again, this is an issue that needs resolving so that end users are able to use the space as they intended it to be used and not how the DoE perceive them to use it:

> *"Technically, we have one main entrance and one back entrance. All the kids come in the main entrance. Half should be using the main entrance and half using the back entrance, which means half of them would have to walk all the way around in the yard. They don't do this. What they do is use the fire exits to leave at lunch time, which we are not supposed to do."* [D&B T2]

This is an issue that the design team along with fire safety office should address going forward in order that pupils and teachers can use the space provided more effectively. This can only happen if the designer knows and understands the problems that are associated with egress from the school.

*7.5.2 Hall*

This theme contains contributions from participants in relation to the *'hall'*. It is a subtheme of issues relating to the post occupancy stage of school buildings. It contains data analysed from verbatim interviews from six participants; four in relation to D&B schools and two about GRD schools.

One of the concerns regarding the hall is the problem with the lack of storage space for tables and chairs that are in the hall space when events are taking place. It is also a concern for the GRD SNA when pupils are knocking into stacked tables and chairs:

> *"When there is anything on in the hall the way the furniture is stacked it is very dangerous… a lot of time is spent telling kids to keep away from the sports equipment."* [GRD SNA]

This concern was also echoed by the D&B C who also felt that storage space was lacking in the hall for the storage of equipment. This means that the hall which is small anyway is also taken over with storage of equipment which makes the space seem even smaller for the end users:

> *"The other problem is that the chairs are always out in the corridor under the stairs. They should have been in a cupboard. If the chairs are not watched and the rubbers come off the legs they will do damage to the floors."* [D&B C]

An issue with the size of the hall is also emerging. The weather is inclement for about six months of the year, which tends to be the time that pupils are in school. The months of July and August when they could use outside space, are the months that the pupils are on holidays and are not in school. Therefore, the hall space should be capable of the pupils using it to carry out sport as well as other activities such as drama, music, etc. In essence, the hall really should

be a multipurpose space where both functions can be carried out. At present it is neither one nor the other. As D&B T3 explained, the floor surface in the hall is unsuitable for any sports or physical education:

> *"From a physical education point of view we cannot do any indoor kind of sport in the hall. The surface is not suitable, it does not have a suitable surface on the floor. It is a "slide" floor. You cannot kick a ball because the fire alarms are positioned in a place where you will hit it."* [D&B T3]

As the curriculum includes sport and physical activities the hall is constantly in use. Perhaps a larger sports hall, which could be divided, would be more beneficial to the school and the community at large, which was also echoed by the D&B T:

> *"The hall works, but a general purpose room would have been great to have. The hall is always booked so it is impossible to get a space in there. Drama, GAA (gaelic games) etc. Would be better if the hall had a separate entrance so it could be used after hours and had a separate entrance."* [D&B T]

### 7.5.3 Floor

This subtheme contains data analysed from verbatim transcripts of interviews from six stakeholders. The floor is a subtheme of the overall theme issues and contains information achieved during the data analysis stage.

Two different types of vinyl flooring were used in the school. One specification was used for the corridors and another for the classrooms. A significant number of teachers and caretakers have complained about the flooring that has been provided in the classroom space. As D&B C explained, the classroom flooring is difficult to clean and there are marks that have appeared from the dragging of chairs that will not come out. It is an issue not only for the caretaker, but also for the D&B P and D&B T2 who are working in the rooms as they feel the floor should not be that marked after the school has only been opened less than two years:

> *"The flooring in the corridor is fine it is magical stuff, but in the classrooms it is mediocre. It is getting more and more worn."* [D&B C]

> *"The flooring has been a bit of a bug bare for us. The floor is lino and you see marks, etc. on"* [D&B P]

> *"The flooring is not good. It is very poor quality. The one on the corridor is much better. There are actual sections in here where the chair has dug out marks in the floor. There are places where the floor is actually marked and it won't come out."* [D&B T2]

Due to the quality of the flooring in the classroom space not being appropriate for the wear and tear that is being inflicted on it, this has the effect that cleaners are spending longer trying to clean the floor. This then has the effect that contract cleaners are beginning to charge more to clean the floor as the time spent cleaning is increasing, which was explained by D&B T3 and D&B P:

> *"The flooring is awful. I am just amazed by the amount of cleaning that has to be done in these schools."* [D&B T3]

> *"The contract cleaners feel that they will not be able to give the floors proper justice."* [D&B P]

The floor finish has become such an issue that one school decided to put a sealant on the floor over the summer months in order to try to reduce the amount of wear and tear that was being inflicted on the flooring, as described by GRD C. This should not be required in a school that is less than two years old and is an additional expense and a drain on the schools financial resources:

> *"Flooring should never have been left the way it has. During the summer they stripped the floor and put a new finish on which helped a lot in the classrooms. Corridor always had the finish on them."* [GRD C]

As can be seen, the floor finish in the rooms is not up to the level of the wear and tear that is being inflicted on it, particularly in the classrooms which has become an issue for the caretaker who is trying to clean it. What becomes evident is that if the DoE had specified that the flooring in all the classrooms had a sealant on it then the problems with cleaning the floor of the scruff marks would not be such a problem for the caretaker.

### 7.5.4 Expenses

The subtheme *'expenses'* was drawn from the overall theme issues. It contains data analysed from verbatim transcripts of interviews from three participants; one in relation to a D&B school and two in relation to GRD schools.

As these schools are new and the technology that went into to them ensures that they are as energy efficient as possible, the schools are still complaining about the cost of running these schools. Stakeholders have indicated that these schools are more costly to run. They are still getting the same capital contribution from the DoE, as it is based on the number of pupils and not the size of the school. In the majority of cases, school sizes have increased compared to the

old school, but the subvention that they are getting from the DoE has not increased to allow for this to happen. This was explained by GRD P of one school that the costs of maintaining the school have increased significantly:

> *"All our costs have gone up including our heating and lighting. We thought we would be saving money in this new building, but it does not seem to be the case. Also, we are not getting any more money from the DoE to maintain these buildings."* [GRD P]

This was echoed by GRD BOM in another school where they felt that they need to come up with alternative ways of making sure that they have enough money to pay for utilities and services that are required in the school, which was not an issue in the old school:

> *"New school is more expensive to run. ESB (electricity) bills have gone way up. Issues are coming up in relation to the financing of the school. Now looking at different packages of getting ESB/ gas together. Bills have certainly gone up."*
> [GRD BOM]

There is also an additional cost associated with the service contracts that have been taken out at the post occupancy stage. The school has to take this out of the same budget from the DoE that they on the old school as it is based on the number of pupils in the school and not the size of the school. The new school includes a lift and additional lighting and heating requirements which was not required in the old school. The maintenance contracts for some of the mechanical and electrical equipment have also become an issue. The lift, alarms and fire alarm services are charging large fees in relation to their maintenance contracts. This has become a concern for the board of management as these increase costs are still coming out of the same budget that the old school had, and the school has no way of reducing the cost of these maintenance contracts as they are locked in for a period of up to five years. The school is new but it is still more expensive to run than the old school as explained by D&B P and GRD P. This also ties in with the increase in the cost of employing a caretaker/cleaner full time in that the budgets for new schools are not being increased but they are more expensive to maintain:

> *"Nothing has gone wrong with the systems, but we are paying a large amount in our maintenance contracts."* [D&B P]

> *"Another issue takes alarm, take the lift, take fire, they got the installation at the lowest price, but maintenance bills are particularly high."* [GRD P]

As a result, in order to pay the additional expenses they have to cut back on other items like caretaker hours of working and the cleaning that happens in the school. This reallocation of the

school budget reduces the ability of the school to use the budget to fund additional items for the enhancement of pupils learning rather than the running cost. This should not be the case, therefore, the amount of money from the DoE that provides for a new school should be increased. It is an interesting finding as it shows that while they may have the best energy efficiency in place, other items such as the service contracts eat into the overall budget as explained by GRD P:

> *"School is costly to run. BoM meeting last week gas bill, electricity bill, has to cut back. Caretaker knocked some hours off him. Have to employ full-time caretaker now."* [GRD P]

Finally, due to the fact that the school is larger now compared to the prefab accommodation that existed in a lot of school along with additional rooms for learning support, doctor's surgery and library the cleaning of the school has become a more costly undertaking. The schools are now paying for a caretaker/cleaner full time, due to the funding being based on the number of pupils in the school rather than the footprint size of the school this is now a costly undertaking compared with the running of schools that consisted of a number of prefabricated building. This could become a greater problem as more schools are being built whereby more caretakers/cleaners will need to be employed full time, thus diverting funding from other areas such as equipment and technology to support the education of pupils. This was explained by the GRD BOM as cleaning is now provided by a company rather than local people from the area:

> *"Cleaning the school used to get people in to clean old school, but because bigger had to employ someone."* [GRD BOM]

*7.5.5 General*

There were a number of issues that fell in under the subtheme general. It was established that these issues were diverse in nature and were what individual stakeholders required from the school and were not what the school as a whole requires. That is why this subtheme was not investigated any further.

## 7.6 Implication of findings from the post occupancy stage

Figure 7.8 demonstrates the overall themes from the literature, the subthemes from the data analysis and the findings from the data analysis in relation to the post occupancy stage of school project.
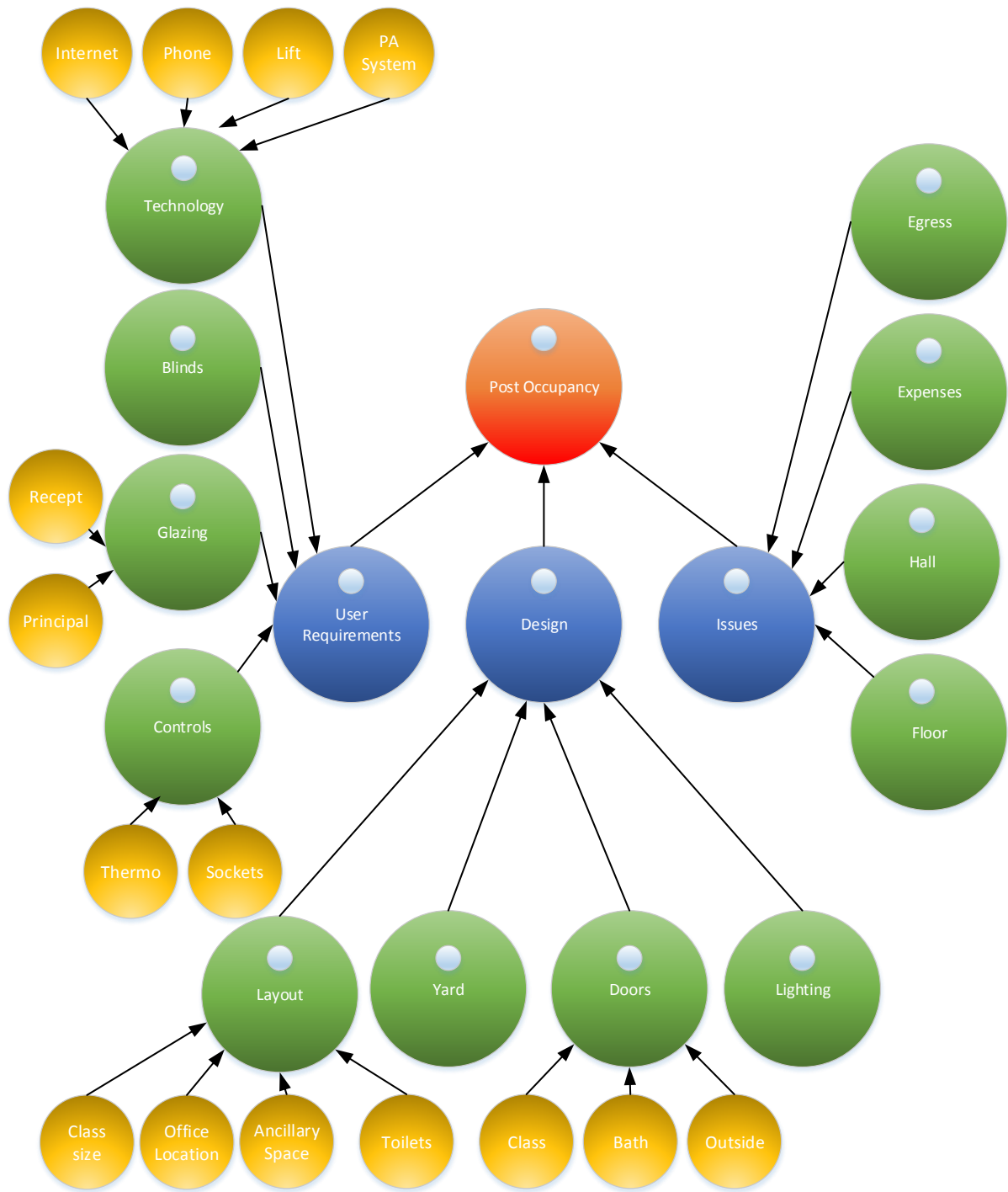
**Figure 7.8** Nodal tree at post occupancy stage of schools

Table 7.2 shows there are a number of findings that need addressing in relation to the post occupancy stage of a school project if true VfM is to be achieved. As can be seen, while they could all be considered minor in nature, when they are all taken into account, they can have a significant effect on how VfM is achieved on these projects. Each theme will be discussed separately below in order that better VfM can be achieved in relation to these projects.

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**Table 7.2** Post Occupancy stage findings

| Themes from Literature | Subthemes from Data Analysis | Findings |
|---|---|---|
| User Requirements | Technology | <ul><li>The internet connection is slow and unreliable</li><li>Mobile phone coverage is bad in certain areas</li><li>Lift issues with type and ability to repair it</li><li>The public address system needs to be looked at</li></ul> |
| | Blinds | <ul><li>Unfit for purpose</li><li>Blackout shades required in all classrooms</li><li>The design team put blackout shades in areas that did not require them and did not put them in areas that needed them</li></ul> |
| | Controls | <ul><li>Temperature controls in each classroom is not a requirement</li><li>Sockets required in classrooms as extra technology devices are used</li></ul> |
| | Glazing | <ul><li>Reduce the amount of glazing in the reception area</li><li>Make some of the reception area glazing opaque</li><li>Change the size of the window in the principal's office so can view yard while sitting at a desk</li></ul> |
| Design | Layout | <ul><li>Classroom size needs to be tailored to the age of pupils</li><li>Location of principal and admin beside each other discussed</li><li>Ancillary space is lacking as the increase in the number of pupils</li><li>Staff toilets need to be located close to the staffroom</li><li>In general teachers are female this needs to be reflected in the number of female toilets</li></ul> |
| | Yard | <ul><li>The orientation of the building not taken in consideration</li><li>Location of yard to take advantage of the sun</li><li>Size of yard as play is an important aspect of learning</li></ul> |
| | Doors | <ul><li>Doors between classrooms invaluable</li><li>Door bathroom facilities in senior classes</li><li>Doors from classroom to outside space would be a welcome introduction</li></ul> |
| | Lighting | <ul><li>Lighting in classroom space remains on for too long</li><li>Outside lighting on too long at night</li></ul> |
| Issues | Egress | <ul><li>Fire drills need fine tuning</li><li>Exit and entrance to school</li><li>Suggestion is to place an exit door in classrooms downstairs</li></ul> |
| | Expenses | <ul><li>Running cost increase</li><li>Service contracts, expensive</li><li>Cutting caretaker hours</li></ul> |

|  |  | • Issue with increase in cleaning costs |
| --- | --- | --- |
|  | Hall | • Storage space lacking in the hall<br>• The size of the hall is too small neither a sports hall or a large meeting area |
|  | Floor | • Specification in relation to flooring corridor and classroom<br>• Issue with cleaning and maintenance |

The findings that can be drawn from user requirements include under the subtheme *'technology'* the internet connection needs to be addressed. As set out in the pedagogical brief for schools (Department of Education, 2012a), the use of the internet is becoming a fundamental part of all pupils' education and needs to be taken into consideration when planning any new building. The phone system also needs to be addressed as teachers are using mobile phones in classrooms and are not using the in-house phone system, which has been installed in each classroom. The specification of the lift installation also needs to be changed as all end user's stakeholders are complaining about the lift. The *'blinds'* also need to be addressed whereby a checklist of the room and where the sun is coming from into the building in order for a more informed decision about whether blackout shades are required or not should be put in place. Also, individual temperature *'controls'* in each of the rooms is not identified as a requirement as schools prefer one person to be individually responsible to change the temperature in the rooms. A user manual to that effect should be tailored to each stakeholder's perspective to explain to them in simple terms the heating system and how it is controlled. In addition, the number of sockets in the classroom space need to be increased as the teachers are using more and more electronic devices within the space. Finally, the *'glazing'* at the reception area needs to be reworked in order to take the receptionist/administrators needs into consideration in order that some privacy is still maintained within the space. As stated by Muhlebach (1998), in order to remain competitive a building or property manager must listen and respond to tenants' needs, concerns, expectations and opinions, and must use this information to quantify performance and compare with best practices. By using this information going forward on school building projects then enhanced VfM can be achieved.

Under the theme of design, a number of areas need to be addressed for true VfM to be achieved. The *'layout'* of the internal space needs a few adjustments, particularly the size of the classroom space. In so doing there should be an ability to increase the overall size of the senior classes. To do this the size of the junior classes can be reduced which at the present time is very large for the size of pupils, the desks and the chairs that are in the classroom. As can be seen from Table 7.3 pupil teacher ratios are increasing which requires more space in the classroom itself.

Departmental statistics revealed that more than 120,000 children, or 23.5 per cent, of primary school children in mainstream schools were in classes of 30 or more in the last school cycle. In certain local authority areas that percentage was closer to a third, with 31.5 per cent of primary school pupils in Wicklow and 30.6 per cent of those in the Limerick County Council area in classes of 30 or more pupils (Department of Education and Skills, 2016d). All of this means that the DoE may have addressed the future need of classroom space for the junior cycle classes but they have not addressed the future needs of the senior cycle classes which cannot cope with not only the size of the pupils but also the size of their desks and chairs within the classroom space.

Table 7.3 Pupil teacher ratio and average class sizes in national schools (Department of Education and Skills, 2016d)

|  | 2014/2015 | 2015/2016 |
| --- | --- | --- |
| Total enrolment in all national schools (at start of school year) | 544,696 | 553,380 |
| Total number of allocated posts (as at 30th June in the given school year) | 33,613 | 34,576 |
| Pupil teacher ratio in all national schools | 16.2 | 16.0 |
| Total enrolment in mainstream classes | 532,932 | 540,955 |
| Teaching teachers of mainstream classes | 21,419 | 21,724 |
| Average class sizes in mainstream classes | 24.9 | 24.9 |

The increase in the number of pupils in the classroom space also has an impact on the ancillary space within the building. As pupil numbers increase the additional spaces such as the library, doctor's surgery and sensory rooms are given over to the education of pupils particularly to remedial teaching. These additional rooms that can be hugely beneficial to pupils with learning difficulties are being eroded and the DoE is ignoring a section of the pupil population that requires additional support and help. Another issue regarding the design is the location and number of staff toilets. The majority of teachers in Ireland are female and as can be seen from Figure 7.9 the ratio of males to females has steadily declined over the last thirty years. In the 1970s, approximately 30% of teachers were male, this reduced to 25% in the 1980s and has further reduced to approximately 18% in 2005 (Department of Education and Skills, 2006). However, in the design of primary schools the number of male and female toilets has remained the same. This needs to be tackled going forward in order that there is an increase in the number of female toilets in the school. The location of these toilets also needs to be taken into consideration in order that they are located in close proximity to the staff room. This is due to the fact that teachers only have a limited break time and when toilets are located at the opposite end of the building to the staff room it is difficult to do both during break times.
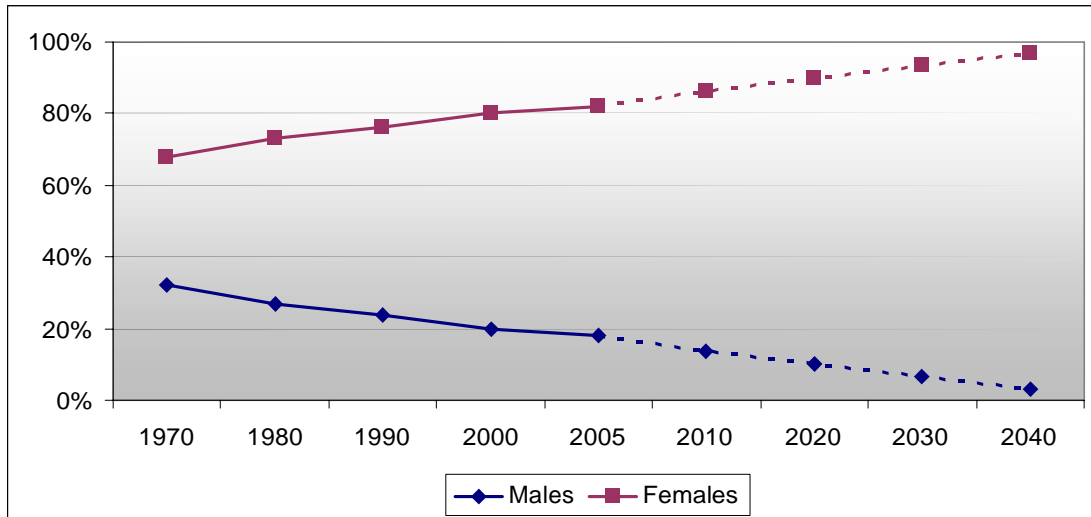
**Figure 7.9** Projected trends in the number of male and female primary teachers (Department of Education and Skills, 2006)

The orientation of the schools on the site also needs to be tailored to the particular site as much as possible. It appears these buildings have just been placed on the site with no attention to how the sun or wind can affect the classroom space. The design of the *'yard'* space also needs to be taken into account in order that pupils can spend as much time as possible playing in the yard (INTO, 2007). Also under the theme of design the *'doors'* need to be included in all classroom space between rooms to allow teachers to use the assistance of the teacher in the next classroom if required. These doors have the potential to create increased VfM than just the doors themselves as teachers get a sense that how they work and interact with each other was taken into consideration. In addition, teachers will feel that they are not alone in their classroom space when an issue arises. The *'lighting'* inside and out needs to be adjusted in order that it does not stay on all the time, which has potential to save money in the long run. As stated by Whyte and Gann (2001) by measuring occupants perception of the design against original design intent ensures that VfM can be achieved in the future design of school buildings.

Under the theme of issues how people *'egress'* the school needs to be assessed as pupils are using the fire exits at break times. Fire drills need to be established in order to evacuate the school within a reasonable time. This should be carried out in conjunction with the fire officer and explained to the staff within the school. One point to observe in relation to the new schools is that the schools are more expensive to run. They now have lifts, fire alarm system, burglar alarms that are on service contracts. This needs to be taken into consideration as schools are bigger and an allowance needs to be included to pay for these additional *'expenses'* that were not in the old schools. Therefore, an additional allowance needs to be obtained from the DoE

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for new schools. One factor than needs to be addressed is the *'hall'* space. Hall space also needs to be addressed as stakeholders find that it is neither a gym nor a hall. The space needs to be increased in size in order for it be used more wisely and facilitates being divided so that two classes could use the space at the same time, thus reducing the overuse of the space and the inability of teachers to book the space at certain times. Finally, the specification for the *'flooring'* needs to be upgraded in the classroom space to match the flooring in the hall space. The specification was higher in the hall space, but the additional cost far outweighs the cost of cleaning, maintaining and changing the flooring in the classroom space, which is not up to the wear and tear that is inflicted on it. These issues might be minor in nature but as Way and Bordass (2005, p. 134) put it *'users occupying new buildings just want to get on with their lives and their business. If teething problems become embedded, even if minor and correctable, irritation and dissatisfaction increase dramatically'*.

The changes discussed have the potential to create better VfM in the school building programme in Ireland. In addition, none of these changes represents a significant cost to the school nor the DoE but do provide ways in which a more holistic approach to VfM can be realised.

## 7.7 Summary

At the post occupancy stage a number of issues have emerged for stakeholders following daily use of the school. The majority of the areas are in the classrooms where the heating, shades/blind and technology are issues. In relation to the design, it appears that if stakeholders were queried then the layout, the doors and the yard arrangement may have been improved. Under the theme of any additional issues, some of these might not have become issues if stakeholders had been consulted before work started on site. What can be drawn from this is that all stakeholders at the post occupancy stage should be consulted during the design stage and construction stage in order to make them more informed of how the design comes together and how it is perceived to work in practice in order for true VfM to be achieved. What can be derived from the findings is that there are still issues that need to be addressed in relation to the design of primary schools in Ireland. While none of these areas are major, they can result in bigger problems if they remain in the design of future schools, which can significantly affect whether VfM is being achieved. The next chapter brings together the findings that have been discussed in the previous chapters, which are discussed through a diagrammatic interpretation

of the findings, to facilitate enhanced VfM being realised on the school building programme in Ireland going forward.

# Chapter 8 Discussion

## 8.1 Introduction

In this chapter the key findings from the various stages of the research are presented. In order to facilitate this a model of the recommendations to the DoE is produced which should improve VfM in school projects in Ireland. The development of these recommendations is based on the literature review and the qualitative data collected through semi-structured interviews. Even though this model is for the provision of primary school accommodation in Ireland it can equally be applied in the provision of secondary school and to a lesser extent to third level accommodation. Following production of this model the chapter then goes on to discuss each of these recommendations, which are divided into three sections. The first section is concerned with achieving VfM on the school building programme in Ireland be they GRD projects or D&B projects. Secondly, the hard side of VfM and how it can be enhanced are considered, which is followed by the third section that focuses on the soft side and ways of enhancing VfM from this position. By concentrating on the themes that emerged from the data analysis stage a more holistic view of achieving VfM can be achieved going forward on school projects.

## 8.2 Model explanation

The aim of the model presented in Figure 8.1 is to provide a coherent and comprehensive interpretation of the findings that have emerged in order to attain VfM on school building projects in Ireland. The main benefit of the model is to the DoE in providing a useful guide in the processing, assessing and planning of school building. In addition it highlights the key factors that need to be taken into account in evaluating how VfM can be achieved on the school building projects.

The centre of the model explains that this research is concerned specifically about achieving VfM on the provision of school accommodation in Ireland. The general recommendation in relation to the provision of schools indicate that there are some general areas of concern about the school building programme that need to be addressed initially, before more detailed recommendations are addressed. Once this is attained there are also some broad outcomes about the benefits and barriers to using the two different procurement methods in the provision of school accommodation, be that GRD or D&B. Whether school projects are constructed using

the GRD or D&B procurement method what has been established is that attaining VfM can be further broken down into hard problems and soft problems. Hard problems are in relation to the building itself, which soft problems are the people using and constructing the building. By appraising the hard problems side, what has emerged is that this distinct area, be it at the construction stage or the post occupancy stage, has defined boundaries around it hence the need to include a box around the themes that have emerged. These fields seem to be boxed off by the DoE as they are of the belief that they have offered a solution to the difficult problems of providing VfM. At the construction stage what developed from the literature is that there are three distinct themes that the DoE believe that deliver VfM on a school building project. These areas include value engineering, value management and risk management. At the post occupancy stage the themes that arose are the technical performance of the building and the design of the building. These are both areas that the DoE has taken responsibility for in that they prescribe the energy performance requirements of the building and the design of the building. It appears that the DoE are accountable for the hard problems of VfM but in doing this they are only concentrating on one side of VfM and have overlooked the soft problems. The softer problems of providing VfM on school projects also include the construction stage and the post occupancy stage. As these areas are less defined areas and more difficult to box off, it is appropriate to include a soft cloud around them rather that a hard box. There are a number of areas that emerged at the construction stage in order for enhanced VfM to be achieved. These areas include relationships between stakeholders, behaviour/attributes of stakeholders, communication, the need to identify stakeholders and sustainability of the school project. At the post occupancy stage, the areas that developed include user requirements, the design and issues with the school. Finally, the entire model is surrounded by a dotted line which demonstrates that if all of these themes can be synergised together on a school building project then a more holistic view of achieving VfM can be achieved.

This model demonstrates that the hard problems relative to VfM concern the building. This side of VfM is more straightforward and easier to assess as they have defined boundaries to them. This hard problem/building area is where the majority of the emphasis has been placed by the DoE in order to demonstrate that they emphasis VfM in the school building programme as it is uncomplicated. The opposing side of VfM is about the softer problems, which are more about the people involved in either building the school or working in the school. As this area is more difficult to define, the DoE have tended not to concentrate on this side of value. However, if this side is also considered then a more holistic view of achieving VfM can be
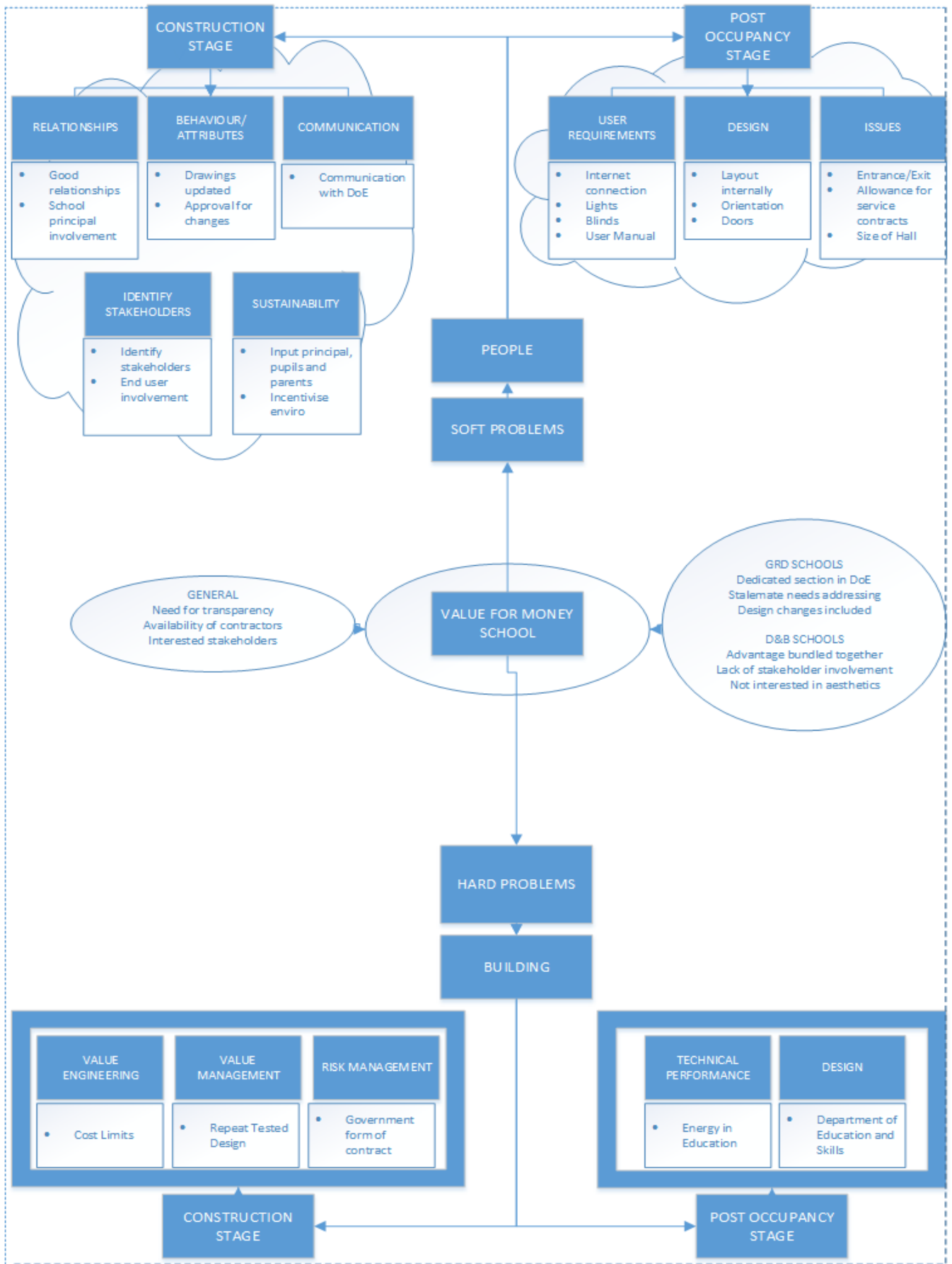
obtained on school building projects in Ireland.

**Figure 8.1** Model for achieving VfM on school projects in Ireland

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These focus areas were derived from the results obtained from the data analysis. The following sections further discuss in detail the areas of attention. It begins with the school building programme in Ireland and then concentrate on the hard problems and the soft problems of achieving VfM on schools.

## 8.3 School building programme in Ireland

Recommendations about the school building programme in Ireland include some general proposals that need to be adopted in advance of any specific proposals regarding GRD or D&B projects. Each of these recommendations will be discussed separately. In doing so, the knowledge of how enhanced VfM can be attained on the school building programme by the DoE should be achieved.

*8.3.1 Generally*

The findings that emerged produced recommendations on the school building programme generally in Ireland. This area was not specific to any type of project but contained recommendations that should enhance the ability to achieve VfM on school projects going forward. As can be seen from the model in Figure 8.1 under the general heading three areas have emerged and these areas include transparency, availability of the contractor and interested stakeholders.

Transparency
All stakeholders were unaware of why a particular project advanced to the construction stage over another deserving project. Within the DoE, there is a system in place by way of GIS mapping and information obtained from the Central Statistics Office (CSO) to track population trends and where the need exists for a new school. However, sometimes political influence comes into play where a politician in the local area can wield pressure in an area to influence which projects are given the go ahead to commence on site. The Minster for Education and Skills does publish every year a list of approved projects to go to tender stage but what is unclear is why these projects were given the go ahead in the first place. Stakeholders, particularly teachers and principals, feel aggrieved by the amount of time they had to spend pushing the DoE to approve their particular school to commence to tender stage. Going forward, it is important that the DoE puts standard procedures in place that are open and transparent when providing school accommodation. This could be achieved by simply

explaining why a particular project has been approved for the tender stage, be that the increase in need in the area, the condition of the old school or the availability of a suitable site. This would ensure that all stakeholders have an understanding of where their particular school is on the list of the provision of new accommodation and approximately how long they are required to wait for a new school. It also means that the necessity for principals, schools and communities to exert political pressure to acquire a new school building in a particular area is diminished. This information needs to be harnessed now so that political influence in certain areas is not seen as the only way that a new school will be provided. If done well it can become a vehicle to help illustrate which projects represent the best VfM options within the overall school building programme. It would also mean that schools would not have to spend time pushing the DoE to provide school accommodation in a particular area.

<u>Availability of contractors</u>
From the findings it was found that the majority of contractors carried out school building projects during recessionary times. As there was limited construction work available in any area, construction stakeholders invested countless additional time and effort into these projects in the expectation that they would gain additional work in the future. Now that the economy is starting to accelerate contractors are beginning to move away from this type of work as they do not see it as being profitable for them. Stakeholders, particularly consultants and main contractors, are of the attitude that the restrictive cost limits and forms of contract that are used on government work ensures that the DoE squeeze the contractor to an extent that these projects are not seen as being a good profit generator. This means that availability of work and the ability to produce larger profit margins in the future means that the number and ability of main contractors and subcontractors to execute this work will lessen in the coming years. It is imperative that a system is put in place to encourage contractors that are doing good work to stay working for the DoE going forward. This could include a feedback loop at the post occupancy stage where points are awarded by the employers' representative for good quality workmanship and the level of service offered by the contractor. These points could then be added to the prequalification stage on the next project that the main contractor is tendering for in order to ensure that the main contractor advances from the prequalification stage to the tender stage. Alternatively, a clause could be introduced in the contract where at the end of defects liability period a percentage reward for good workmanship is incorporated. If this was instigated it would then ensure that the main contractor would see these projects as guaranteeing workload over a period of time and would be more inclined to tender for these

projects. It would ensure that a degree of competitiveness is included in the tendering of school project work and overall VfM is safeguarded.

<u>Interested Stakeholders</u>

It was intended that this research would identify all relevant stakeholders on school building projects. However, it was found that two stakeholders can have a major impact on whether school projects are completed on time and ultimately, whether VfM is achieved. They include the fire officer and the disability officer. Additional work needs to be done in order to satisfy all requirements in relation to these two stakeholders. There have been times where individual fire officers have taken a different interpretation of codes for the same design in two different local authority areas which meant that additional work had to be executed on the particular project. As these projects are basic standard designs, the ability of a fire officer in one jurisdiction to change the requirements should not be acceptable. When a fire officer does not sign off on the building this means there is a delay in the completion of the project, which ultimately results in higher costs associated with making the required changes to the design and has the potential impact that it delays the school opening. This, in turn, erodes the potential for achieving a successful project from VfM outlook. In order to resolve this, a decision needs to be taken at the DoE level to ensure that the design meets standards and codes before work commences on site. Discussions also need to take place between the DoE and fire officers so that an agreement can be reached so that complications do not occur going forward and that agreement is put in place for all schools that are constructed using the standard design. At a local level, fire officers and disability officers need to be brought into the project at an early design stage to ensure that if they do not have any issues with the design they are resolved before work commences on-site. The effect of this would be that changes can be made at the design stage will cause minimal disruption, cost and time to the project ensuring that VfM is achieved.

### 8.3.2 GRD projects

What materialised is that using GRD or D&B to procure a project is dependent on the DoE. No one procurement option is superior to the other but there are some areas that need adjusting in order for improved VfM to be accomplished on GRD projects. These areas include providing for a dedicated section in the DoE, eliminating the stalemate that exists and including any design changes to the standard design.

## Dedicated section in DoE

One of the recommendations for achieving enhanced VfM on GRD projects is ensuring that there is a dedicated section within the DoE to deal with any issues and questions that may be raised in relation to constructing a project. It was established that the DoE does not like to relinquish full control of the project to the design team. The consequence of this is that the design team at times feel constrained in that they cannot make a decision without first gaining approval from the DoE. What has been found is that gaining that approval can take time as there are numerous people in the DoE responsible for different issues. If a dedicated team within the DoE was accountable for each individual GRD project, then this would ensure that decisions were made swiftly and efficiently. It should also be a requirement that each team have an agreement as to who is responsible for making what decision within the DoE, and this should be explained to the main contractor and the consultants in order that they are aware of who is responsible for which area on the project. This should ensure that the frustration that consultants and the main contractor experience about the project are eliminated and downtime spent trying to get the person responsible in the DoE to make the decision is reduced. Alternatively, the decision could be given to the employers' representative while on site to make any decisions that are required on the project without having to gain approval from the DoE. By either instigating a dedicated team in the DoE or relinquishing control to an employers' representative, standard and repeatable procedures are put in place for effective sharing of information, thus ensuring that these projects are valued by the DoE and that the frustration when dealing with the DoE is eliminated.

## Stalemate

At the present time there is a stalemate between the DoE and the consultants and contractors that are involved in these projects, which needs to be addressed. This involves a legacy issue where the Building Control (Amendment) Regulations (Statutory Instrument, No. 365 of 2015) provides for a much more intensive system of monitoring and control of certain building work. The new regulations requires mandatory design certification, lodgement of plans and particulars, builders' supervision and certification and mandatory inspection by an appointed assigned certifier. There are a small proportion of projects where consultants are not being paid to carry out these additional roles as they tendered for work before these regulations came into place. It may be considered a minor issues but the consequences are that there is tension between some consultants and the DoE. This has the potential that some consultants will move away from tendering for school project work in the future as they do not see the DoE as being

fair and reasonable with them. If proper VfM is to be attained then consultants need to be compensated for the additional role that they are taking on in order that this tension is eliminated.

Design changes included

On GRD projects the design is set and the documents are given to the design team. The only changes that are required to be made to the design are fitting the design to the footprint of the site. This should only involve the design of the substructure, siteworks and site services piped and ducted. The rest of the design should remain the same. However, it has been found that consultants have been required to make changes to the design. Sometimes these changes are minor as some details are not shown on the drawings. Making these changes is difficult as the DoE are of the opinion that there are no issues with any of the drawings, the design or the specification. A system needs to be put in place such that any issues with the information that is provided by the DoE is explained to them by the employers representative at the design stage (normally the architect) and any relevant changes are made to the design. Going forward, when GRD drawings and information are issued these design changes should then be included. This would ensure that the design is being constantly updated so that it finally gets to a stage where there should be no issues with it. Finally, over a period of time the design then needs to be reissued so that all changes and any areas of concern are taken into consideration. By undertaking this, even though the design is standard, enhanced VfM is being achieved as any issues or changes are incorporated in the design and it is not waiting until projects get on site before changes are made to it.

### 8.3.3 D&B projects

As mentioned earlier, using the D&B method and the GRD method of procuring a school project each have their own merits when used in certain situations. However, in order to ensure D&B projects realise VfM a number of recommendation should be adopted which includes bundling schools together, stakeholder involvement and the aesthetics of the school.

Bundling Together

On D&B projects a number of schools are bundled together to ensure that the projects are large enough to sustain the interest of main contractors in tendering for these projects. It appears that main contractors see this bundling together as an advantage as they are guaranteed work over a period of time. What needs to be investigated further is the composition of this bundle so that

it is large enough to sustain the interest of main contractors but not too large that it erodes competition in the marketplace. As stated earlier, the attractiveness of these projects is diminishing with an expanding construction market so bundling together ensures that consultants and main contractors view these projects as an opportunity to be guaranteed work over a period of time. This in turn then ensures that competiveness is maintained in the marketplace so that VfM is still achieved on school projects.

Stakeholder Involvement

On D&B school projects what has been established is that end user stakeholder involvement is not encouraged during the construction stage. However, from the literature it has been established that by involving end user stakeholders at the construction stage this, in turn, means that they take ownership of the school building before they begin working in it. By taking ownership of the building end users are predisposed to sense that everything was done at the construction stage to enhance the school building and the spaces that they use within that building. It also means that as each school project is part of a bundle, knowledge can be gained from one project to the next from the end users. From the perspective of end users, this means that they gain an appreciation of why certain decision are made, be they due to budget constraints, time constraints or specification constraints. When end users are consulted they then are less likely to complain about issues once they take ownership of the building and they have a greater understanding of why certain decisions about the school were made. To achieve this, a designated consultant should be required to liaise with the end users in a constructive way during the construction stage. Rather than not paying attention to them they need to become a constructive member of team at the construction stage which can be done by meeting a representative end user on site once a month to explain in simple terms, what is happening and why. This representative could also use this opportunity to make suggestions at the construction stage that might further enhance the school once complete. Alternatively, a summary report could be emailed to end users on a monthly basis explaining what has happened during that month and why certain decisions have been made. This also needs to be a two-way system where suggestions that have been made by end users and not implemented are explained.

Aesthetics

The aesthetics of D&B schools is one area that is not taken into consideration at all in the building. Each stakeholder has a different objective. All the consultants are concerned with is getting these projects completed on time in order to receive their fees. The main contractor is

concerned with getting these projects to the required quality standard and the DoE are interested in making sure that the costs do not exceed the cost limits that have been set by them. At no stage in the process is the aesthetics or the merits of the design explored. This should also be a requirement as these are buildings that are invested in a community and can potentially have a massive role to play in that community. To achieve this, before school projects are submitted for planning permission, they should be displayed in the community to interested parties. In this way, any suggestions that could be done to enhance the community spirit of the project could be incorporated in the design. This could be simply changing colour of the outside elevation to incorporate the local team colours or the provision of local stone for the walls along the entrance to the school. This has the potential then to give the community a sense of ownership of the building as there is a sense that the school was tailored in some small way to their specific community requirements.

## 8.4 Hard problems

The findings suggest that there are several factors that impact on whether VfM is achieved on a school building project. What are referred to as the hard problems at the construction and post occupancy stage concerns the building itself. This is the area that the DoE have focused on as it has defined boundaries of what it is regarding and it is more tangible in nature. However, there still are a number of recommendations to the DoE, which could enhance VfM in this hard area. Once the DoE has developed an understanding and addressed these recommendations then there is the opportunity for them to benefit from the improvement it creates in providing VfM on school projects.

### 8.4.1 Hard problems at the construction stage

At the construction stage the hard problems include those associated with value engineering, value management and risk management. The findings on each one of these areas will now be discussed.

<u>Value Engineering</u>
The DoE has concentrated on the delivery of function in relation to cost in order to achieve VfM. To do this, they provide cost limits for primary schools, secondary schools and third level facilities. The issue with providing cost limits is that the DoE achieve cost certainty rather than VfM. When a VE exercise is carried out on an item then a narrow interpretation of what VfM

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is presented, as the concern is about capital costs rather than operating costs. Indeed, the public works contract (Public Works Contract PW-CF1 V1.10, 2014; Public Works Contract PW-CF2 V1.10, 2014) reinforces this stance when they state that if the contractor gives the employer a written VE proposal, then that proposal should either reduce the contract sum or accelerate the execution of the works. At no stage in the contract does it state that a VE proposal could reduce the overall life cycle cost of the building. This is a missed opportunity as by increasing the cost of certain materials and elements at the construction stage, this can lead to lower maintenance, replacement and servicing costs in the long term. In essence, this requires that the budget that is allocated for the capital costs and operating costs are combined so that an increase in the construction budget could cause a decrease in the operating yearly budget. In order to do, a VE proposals could be made to the DoE by the main contractor or the consultants before work commences on site and agreement reached about the increase required in the construction budget if required to execute the work. If this was implemented then VfM would be investigated from the inception to the completion stage rather than just at the design and construction stage of a school building project.

Value Management
VM ensures that the design solutions evolve in accordance with the clients objectives. By prescribing the design the DoE is ultimately guaranteeing what their objectives are and how the design can be interpreted by the consultants and the contractor. Not only does the DoE prescribe the design of the school, but they also prescribe the specification for materials in the building. In doing this the DoE eliminate the ability of the consultants to make suggestions and recommendations that can enhance the school building. The DoE also does not engage the end users about whether the design solution achieves their objectives for the building. A recommendation is that once a year, either a structured POE or some form of feedback from end users is carried out on all completed schools. This should not be just be a "tick box" exercise but actual interviews with the schools in order for them to make suggestions on what is working and crucially what is not working in the school building. This can then be brought back into the design brief so that continuous improvement in relation to the design is achieved, which fulfils the end users objectives using the space.

Risk Management
At the construction stage in order to ensure that VfM is achieved, the DoE are reducing the amount of risk that they are willing to take on. They achieve this as they require the contractor to use the government form of construction contract. By the contractor signing this contract,

the DoE are ensuring that any variations and extras on the project are kept to a minimum. This contract is quite onerous on the main contractor as they are required to take the responsibility for a variety of risks on the project that are normally the responsibility of the client. It is clear from this that in order for risk management to be achieved the DoE are using the government forms of contract. As the main contractor is required to price for certain risks that they do not normally take on, the DoE are realising cost certainty but not VfM. As the amount of private work increases in Ireland, contractors are unwilling to tender for public work due to the onerous requirements in relation to including all risks in their tender. To prevent this from occurring, a revision needs to be made to the government form of construction contract so that there is a fairer allocation of risk on a construction project. If this does not happen, contractors will begin to start to price for all the risks that they are asked to include, which erodes how VfM is achieved on all government work and especially school building projects. In the short term, the DoE needs to ensure that only the risks that should be apportioned to the contractor are apportioned to them. This will in turn alleviate the need for the main contractors to manage and price for certain risks that they should not be pricing for.

### 8.4.2 Hard problems at the post occupancy stage

As well as hard problems of achieving VfM existing at the construction stage, there are also some hard problems that need addressing at the post occupancy stage. These include the technical requirements of the building and the overall design of the building.

Technical Requirements

The DoE has a section within the department that investigates technologies that can be introduced into school buildings. It should be noted that they do not include all technologies within the building as the schools, as unlike other buildings the schools are only occupied approximately nine months of the year. This means that certain technologies would be of no benefit in a school setting. As consultants and the main contractor are involved in the design and implementation of new technologies into buildings, they should be consulted about what can work from a school perspective. Moreover, the end users should also be consulted about the running cost of particular equipment and how these technologies work within the building. If this is accomplished, then potentially enhanced VfM can be achieved from project to project.

Design
As can be seen from Figure 8.1 at the post occupancy stage the design has a box around it. This implies that nothing can be done to chance or make suggestions about the design. Again, any suggestions or knowledge that has been gained from using the building needs to be included on the next project. As stated earlier the harnessing of this knowledge can be achieved by introducing a POE when end users have been embedded in the school for over a year. Any knowledge gained about how the design works and crucially what does not work, can then be collated together for all schools on a yearly basis and relevant suggestions implemented into subsequent designs as required. This guarantees that going forward the design and specification are produced with not only the overall cost in mind but also with VfM in mind.

## 8.5 Soft problems

Soft problems is the area that has not been concentrated on when endeavouring to achieve VfM on school projects. The perception from the DoE is that once the building has been considered from the hard problem side then VfM has therefore been addressed. This is not the case, as the research suggests, the soft problems of achieving VfM should also be included. If you only look at the hard problems then the same answers are always achieved, in that answers will always revolve around the cost aspect of certain items within the building. The soft problems in relation to providing school buildings include stakeholder satisfaction, behaviour and attributes of stakeholders, identify stakeholders, communication between stakeholders and sustainability. Fundamental to this is the inclusion of the people who are building and ultimately, using the finished school on a daily basis.

### 8.5.1 Construction stage
At the construction stage of a school building project in order to achieve VfM the softer problems also needs to be addressed by all stakeholders involved. The model (Figure 8.1) shows that there are also a number of soft areas at the construction stage that can augment the hard problems of achieving VfM. These areas include relationships, behaviour/attributes, identifying stakeholders, communication and sustainability.

Relationships
A good working relationship between all consultants working on these projects has been achieved, which enhances achieving VfM. However, this good working relationship is in part due to fact that consultants have been working on these projects for a considerable period of

time together. This has happened as the projects have been slow to advance through the stage in the school development process. It appears that by bundling schools together and constructing them using the D&B method, this enhances the ability of the main contractor and the consultants to develop a good working relationship. Going forward, it appears that by using the D&B procurement method rather than GRD, a good working relationship is achieved as consultants work together on a number of projects. If a good relationship is to be achieved on D&B projects, then one aspect needs to change which is a good relationship also needs to be encouraged with the school principal at the construction stage. It can be seen that having some end user stakeholder involvement ensures that enhanced VfM is achieved. A system needs to be established on D&B projects that keeps the principal of the school informed of decisions made at the construction stage. Again, this can be done by involving the principal in the site meetings; however, if this is not practicable then a system needs to be set up to encourage information flow about the project to the principal. At the other side, suggestions or proposals by the principal should also be taken into consideration by the consultants and the main contractor at the construction stage of the project.

Behaviour/attributes

One aspect of GRD projects is that even though the design is set by the DoE, the drawings still need to be updated due to small errors or missing information. The procedures to deal with this in the DoE in relation to updating these drawings are currently not in place. As indicated earlier, the provision of a dedicated section within the DoE to deal with not just D&B projects, but also with GRD projects should see the frustration of dealing with different sections in the DoE diminish. By providing this section in the DoE, it again enhances achieving VfM as it reduces the amount of time waiting to gain approval for changes to the drawings.

Identify stakeholders

It is imperative from a VfM perspective that all stakeholders that can have an influence on the project are identified at the construction stage. As stated earlier, the fire officer and the disability officer can have a significance influence on the overall smooth running of the project and therefore, need to be identified not only by the consultants and the main contractor but also by the DoE and brought on board at an early stage. This has the potential to identify issues that can have an influence on whether VfM is achieved or not. Another stakeholder that can have a massive influence on whether VfM is achieved once the school is occupied is the end user. Their involvement in the construction stage of the school needs to be encouraged. As stated earlier, if the principal is involved in the construction stage then any potential problems or

issues with the construction stage are explained to the principal. This information also needs to be explained to the end users so they get a sense that their decisions are also taken into consideration at the construction stage. This could be achieved by conducting monthly meetings between the staff and the principal with a representative of the main contractor and the consultant present to explain what is occurring and why. End users then feel that even before they move into the building everything was done to enhance achieving VfM on the school project.

Communication
Communication between the DoE and all consultants on the project needs addressing. If this is achieved then all stakeholders are of the opinion that there is a collective engagement with the project by the DoE and that they are dedicating time to this project thereby ensuring that VfM is achieved. It should be noted that this was difficult in recessionary times due to the embargo on new staff entering the DoE, which had the effect that the DoE itself were overstretched and not having staff available to dedicate to a school project. To compensate for this, people were drafted in from other government departments who did not have an understanding or experience with building work. This embargo on recruitment is beginning to ease so that experienced people should be introduced to the DoE which ensures that people with relevant experience are working in the DoE and who have the ability to make informed swift decisions on any issues that develop at the construction stage. If this happens, then communication should again begin to flow more swiftly; this ensuring that enhanced VfM is achieved.

Sustainability
From a sustainability outlook, the social aspect is important in order to achieve VfM. As stated earlier, end user involvement is required for enhanced VfM to be achieved. This also needs to be encouraged at the construction stage so that the school is embedded in the community that it is being constructed in. This can be achieved at the construction stage by allowing the pupils, teachers, and parents to feel part of the construction process. There are a number of ways to achieve this, which include the main contractor spending time with the pupils and teachers explaining to them about the project and how they are part of the project. One idea that was produced by a principal of a school was for pupils and parents to help move furniture and books into the new school. Another example would be the main contractor and the consultants funding some part of the pupil's school activity for example, the Christmas play or school sports day. This ensures that the pupils, parents and community at large feel part of the construction process and there is an early sense of community about the project before it is completed. The

sustainability of the project in the community is realised thus, ensuring VfM is achieved. Another aspect of sustainability is the environmental side. The main contractors and consultants also need to be encouraged to develop enhanced environmental aspect of the project. This is particularly the case as the environmental aspect of materials and technology is advancing at a growing pace and the person best able to make suggestions about a particular material or technology is not always the DoE, but can also be the consultants and contractors that are working everyday on construction projects.

*8.5.2 Post occupancy stage*

At the post occupancy stage of a school project the softer problems from a VfM perspective also need to be addressed to ensure a more holistic view of VfM is achieved. What has become clear is that the end users at the post occupancy stage are often ignored. The school is built for them and at no stage is there communication with them about how the building is working for them and more importantly what is not working for them. When end users are consulted then additional work carried out at the post occupancy stage can sometimes be avoided which ensures that VfM is achieved at the outset of a project that is being undertaken. The areas that have emerged at the post occupancy stage include user requirements, the design and issues with the school building.

<ins>User Requirements</ins>
A number of user requirements need addressing in order to achieve enhanced VfM. These include ensuring that good internet connection exists in the area that the school is being built in before work commences on site. Internet connection is normally very good in inner city areas and towns, but in rural school locations or in some deep valley sites the internet connection can be an issue. It should be a fundamental requirement for all consultants that internet connection is sufficient and if it is not then steps are taken at the construction stage to ensure that additional work is not required once the building is occupied to upgrade the system. By undertaking this the additional expense of upgrading the internet could be avoided at the post occupancy stage. Another user requirement is to ensure that black out blinds are installed in rooms that require them. This is something that was neglected at the construction stage as blinds were not investigated for their suitability in a particular room. What is required at the construction stage is to ensure that black out shades are used in rooms that actually need them. If this can be achieved then additional expense is not required once the building is occupied and it ensures that end users get the sense that their user requirements and the way they use the

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space were taken into consideration. Finally, individual temperature controls were installed in rooms but end users do not use them as they were not instructed how to use them. The same can be said about the length of time that the lights stay on outside the building and in the classroom space once it is not occupied. In order to rectify this, a user manual needs to be produced that is tailored to each type of stakeholder be they administration, teaching or back up staff. By tailoring an individual manual to each end user, this again gives these end users a sense that their individual requirements are taken into consideration and VfM is achieved.

Design

The DoE need to discuss with stakeholders at the post occupancy stage the practicality of the design to ensure that what the DoE considers should work for end users actually works for them. If this was considered then changes may have been made to classroom spaces. The DoE are of the opinion that all classroom spaces need to be of the same size, otherwise teachers may have an issue that another teacher's space is larger than theirs. What has been found is that teachers discussing this concept are of the opinion that you should be able to reduce the size of junior classes in order to make the size of the senior classes larger. This can easily be done and is something that the DoE have not even considered. By undertaking this, again teachers get the sense that the design is becoming tailored to their requirements and thus enhanced VfM is achieved. The same can be said in relation to the orientation of the school. Many stakeholders at the post occupancy stage are of the attitude that the orientation of the building did not take the weather conditions into consideration as school yards have been placed where the sun does not get to them. Design decisions were taken by consultants to position yards in a location without taking the orientation of the building into consideration. In some schools this means that the yard does not get the sun in the morning so the space cannot be used during the winter months due to the ice. The consultants at the design stage should endeavour to position the yard space in a suitable location to ensure that it can be used as much as possible as play is becoming a fundamental part of the school curriculum. Finally, another simple solution to the design of the school that emerges from the findings at the post occupancy stage, is in relation to the doors between classrooms. Stakeholders are of the opinion that doors between classrooms ensures the efficient flow of the day, as if an issue in a classroom space it is easy to open the door and get the assistance of the teacher in the adjoining room. By ensuring all of these design issues are addressed, this ultimately enhances the end users sense that VfM is achieved on the school project.

The findings also identify additional issues that can erode how VfM is achieved. This includes how the pupils enter and exit the building. During fire drills the system means that upstairs pupils and downstairs pupils meet in the corridor and all exit the same doors. A procedure needs to be put in place by the fire officer in the region to explain how the fire drills will work in practice which is tailored to each school. This needs to be done in conjunction with the teachers in the classroom where it is explained to the fire officer how junior classes exit the classroom is different to how the senior classes do. At the present time, fire officers are unaware that there is an issue with the fire drills in the school so the problem is compounded from the design of one school to the next. Again, this is eroding how VfM can be achieved in the building as the pupils using the space have not been given the attention it deserves. Awareness by the DoE also needs to be achieved to justify why an additional allowance has not been included in the allowance that is paid to the school for the operating costs. An additional allowance, should be included to pay for the servicing and maintenance of equipment that was not required in the old building, for example lift installation. In providing this additional allowance it ensures that the schools are not taking from other budgets to pay from these additional expenses. Finally, the additional space requirements within the school need adjusting. The requirement is that the size of learning support rooms, sensory rooms, doctors/nurses spaces and particularly the hall space are all increased. In the foreseeable future the size of classroom spaces will not change unless pupil/teacher ratios are increased. What will change, however, is the amount of additional support and help that is required in some schools, but no future allowance has been made for these additional spaces. What is happening at the present time, as the number of pupils increase in school, is that these additional spaces are being taken over for mainstream education. It is now getting to the stage that in some cases prefabricated buildings will be required which means that an additional outlay of funding to rent these buildings will be required. This is a design consideration that the DoE needs to address going forward in their standard design of school buildings so that the allowance for additional space is increased.

## 8.6 Summary

This chapter has presented a model of recommendations for achieving a more holistic interpretation of VfM on school building projects specifically at primary level. It highlights the need to focus on some key areas in order to achieve a more holistic interpretation of what VfM is. It recommends that as well as looking at the hard problems of the building the soft problems

which relate to the people also need to be taken into consideration. The recommendations should assist the DoE to create a more holistic understanding of VfM in order that all stakeholders as well as the building itself, are considered. The next chapter presents the conclusions and recommendations that have emerged in relation to the research, in addition to the contribution to knowledge, limitations and areas of future research.

# Chapter 9 Conclusions and recommendations

## 9.1 Introduction

The aim of this research was to evaluate how VfM can be achieved from a government's perspective in relation to school building projects in Ireland. This chapter reflects on the research aim and objectives as well as presenting a summary of the key findings. Recommendations are also presented, followed by the research contribution to knowledge and the limitation of the research are discussed. Finally, this chapter concludes with areas for further research.

## 9.2 Reflection on research aim and objectives

This section presents a reflection on the research study while reviewing how well the aim and objectives as set out in Chapter 1 have been achieved. As mentioned in Chapter 1 this research was triggered by the increase in the birth rate in Ireland and the subsequent requirement to provide new school accommodation in Ireland. Given this requirement the research aim with six overarching objectives were set out. The following section reflects on each of the objectives and how they have been met and therefore the overall aim achieved.

Research Aim
**The overall aim of the research is to evaluate how VfM can be achieved from a government's perspective in relation to school building projects in Ireland.**

In order to achieve the aim of the research Chapter 8 section 8.3 presented the key findings in order to achieve VfM on school building projects in Ireland. It included presented these key recommendations in a diagram form which was then explained in detail. In order to evaluate how VfM is achieved on school building projects in Ireland VfM was split into three main areas. These areas include achieving VfM generally on school projects. Exploring the soft problems of value which are the people constructing the building and using the building on a daily basis. The hard problems of achieving VfM was also considered. This area included the building itself and how VfM can be achieved in relation to this area. All of these areas were then synergised together into a coherent and comprehensive set of useful and practical actions that can assist the DoE in improving how VfM is achieved on school projects in Ireland.

Breaking this main aim down into more achievable steps was what the objectives were about. Each one of these objectives will now be revisited in order to discuss how they have been met.

**Objective 1: Ascertain how value generally, from both a government perspective and construction perspective is achieved at the present time in order to gain an understanding of how VfM can be attained.**

Although the concept of value has been widely discussed in the literature, a review has revealed that the objective nature of value has been the dominant force when creating value. No consideration has been given to value as a dynamic concept, varying according to the context within which value judgements are expressed. Consequently, value has been linked to measurable attributes or physical product features. The subjective nature of value also needs to be addressed, but, as it is a complex feature to which everyone is able to contribute with an individual vision of the concept it is often overlooked. What this demonstrates is that both the objective and subjective nature of value needs to be taken into consideration when endeavouring to achieve VfM.

From a government perspective this objective view of obtaining value has been where the "3E's" of efficiency, economy and effectiveness have been realised. However, with this there is a strong focus on the quantifiable outputs rather than outcomes, in many current measurement systems. In describing public value there is an implication that there should be a focus on a wider range of value than just public value. It should also focus on what has meaning for people rather than what a public sector decision-maker might presume is best for them.

The literature suggest that the simplest definitions of VfM, as applied to construction is illustrated by the time, cost and quality model. The normal situation is that one of these factors is fixed and the other two will vary in inverse proportion to each other. From this it can be seen that the value delivery activities of the construction industry can be characterised by the prominence of an objective view of value. The industry's current understanding of value is such that it routinely fails to consider the relationships between built environment assets and the people who will provide, use and be influenced by them. This demonstrates that construction is also biased towards achieving VfM by concentrating on the objective nature of value. This is due to the fact that the worth of hard values is more easily measured, whilst that of soft values are often partly personal, partly shared and therefore can be difficult to measure dependably. There is a danger that those values where the worth is not easily measured are

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avoided or ignored. Indeed, only a portion of development work and outcomes may be captured in quantitative terms. To do this, an understanding of the values of the individual, organisations and societies using the building are also considered so that their subjective value judgements can be pre-empted in any design solutions.

What the literature demonstrates that in order to attain value at the present time the concentration is on the objective side of value as it is easier to quantify and measure. The subjective side of value as it is more difficult to quantify and measure is all too often ignored. Therefore, there is also a need to have an understanding of value that is both subjective and objective in nature so that a more holistic view of achieving VfM can be achieved.

**Objective 2: Establish specifically how VfM is achieved on a construction project at the present time and propose steps that may be introduced in order to achieve VfM in the future.**

At the present time, in order to achieve VfM in construction three concepts are used, which include value engineering, value management and risk management. It was necessary to investigate how each one of these concepts is used in the construction industry to understand how VfM is being achieved at the present time and the benefits and shortcomings with each of this methods as applied to a construction project. What is clear is that in relation to the VfM concept and the Irish government, not only does the government's own perception of what they believe is value comes into play, but this is then tied up with monetary issues if true VfM is to be achieved in the Irish school building programme. From an Irish perspective on school projects, the DoE considers that value engineering has been achieved by using cost limits for the design and construction of schools, value management is achieved due to the fact that it is a repeat tested design and risk management is achieved by using the government forms of construction contract which transfers the majority of risk to the contractor. Therefore, the DoE is achieving VfM by looking at the hard problems, but in order for true VfM to be achieved on school projects, then the soft problems also need to be addressed. This soft problems are rooted in a perception of values as human guidelines, which has an influence on human behaviour and actions thus creating a culture of cooperation. In order to realise this on school projects, the stakeholders at each stage need to be embraced so that a more holistic view of VfM is reached. On school building projects where the design is set by the DoE this entails concentrating on the later stages of a project where value is not about potential cost savings but about the stakeholders involved. This necessitates concentrating on the construction and the post

occupancy stages of school building projects to comprehend where additional value can be realised.

In summary what has been found in relation to this objective is that, at the present time VfM is achieved on a construction project by utilising value engineering, value management and risk management. In the future, it has been established that the later stages of a project which include the construction stage and the post occupancy stage is where the potential to achieve enhanced VfM on a project.

**Objective 3: Determine the government challenges in building schools in Ireland from a legislative background, to the design and the delivery background in order to explain the processes and procedures that influence the building of schools in Ireland and how VfM can be realised.**

It is predicted that by the end of 2017 enrolments in primary schools and secondary schools will grow by; up to 45,000 and 25,000, respectively, and growth is expected to continue at that level until at least 2024 (Central Statistics Office, 2014). The government, therefore, has no choice but to provide new schools and, in many cases, dramatically improve existing ones. It is therefore crucial that the provision of these schools is investigated in order to appreciate how VfM can be achieved. As exposed in the literature the Education Welfare Act 2000 (Office of Attorney General, 2000) provides that all children shall attend school by the age of six years with most children commencing school in the September of their fifth birthday. Primary education consists of an eight year cycle: junior infants, senior infants, and first to sixth classes with pupils normally transfer to post-primary education at the age of twelve. What this establishes is that from the age of five to the age of twelve pupils are educated in one classroom by a single teacher with no moving in or out of the classroom for different teachers. This has an influence on the design of the space as both the pupils and the teachers use the space throughout the day. In relation to the primary curriculum this is contained in the Government of Ireland curriculum (Government of Ireland, 1999) which ensures that the child is nurtured in all dimensions of their life: spiritual, moral, cognitive, emotional, imaginative, aesthetic, social and physical. In order to achieve enhanced VfM on any school project, the curriculum for primary pupils also needs to be adhered to as it can also shape the design of schools.

The literature has exposed that the DoE has produced a number of documents and guidelines in relation to the design of schools. This narrows the free reign of consultants to produce an

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appropriate design for schools. The documents that are produced from the DoE fall under a number of categories and include: general, room layouts, construction standards, percentage for art and technical guidance documents. This affects the willingness of consultants to produce any designs that do not follow the norm and are thus reluctant to design something in a non-standard way. All of these technical guidance documents serve to add to the layers of information and restrictions that are put in place on the design of schools. What this illustrates is that it is difficult to investigate alternative ways to design the school building as the processes and procedures that need to be adhered to are quite onerous. Furthermore, this suggests that other areas need to be investigated in order to enhance VfM such as the construction and post occupancy stage of a school project.

The findings from the literature review also revealed that there are a number of ways to deliver schools and this includes: traditional procurement, PPP, GRD and D&B. However, in today's climate; where schools need to be completed rapidly, there are only two options that are favoured by the DoE. These two options include the GRD option and D&B options. What this highlights is that schools need to be built rapidly to keep up with the demand and therefore only those procurement options that can achieve a quick turnaround are considered from a VfM perspective.

This objective explored the government challenges in building schools in Ireland. These challenges include an increase in population and a requirement to build school rapidly. It was found that the legislative background has an influence in the design of the primary school as the government stipulate that from the age of five to twelve years all subjects are taught by one teacher in the same classroom. The design of the school is also specified by the DoE as they produce standard layouts for classroom spaces, cost limits and standard specifications which limits the ability for consultants to have an influence on achieving VfM on school projects. Finally, the delivery of schools rapidly also constricts the ability to influence VfM, as GRD and D&B are the two procurement choices that are only available when schools need to be built rapidly. As can be seen from this there are numerous processes and procedures that influence the building of schools in Ireland and hence have an influence on how VfM can be realised.

**Objective 4: Establish how VfM can be achieved at the construction stage and post occupancy stage of the delivery of a primary school project in order to gain an understanding of how enhanced VfM can be attained on these projects.**

It was defined that in order for a truly holistic VfM to be achieved, then along with the "hard" side of value, the soft problems of value also needs addressing. At the construction stage on a school project, the hard problems includes areas than can be quantified. These include value engineering, value management and risk management. The other side that also needs addressing is the soft problems of VfM, which includes the sustainability of the project not only from an environmental perspective, but also from an economic and importantly a social perspective. At the construction stage of a school project it also includes stakeholder satisfaction which includes: identifying stakeholders, behaviour and attributes, relationships and communication. If these areas are addressed then a more holistic view of VfM can be attained on school projects.

At the post occupancy stage of a school project, the "hard" problems includes the building itself and the sustainability of the structure. The "soft" problems addresses the people using the building on a daily basis following occupation. It has been noted that the "hard" problems has been taken into consideration by the DoE where a section within the department is responsible for including materials and technology that enhances the performance of schools. From a sustainable perspective, the DoE only incorporates technologies in a school that is only occupied nine months of the year. What the DoE does not address at the post occupancy stage is the "soft" problems, which relates to the people. When investigating this side what has come to the fore is that the user requirements, the design of the school and any issues that have emerged following occupation need to be addressed. The emphasis therefore is to focus on the people using the building in order to unearth how the design works in practice, how user requirements are being met and if there are any issues that need focusing on so that improved VfM can be achieved.

This objective established that at both the construction stage and the post occupancy stage of a school building project in order for VfM to be achieved both the "hard" problems and the "soft" problems need to be included. The "hard" problems at the construction stage includes value engineering, value management and risk management. The "hard" side at post occupancy stage include technical performance and the design of the building. The "soft" problems of VfM at the construction stage includes stakeholder satisfaction and sustainability whereas at the post

occupancy stage it includes the user requirements, the design and issues that can emerge. If all these areas are addressed on a school building project then enhanced VfM can be achieved.

**Objective 5: Determine how a more holistic view of VfM can be achieved on school building projects by proposing a model of the processes and procedures that should be implemented in the future.**

What has emerged from the stakeholders is that in order for VfM to be achieved on school building projects, there are a number of core themes that require addressing. These include in relation to school building generally as outlined in Chapter 5 section 5.3.6, cost and time, relations between stakeholders, the design itself and the contractor who is building these schools. Specifically, on GRD schools as outlined in Chapter 5 section 5.4.6, what needs to be taken into consideration is the design of the schools, the principal involved in the construction stage, the project themselves and how VfM can be achieved. Finally, in terms of D&B schools the core themes identified in Chapter 5 section 5.5.5, include the design of the buildings, the relationship between stakeholders, the build itself, and finally the contractor. The broad conclusion is that the GRD option has not been updated recently, so projects are now taking as long as traditional built schools as consultants continue to argue that the design does not comply with building regulations and an assigned certifier at the construction stage has not been agreed. Moreover, the DoE believes that the way forward is the D&B option and that by packaging schools into large bundles it ensures that VfM is achieved. Therefore, D&B seems to be their preferred option in order to get schools built as quickly and efficiently as possible. Indeed, the dedicated section in the DoE reinforces this. However, what needs to be addressed in going forward, is the way in which VfM is achieved, particularly as the workload of main contractors and consultants alike begins to increase and the appeal of doing public work begins to wane as more profitable private work comes on stream.

The findings from the analysis of the construction stage demonstrate that the construction stage the design need approval at the construction stage from all local authority fire officers and disability access officers prior to handing over the completed school to the end users. Any issues in relation to the design itself needs to be addressed so that on future projects the same issues are not reoccurring. The DoE needs to have a person in the organisation assigned to each individual project in order for communication and relationships to work. In relation to sustainability, the link between the local authority, the DoE and the school principal needs to be stronger in order to ensure that a truly sustainable project is achieved in the community.

At the post occupancy stage a number of issues that have emerged for stakeholders following daily use of the school. The majority of the areas are in the classrooms where the heating, shades/blind and technology are issues. In relation to the design, it appears that if stakeholders were consulted then the layout, the doors and the yard arrangement may have been improved. With regard to the theme of additional issues some of these might not have become issues at all if stakeholders had been consulted before work started on site. What can be drawn from this is that all stakeholders at the post occupancy stage should be consulted during the design stage in order to make them more informed of how the design comes together, and how it is perceived to work in practice in order for true VfM to be achieved.

In order to amalgamate all this information into a coherent whole, a model of the findings was produced, for the DoE to achieve a more holistic view of how VfM can be achieved.

**Objective 6: Formulate recommendations in relation to achieving better VfM on school projects, which can be fed back into the provision of future schools.**

The general recommendation in relation to the provision of schools indicate that there are some general areas of concern about the school building programme that need to be addressed initially, before more detailed recommendations are addressed. These areas include the need for transparency in how projects are selected, addressing the availability of suitable contractors to undertake the work and defining stakeholders that have an interest in the outcome of the project. Once this is attained there are also some broad outcomes about the benefits and barriers to using the two different procurement methods in the provision of school accommodation, be that GRD or D&B. Whether school projects are constructed using the GRD or D&B method, what has been established is that attaining VfM can be further broken down into hard problems, which is the physical building asset itself or soft problems. By appraising the hard problems side, what has emerged is that this distinct area, be it at the construction stage or the post occupancy stage, has defined boundaries around it so it is more straightforward and easier to assess. This hard problem/building area is where the majority of the emphasis has been placed by the DoE in order to demonstrate that they place emphasis on VfM in the school building programme. The opposing side of VfM is about the softer problems which is more about the people involved in either building the school or working in the school. As this area is more difficult to define the DoE tended not to concentrate on this side of value. However, if this side is also considered then a more holistic view of achieving VfM can be obtained on school building projects in Ireland.

## 9.3 Summary of key findings

Having thoroughly explored and identified the key recommendations for achieving VfM on school building projects, this section presents a summary of the key findings:

- The findings from this study indicate that the Irish government concentrate on attaining VfM by concentrating on the "3E's" of efficiency, economy and effectiveness. They exploit value management, value engineering and risk management to achieve this on construction projects. The research reveals that by focusing on these areas the government are only concentrating on one aspect of achieving VfM. In order to achieve enhanced VfM the government also needs to concentrate on the softer problems which are the stakeholders involved in the construction and the occupancy of the building.

- By undertaking a critical review of the literature, the study gathered evidence from past research into realising VfM on construction projects. The subsequent research from this study revealed that the DoE by specifying the design, the cost limits and the form of contract on school projects restricts the opportunity to explore certain other possibilities in order to achieve VfM.

- The findings from this study also indicate that on school projects in Ireland as the design is set, cost limits are set and the forms of contract is prescribed in order to obtain VfM other areas needs to be investigated. This includes the construction stage and the post occupancy stage of the project. At these two stages other factors that can influence how VfM is achieved can be revealed and can be implemented on school projects.

- What has been discovered is that VfM at the construction and post occupancy stage involves not only concentrating on the defined hard problems but also on the soft problems. The hard problem areas at the construction stage include value management, value engineering and risk management. At the post occupancy stage the hard problems, which also need addressing include the technical performance of the building and the design. The soft problems at the construction stage include stakeholder satisfaction and sustainability and at the post occupancy the user requirements, the design and stakeholder issues.

- Finally, this study offers a holistic approach to examine VfM by developing

recommendations that can be implemented at the construction and post occupancy stage of a school project. These recommendations are supplemented with general recommendations on the provision of school accommodation in Ireland.

## 9.4 Recommendations

The research recommendations on how VfM can be achieved are presented below.

- Explore alternative procurement arrangements to support delivery of necessary investment in new school infrastructure to meet projected demand. A fundamental requirement of this procurement is speed of delivery as well as VfM.

- In order to maintain sufficient competition between main contractors tendering for these projects a number of schools should be bundled together. This ensures that main contractors are not just tendering for one project but are tendering for a number of projects over a period of time thus, ensuring sufficient profit margins and a guarantee of work. The recommendation to achieve this is the use of D&B going forward where appropriate.

- The DoE should ensure that there is end user stakeholder involvement at the construction stage so as specific requirements for that particular school are implemented. This can be realised by making it a requirement that the main contractor and the consultants liaise with the end users on a continuous basis. The form that this takes includes a monthly meeting with end users and a summary document to explain why certain decisions were made on the project thus, ensuring that end users take ownership of the design and the building at an early stage.

- A standardised post occupancy evaluation should be carried out on all completed school projects following a year of occupation by the DoE. This post occupancy evaluation should include not just the technical performance of the building, but also how the building fulfils the end user requirements. This ensures that the design can evolve as areas of concern are revealed so that continuous improvement is realised and enhanced VfM on school projects is achieved.

- There is a requirement that a tailored end user manual is produced by the main contractor, which not only explains the technology, equipment and services within the school in general terms, but also explains it in specific terms based on the particular stakeholder using the building.

- Review building space standards and construction budgets to emphasise long life and design quality, and to deliver whole-life cost efficiencies to the exchequer so that rather than achieving cost certainty VfM is also achieved.

- Review design brief vis-à-vis current international best practice and emerging standards, including the role of school buildings in the community. This should also include an appreciation of end user requirements particularly in relation to requirements for ancillary space within the school, so that enhanced VfM can be achieved.

- Finally, implement a National School Building Plan to upgrade the entire education estate to 21st century standards. This plan should include contributions from all relevant stakeholders to ensure that relevant knowledge from these stakeholders is included in the plan so that VfM can be ensured.

## 9.5 Contribution to knowledge

The value of any research is associated with the extent to which it contributes to human knowledge be it academic or practice based. On the academic side the literature review revealed the importance of combining both the objective and subjective side of VfM in order to achieve a more holistic interpretation of how it can be achieved particularly on construction projects. By proposing a model it helps to fill the gap that exists in our understanding of the complex ways in which barriers and benefits exist in providing VfM on projects. The identification of a set of factors that are vital for achieving VfM on school building projects also contributes to knowledge in this area as a study of this nature has not been carried out previously. So by proposing a model to the DoE it enhance the ability of the government generally, and the DoE specifically to achieve value on the provision of school accommodation.

From a practice viewpoint knowledge has been gained that at no stage are stakeholders taken into consideration at either the construction stage or the post occupancy stage. This study reveals that it is important to include these stakeholders in decisions in order to ensure that

enhanced VfM is achieved. Knowledge is also provided for the DoE that they should be cognisant of the fact when providing school accommodation that value is not just about cost cutting it is also about the inclusion of the people constructing and using the building on a daily basis.

Finally, this research has proposed a model of recommendations to the DoE for achieving a more holistic interpretation of achieving VfM on school building projects in Ireland. This is in line with the research aim of evaluating how VfM can be achieved from a government's perspective in relation to school building projects in Ireland. These recommendations have added a new insight through which the government involved in the provision of school accommodation namely the DoE can comprehend the main areas that need addressing in order to attain enhanced VfM.

## 9.6 Limitations

Although the research achieved its aim and all research objectives were adequately met, there were some unavoidable limitations. Like other research studies, budget and time were subject to limitations. This was particularly the case in this study where the research was conducted on a part time basis and inevitably there were stages that the time available to carry out the research was restricted. The cost of carrying out the research also affected the ability to conduct the research in certain areas of Ireland as travel and expenses were incurred. This restricted the research to be conducted in two areas. One area was in close proximity to the researcher's place of work. The other area that was chosen was Dublin as it is the capital there is a concentration of school construction work taking place there. This meant that a number of detailed semi-structured interviews could be conducted over an intense period of time.

This research also has limitations due to several decisions that were made in its conduct. For instance, the research was conducted under a qualitative paradigm. It is widely considered that results from qualitative studies are contextual in nature and there can be unintended consequences of generalising them in a global context. At the commencement of this study the two areas that the DoE were concentrating on in order to provide school accommodation within a reasonable time were GRD and D&B procurement method. As the study demonstrate it is the D&B procurement option that appears to be the preferred option to provide school accommodation. If this study was commenced again it would be the D&B option that would

be concentrated on in more detail in order to investigate how VfM is achieved. At the post occupancy stage of the study, semi-structured interviews were conducted with end user stakeholders. If more time was available to carry out this study then these semi-structured interviews would be supplemented with a questionnaire send out to all end users in schools that have been completed within a five year period to supplement the information that became available. Pupils attending the school would also be targeted to gauge their understanding of how the school is working for them but this may have to take a different format to semi-structured interviews or a questionnaire as the pupils are quite young. All of the participants on this study are involved in the primary school building programme in Ireland so the generalisability of this research is limited. If the research was to be conducted on the secondary school building programme or the third level building programme other factors might also come into consideration and this also needs to be addressed. Finally, this study focused on identifying the recommendations for achieving VfM on primary school accommodation from a government perspective but other determinants for achieving VfM not covered by this study may be important to other government departments. This is particularly the case in providing local authority housing at the present time as again speed of delivery is the overarching concern to the government. It is important, therefore, that the findings of this study may not be applicable to other government departments and should not be adopted without a detailed critical analysis.

## 9.7 Future research

It is evident from the research findings that VfM can be achieved on school building projects in a variety of ways. However, further research is recommended to identify more precisely if the different recommendations can improve the schools provided, and to develop a more detailed in-depth set of recommendations for achieving VfM. Specifically, the recommendations for future research are:

- Further studies should be conducted to investigate whether the findings of this study are supported by a wider survey of stakeholders involved in the provision of primary school accommodation particularly in other geographical areas.

- A detailed study of a D&B bundle should be conducted in order to investigate how VfM can be ensured on these bundles. This should be conducted on all school projects within

that bundle and could represent 10-15 schools in order to ensure that there is continuous improvement in value between the building of the first school and the last school.

- At the post occupancy stage of a school building project a more detailed investigation of end user stakeholders should be conducted by introducing a questionnaire in all schools following completion. This would ensure that all stakeholders' recommendations would be taken into consideration so that VfM can be ensured on school building projects in the future.

- To further increase the generalisability, future research should be undertaken by repeating the methodology adopted with stakeholders on secondary schools and third level institutions projects. By doing this a more comprehensive representation of achieving VfM on providing school accommodation will be achieved.

- Investigate further whether the findings of this study can be implemented on other government building projects particularly on the provision of local authority and social housing where speed of delivery and the provision of new accommodation is also a concern.

- Finally, further research is required to test the application of the VfM model recommendations with consultants involved in the provision of primary school within the context of public projects.

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# Appendices

# Appendix 1: List of publications

- **Carey, G.,** and Underwood. J. (2016). 'Post Occupancy Evaluation of Generic Repeat Design Schools in Ireland', *RICS COBRA 2016*, George Brown College, Toronto, Canada, 19th to 22nd September 2016.

- **Carey, G.,** and Wu, S. (2013). 'Delivering stakeholder satisfaction in sustainable school projects in Ireland', *International Postgraduate Research Conference (IPGRC),* University of Salford, Manchester, UK, 8th-10th April, 2013.

# Appendix 2: Management Introductory Letter

Dear Sir,

As a Lecturer in the Department of Construction at Cork Institute of Technology and a Chartered Quantity Surveyor I have decided to look into the area of achieving VfM on school projects in Ireland. To this end, I am currently undertaking a PhD at University of Salford, Manchester.

The initial part of my research was looking at the construction stage and post occupancy stage of GRD primary schools to see what can be done to get better value in relation to the building. I am now in year 5 of a part-time PhD and have now moved on and have decided to look at design and build primary school accommodation. I have noticed that _____ is involved in a number of design and build primary schools (rapid schools programme) over the last few years. I am wondering if I could interview you in relation to these projects. As my research is more stakeholders centred I am not looking for costing information or competitive advantage as my research is more about the people involved in these projects and any problems/issues they may have with them.

I understand how busy the construction industry is at the moment, but I would really appreciate if you could help as your knowledge and experience would greatly enhance my research. You can contact me at (021) 4326409 or mobile (087) 681 0766 or by email at Gillian.Carey@cit.ie to discuss further.

Thanking You
Gillian Carey BSc MSc MRes ASCSI MRICS
Lecturer
Department of Construction
Cork Institute of Technology

# Appendix 3: Research Participant Information Sheet

**Study Title**
An evaluation of how VfM can be achieved from a government perspective in relation to school building programme in Ireland.


**Invitation paragraph**
I would like to invite you to take part in a research study. Before you decide, you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Ask questions if anything you read is not clear or if you would like more information. Take time to decide whether or not to take part.

Overall, children of primary school age are expected to increase in number by at least 10 per cent, and possibly even higher, by 2025 (Central Statistics Office 2008). The first quarter of 2011 was the highest quarterly birth rate since CSO (Central Statistics Office) records began in 1960. These national population projections indicate that the number of enrolments in primary schools will continue to rise in the coming years. This will require new school buildings and it is therefore timely to consider the nature and quality of these schools.

As can be seen from Figure 1 the overall doctoral research is looking at VfM on government project more specifically the school building programme. If you look at the two different sides of achieving VfM you can see that there are hard problems and soft problems. The hard side has clearly defined problem boundaries. They include areas in relation to the building which include value management (VM), value engineering (VE) and risk management (RM).  If you look at the softer aspect of VfM this seems to consider more unsure, less certain areas. These areas concentrate on the people either constructing the school or working in the school. If you address both these areas in relation to school building projects, then you have a more holistic view of achieving VfM. The findings of this study can then be fed back into the design of school buildings in the future. From this the main aim of the doctoral work can take shape.
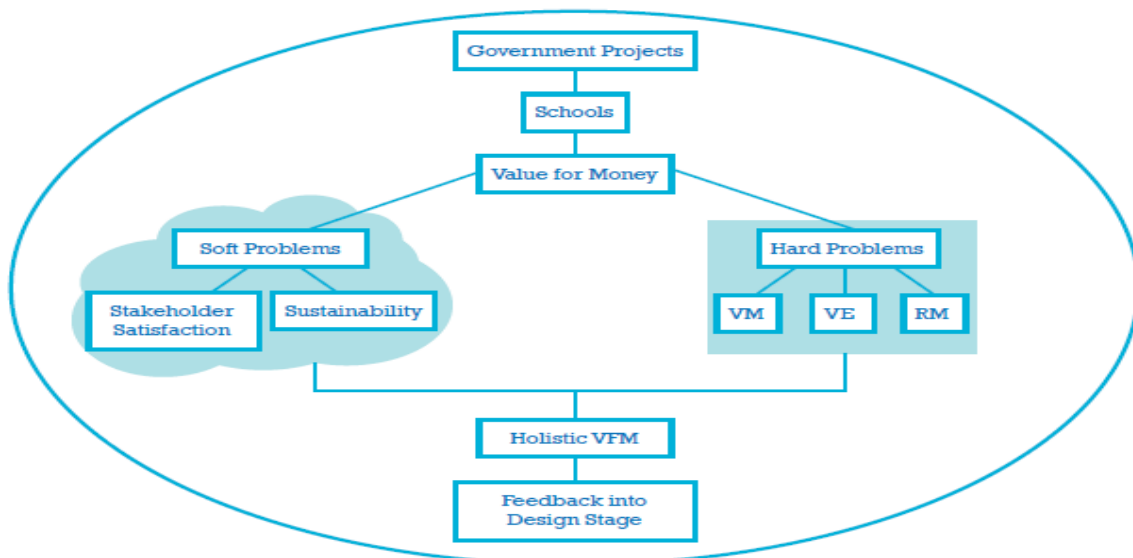
It is envisaged that a research project will be undertaken on design and build schools at both the construction and post occupancy stage. At the construction stage the aim is to identify and prioritise the various factors that contribute to stakeholder satisfaction. At the post occupancy stage the aim is to identify the stakeholders using the school and formulate an understanding of their experiences of the school. In doing both of these recommendations to enhance the future design of schools can be developed so that better VfM can be achieved going forward.

**What is the purpose of the study?**
The primary purpose of this study is to identify where VfM is being achieved on school projects.

**Why have I been invited?**
As a stakeholder involved in school building your knowledge will be invaluable to the researchers' understanding of the design and build process.

**Do I have to take part?**
It is up to you to decide. We will describe the study and go through the information sheet, which we will be given to you. We will then ask you to sign a consent form to show you agreed to take part. You are free to withdraw at any time, without giving a reason.

**What will happen to me if I take part?**
The following will happen if you take part:
- you will be involved in this research for a maximum 6 month period
- you will meet with the researcher once for an interview
- this interview should take no longer than one hour
- The format of this interview will involve a general discussion on design and build schools undertaken by you.

**What will I have to do?**
Research subjects will be expected to attend an interview.

**What are the possible benefits of taking part?**
We cannot promise the study will help you but the information we get from the study will help to increase the understanding of the school design and build process.

**What if there is a problem?**
If you have a concern about any aspect of this study, you should ask to speak to Gillian Carey on (021) 4326409 or (087) 6810766 who will do her best to answer your questions.

If you remain unhappy and wish to complain formally you can do this through Dr Jason Underwood Supervisor School of the Built Environment University of Salford Manchester 0161 295 6290.

**Will my taking part in the study be kept confidential?**
All information which is collected about you during the course of the research will be kept strictly confidential, and any information about you which leaves your organisation will have your name and address removed so that you cannot be recognised.

Note the following:
- information will be stored safely, giving the custodian and level of identification, including:
  - hard paper/taped data will be stored in a locked cabinet, within locked office, accessed only by the researcher
  - electronic data will be stored on a password protected computer known only by the researcher
- Access to view identifiable data to include the researcher and the supervisor only
- Information will be retained for 10 years and will be disposed of securely

**What will happen if I don't carry on with the study?**
If you withdraw from the study all the information and data collected from you, to date, will be destroyed and your name removed from all the study fields.

**What will happen to the results of the research study?**
Results will be included in a research project which can be forwarded to you on request. You will not be identified in this project unless you have given your consent.

**Who is organising or sponsoring the research?**
Cork Institute of Technology is funding the research.

**Further information and contact details:**
Gillian Carey
Lecturer
Department of Construction
Cork Institute of Technology
Rossa Avenue
Cork
Telephone: (021) 4326409
Mobile: (087) 6810766
Email: Gillian.Carey@cit.ie or G.Carey@edu.salford.ac.uk

# Appendix 4: Participant Consent Form

**Research Participant Consent Form**

**Title of Project: A post occupancy evaluation of a sustainable school project in Ireland.**

**Name of Researcher: Gillian Carey**

**Name of Supervisor: Dr Jason Underwood University of Salford**

*(Delete as appropriate)*

> I confirm that I have read and understood the information sheet for the above study and what my contribution will be.

| Yes | No |
|-----|-----|

> I have been given the opportunity to ask questions (face to face, via telephone and email)

| Yes | No |
|-----|-----|

> I agree to take part in the interview

| Yes | No | NA |
|-----|-----|-----|

> I agree to the interview being tape recorded

| Yes | No | NA |
|-----|-----|-----|

> I agree to digital images being taken during the research exercises

| Yes | No | NA |
|-----|-----|-----|

> I understand that my participation is voluntary and that I can withdraw from the research at any time **without giving any reason**

| Yes | No |
|-----|-----|

> **I agree to take part in the above study**

| Yes | No |
|-----|-----|

Name of participant

Signature

Date

Name of researcher
Gillian Carey

Researcher's e-mail   Gillian.Carey@cit.ie or G.Carey@edu.salford.ac.uk
address

# Appendix 5: Semi-structured Interview Guide

## Interview questions at construction stage

**Cost:**

➢ Project carried out within contractual agreed budget.

| strongly agree | agree | neutral | disagree | strongly disagree |
| --- | --- | --- | --- | --- |
| O | O | O | O | O |
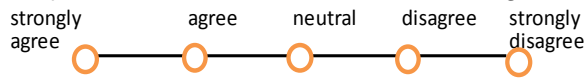
➢ Cost of changes are fair priced.

| strongly agree | agree | neutral | disagree | strongly disagree |
| --- | --- | --- | --- | --- |
| O | O | O | O | O |
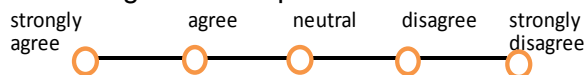
➢ Payment for project is as contractually agreed.

| strongly agree | agree | neutral | disagree | strongly disagree |
| --- | --- | --- | --- | --- |
| O | O | O | O | O |
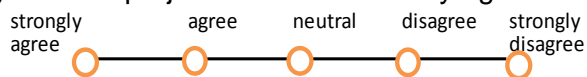
➢ Ensure cost estimate is in accordance with requirements.

| strongly agree | agree | neutral | disagree | strongly disagree |
| --- | --- | --- | --- | --- |
| O | O | O | O | O |
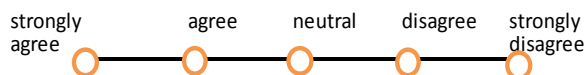
➢ Allows flexibility for changes or modifications.

| strongly agree | agree | neutral | disagree | strongly disagree |
| --- | --- | --- | --- | --- |
| O | O | O | O | O |

➢ Meet profit or fee goal.

| strongly agree | agree | neutral | disagree | strongly disagree |
| --- | --- | --- | --- | --- |
| O | O | O | O | O |
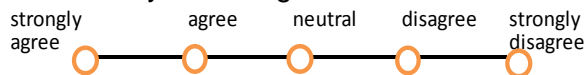
**Quality:**

➢ Quality desired standard.

| strongly agree | agree | neutral | disagree | strongly disagree |
| --- | --- | --- | --- | --- |
| O | O | O | O | O |
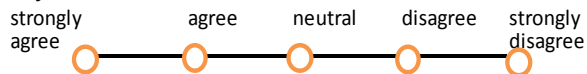
➢ Design contains sufficient and accurate details.
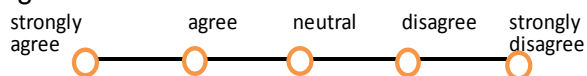
| strongly agree | agree | neutral | disagree | strongly disagree |
| --- | --- | --- | --- | --- |
| O | O | O | O | O |

> Good client service.

strongly agree — agree — neutral — disagree — strongly disagree

> Efficient communication.

strongly agree — agree — neutral — disagree — strongly disagree

> Client action and interaction.

strongly agree — agree — neutral — disagree — strongly disagree
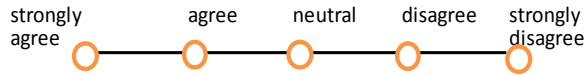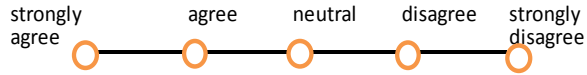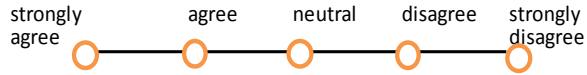
> Tender assessed on quality not just price.

strongly agree — agree — neutral — disagree — strongly disagree
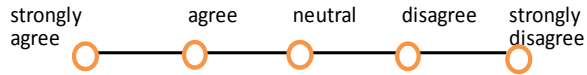
> Project consultants responsive to questions and clarifications.

strongly agree — agree — neutral — disagree — strongly disagree

> Minimal rework and defects.

strongly agree — agree — neutral — disagree — strongly disagree
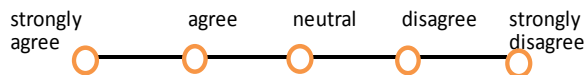
> Project supply specification contains sufficient details.

strongly agree — agree — neutral — disagree — strongly disagree
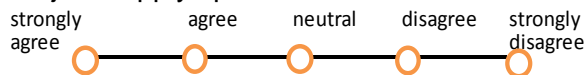
> Conforms to user expectations.

strongly agree — agree — neutral — disagree — strongly disagree
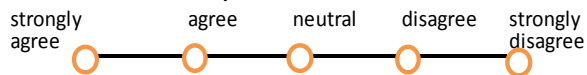
**Safety & Environmental:**
> Health & Safety no incidents.

strongly agree — agree — neutral — disagree — strongly disagree
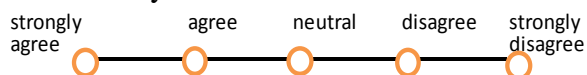
➤ Minimal defects in supply.

strongly agree    agree    neutral    disagree    strongly disagree
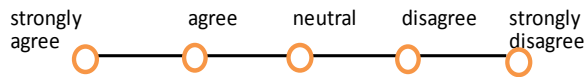
➤ No legal claims minimise construction aggression and no conflict.

strongly agree    agree    neutral    disagree    strongly disagree
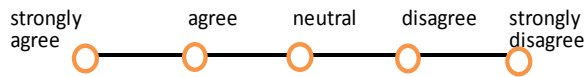
**Time:**

➤ Schedule details easy to understand.

strongly agree    agree    neutral    disagree    strongly disagree
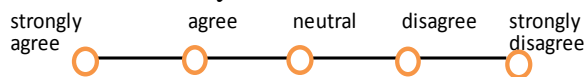
➤ Each phase completed on time.

strongly agree    agree    neutral    disagree    strongly disagree
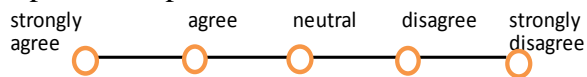
➤ Communication flow is consistent.

strongly agree    agree    neutral    disagree    strongly disagree
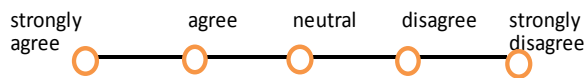
➤ Response to complaints is quick and productive.

strongly agree    agree    neutral    disagree    strongly disagree
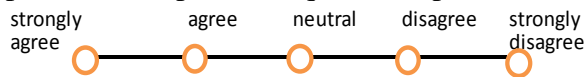
➤ Changes and cost of changes introduced as early as possible.

strongly agree    agree    neutral    disagree    strongly disagree
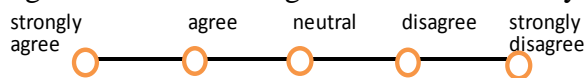
➤ Sufficient time to tender.

strongly agree    agree    neutral    disagree    strongly disagree
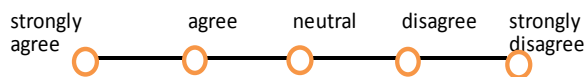
Source: Adapted from Nzekwe- Excel (2010) Classification of Satisfaction Attributes into Key Categories.

# Interview Questions at Post Occupancy Stage
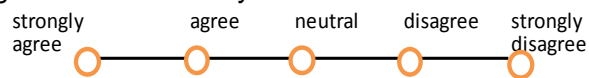
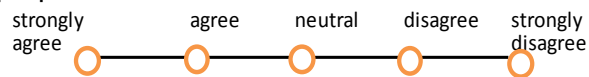## User Requirements:

➢ Inspiring for children.

| strongly agree | agree | neutral | disagree | strongly disagree |
|---|---|---|---|---|
| O | O | O | O | O |
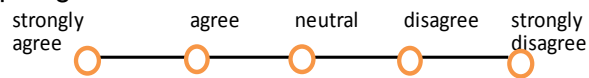
➢ Size suitable for the activities.

| strongly agree | agree | neutral | disagree | strongly disagree |
|---|---|---|---|---|
| O | O | O | O | O |
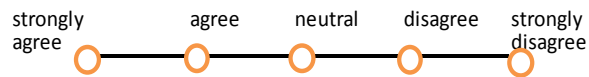
➢ Logic of the overall layout.

| strongly agree | agree | neutral | disagree | strongly disagree |
|---|---|---|---|---|
| O | O | O | O | O |

➢ Appropriate in local context.

| strongly agree | agree | neutral | disagree | strongly disagree |
|---|---|---|---|---|
| O | O | O | O | O |

➢ Adaptable if needs change.

| strongly agree | agree | neutral | disagree | strongly disagree |
|---|---|---|---|---|
| O | O | O | O | O |
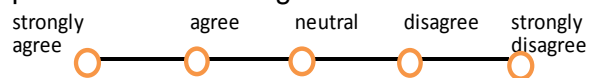
➢ Special attention to sustainability.

| strongly agree | agree | neutral | disagree | strongly disagree |
|---|---|---|---|---|
| O | O | O | O | O |
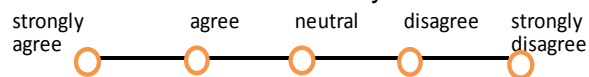
➢ Ease/economy of maintenance.

| strongly agree | agree | neutral | disagree | strongly disagree |
|---|---|---|---|---|
| O | O | O | O | O |
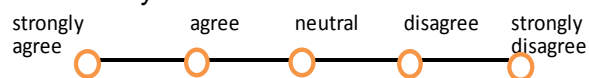
## Design:

➢ Convenient for all users.

| strongly agree | agree | neutral | disagree | strongly disagree |
|---|---|---|---|---|
| O | O | O | O | O |
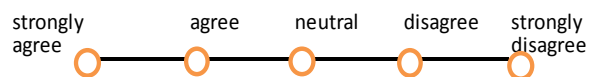
➢ Welcome, secure, friendly, helpful.

| strongly agree | agree | neutral | disagree | strongly disagree |
|---|---|---|---|---|
| O | O | O | O | O |

299
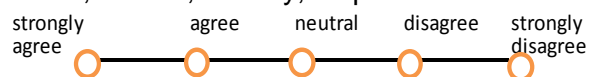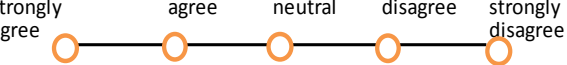
➤ Good natural light, variable artificial.

strongly       agree     neutral    disagree   strongly
agree                                      disagree
O————O————O————O————O


➤ Acoustic comfort, ability for staff and children to concentrate.

strongly       agree     neutral    disagree   strongly
agree                                      disagree
O————O————O————O————O


➤ Adequate outdoor play space.

strongly       agree     neutral    disagree   strongly
agree                                      disagree
O————O————O————O————O
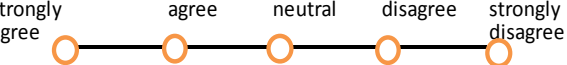

➤ Adequate size of classrooms

strongly       agree     neutral    disagree   strongly
agree                                      disagree
O————O————O————O————O


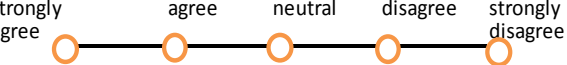## Issues:

➤ Issues with access.

strongly       agree     neutral    disagree   strongly
agree                                      disagree
O————O————O————O————O


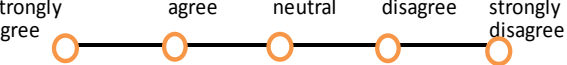➤ Issues with classrooms.

strongly       agree     neutral    disagree   strongly
agree                                      disagree
O————O————O————O————O


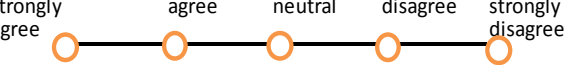➤ Issues with outdoor play space.

strongly       agree     neutral    disagree   strongly
agree                                      disagree
O————O————O————O————O


➤ Issues with staff/parent space.

strongly       agree     neutral    disagree   strongly
agree                                      disagree
O————O————O————O————O


➤ Issues with furniture and facilities.

strongly       agree     neutral    disagree   strongly
agree                                      disagree
O————O————O————O————O


Source: Adapted from CABE (2008) Sure Start children's centres: A post-occupancy evaluation.