MODELLING THE SUPPLY AND DEMAND FOR CONSTRUCTION AND BUILDING SERVICES SKILLS IN THE BLACK COUNTRY

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DEDICATION

DEDICATED TO THE LORD GOD ALMIGHTY
Evidence seems to suggest that with 14 years of unbroken economic growth, the UK’s construction and building services sector is experiencing severe skills crisis of between 40 – 50 per cent retention rate and declining numbers of entrant trainees. More importantly, the level of this severity varies with sub regional and regional peculiarities. To date, most studies on this area have focused on increasing the population of the existing pools of labour rather than harnessing existing ones. Adopting the concept of multiskilling, current techniques of evaluating skills crisis were critically reviewed. While there has been some empirically beneficial application of this concept in the US, it is a rarity in the literature to find previous works on multiskilling in UK’s construction and building services sector.

Adopting an action research approach, a Project Steering Group of industry stakeholders served as a research ‘think tank’ for validating empirical results, and in line with the theory of construct validity, instruments of survey were designed and operationalized in a pilot and major surveys of supply and demand sides’ target groups. Employing the relative index ranking technique, the forecast implications of UK’s economic stability are ‘real’ and a demand led system is prescribed as a tentative ‘cushion’ for sustainable but immediate redress.

A time series data for the period 1961 – 2004 is explored and systematised quantitative demand led models for evaluating construction output based on aggregated and disaggregated manpower
attributes are developed using principal component regression (PCR). Aggregating these models, it is deduced that multiskilling could help redress skills shortage in the long term. A new trade equilibrium framework and a multiskilled focused partnership in training programme are prescribed with response strategies and recommendations.

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CHAPTER 1

INTRODUCTION

1.1. Background

The UK construction and building services industry was in the 19th Century classed as one of the strongest in the world (with output ranked in the global top ten) because it had the natural resources, the labour force and inspiration to lead the world into the Industrial Revolution (DTI, 2004; Leitch, 2006). In the 21st Century however, the industry is witnessing a different type of revolution (untapped and constrained manpower base) where disequilibrium in the supply and demand for construction and building services skills in the UK can be traced to the consequences of early recessions; a time when the surge in construction works manifested into huge unemployment of tradesmen\(^1\). In contending with this unemployment, tradesmen sought employment in alternative industries resulting in skills crisis during periods of economic recovery and output growth (Hillebrandt, 1995; Harvey and Ashworth, 1997; Morton, 2002).

Evidence suggest that in a bid to manage the periods following the aforementioned economic recovery and output growth (skills crisis), several supply and demand redress schemes and strategies were considered in conjunction with advances in construction equipment

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\(^1\) The bulk of UK’s construction and building services activity are being performed by tradesmen hence the emphasis.
Notably, these redress schemes and strategies have been geared, largely, towards attracting new and exited tradesmen and not optimising existing pools of labour (CITB 2001, 2002, 2003 and 2004; Constructionskills, 2007). The observation after a short while however was that these redress schemes and strategies were not ‘effective’, or at best functioned only when newly introduced. Briscoe and Wilson (1993) and Mackenzie et al (2000) have argued that in the UK, a variety of these schemes and strategies were used with more failures than successes. On the contrary, Burleson (1997) has argued evidently that the benefits of exploiting the prowess of a functional pool of labour (optimising existing pool) whilst drawing on the concept of multiskilling have been a ‘better’ redress strategy for curbing skills crisis in the US construction sector (a sector were skills crisis is also rife).

Although the application of the concept of multiskilling is familiar to other industries in the UK, particularly the manufacturing sector (Alster, 1989); the construction industry’s understanding of its application remains unexploited. Could this lack of exploitation have been due to the lack of empirical analysis of the relationship between UK multiskilling and total value of work done (construction output)? Had this been achieved, it would have been possible to devise a more responsive system to motivate funding agencies (like the Learning and Skills Council) and other industry stakeholders of the quantified benefits of sustaining and procuring multiskilled tradesmen and/or frameworks. It is this gap in exploitation of existing pools of labour
Introduction

amidst heightened demand for skills that is the main stimulus for this research.
1.2. Why the heightened demand for skills in UK?

Overall, the UK construction industry’s output ranges between £70 and £80 billion annually; and the products / services which the construction industry engages with can be grouped into housing and non-housing projects. Its key customers come from either the Public or Private sector, and to date, the latter contributes an average of £55 billion annually while the former contributes an average of £29 billion. More so in 2004, together the industry accounted for approximately 10% Gross Domestic Product (GDP) and employed 1.4 - 2 million people which is more than one in fourteen of the total workforce (Anumba et al., 2004). In 2005, 2.41 million people were employed in the sector and that figure is expected to rise to more than 2.8 million by 2011 (Constructionskills, 2007). Over these seven years, this represents an employment increase of 17.5 per cent.

To deliver this growth and replace those who will leave the industry over the period, an average of 87,600 new workers will need to be recruited per year (Constructionskill, 2007). Leitch (2006) and Campbell (2006) argued that it is very unlikely that the set target of 87,600 new recruits will be achieved because there has been a steady decline in the number and quality of entrant trainees and few (less than 20 per cent) migrant workers become gainfully employed within the sector. In other words, the UK’s construction industry must have to lead the act of ‘inward looking’ (optimising existing pools of labour and embracing new construction paradigms like Manubuild amongst
others) if it is to benefit from and not suffer the consequences of forecast economic growth.
1.2.1. Key drivers of growth

The two known key drivers of growth in the short-term (next 3-5 years) are the expected projects for the 2012 Olympic games and Government building programmes. The latter, which is government spending on education is forecast to be the single largest investment in the UK construction and building services sector, obscuring even the budget for the Olympic building programme. That is, the first three waves of the Building Schools for the Future programme, which will renew and/or rebuild every secondary school in the country, are all expected to start by 2011 resulting in the release of £4.7 billion for UK-wide construction and information communication technology (Constructionskills, 2007). The former (the 2012 Olympic programme), which is the likely catalyst for the shift in industry growth from North to South in the coming years, is expected to bring about an estimated £2.35 billion building programme. However, the concentration of Olympics and related projects in South and East England are indications that while all regions are expected to see growth between 2007 and 2011, the highest levels of demand and opportunity for employment (and not necessarily the highest level of skills shortage given regional peculiarities) will occur in the Southern regions.

1.3. Justification for the Black Country sub region

The construction industry plays an important role in the West Midlands – 14,000, mostly small, VAT registered construction businesses
employing 128,000 people. Approximately 43 per cent of the regions construction outputs are repairs, maintenance and improvement works.
The largest sector in the region being housing repair and maintenance – accounting for 22 per cent of total output; construction output was forecast by Construction Industry Training Board (CITB) to increase at an average rate of 2.6 per cent over the period between 2007 and 2011 and an average annual intake of 6,340 construction workers will be required to achieve this output forecast (CITB, 2003; DTI, 2005; Experian, 2007).

The Black Country sub region captured in Figure 1.1, which is the research laboratory for this study, is a constituent part of West Midlands. It is located to the north-east of Birmingham, encompassing the four boroughs of Dudley, Sandwell, Walsall and Wolverhampton. However, it is worth noting that the justification for considering the Black Country sub region as a research laboratory rests largely on its sub regional peculiarities and the on-going and expected peaking of regeneration works (government built programmes); the implication of which will likely lead to under capacity within the sub regional construction labour market (Constructionskills, 2007). The next sub section of this chapter describes the peculiarities of the Black Country sub region².

²The research laboratory (Black Country sub region) was chosen because of its peculiarities.
1.3.1. Peculiarities of the Black Country sub region

Manufacturing activities dominated the sub-region - for long - and the region was termed ‘Black Country’ because of the smoke that bellowed from these manufacturing factories in time past. However, decline in manufacturing activities over the years has led to some evidently peculiar characteristics (ECOTEC, 2003; CITB, 2001, 2002 and 2003).
Overall unemployment is higher at 5.2 per cent than the regional average of 3.9 per cent or the UK average of 3.3 per cent. The Institute of Employment Research prediction was that construction in the Black Country would decline at 0.6 per cent per year compared with a national average of 0.1 per cent.

A relatively high proportion of the population is in families reliant on income support at 32 per cent for the Black Country as against 27 per cent for the West Midlands and 24 per cent nationally. The prospects for the sub-region’s future are currently limited by low rates of business start-ups with annual VAT registrations per 1000 population running at 83 per cent of the national average. There are relatively low levels of educational attainment (GCSE A* C passes) at 87 per cent of the national average, and working age population with at least NVQ level 4 qualifications at 69 per cent of the national average.

With the on-going and perceived future regeneration works (key drivers for growth), projected increase in output for the building repairs, maintenance and refurbishment sector, increased demands in peculiar sub-regions like the Black Country will likely lead to increased under-capacity within the sub-regional labour market and potentially severe skills crisis over the next four years (Leitch, 2006; Constructionskills, 2007). More so, this could create inflationary pressures within the construction market. Alternatively, Black Country firms (mainly SMEs) will have to draw from the not very productive ‘informal’ labour market and new-fully EU countries to meet forecast
demand. An alternative, which this research argues is inconsistent with the Egan’s concept - Rethinking Construction - for sustainable construction. See Egan (1998 and 1999) for fuller details on accelerating change for construction for the construction and building services industry.
1.4. Aim and objectives

Following the discussions above, the research described herein evolved around the main aim of the research - to evaluate the impact of multiskilling as a redress for skills crisis in the UK construction and building services sector. To achieve this aim the following objectives were pursued.

(i) To carry out a review of the literature on manpower planning and its impact on the supply and demand for UK construction and building services skills.

(ii) A quantitative review of Black Country supply and demand for construction and building services skills - a micro insight into construction trades.

(iii) To examine existing patterns (if any) of the relationship between manpower attributes and construction output - a macro insight into UK construction manpower.

(iv) To develop a skills combination framework for testing the concept of multiskilling and to evaluate the impact of multiskilling on construction output using this framework.

(v) Suggest ways of imbibing and sustaining the equilibrium supply and demand for construction and building services skills.
Develop a set of supply and demand side policy measures to help improve future manpower planning directions in relation to the supply and demand for construction and building services skills in the Black Country.

### 1.5. Methodology

This research arose out of the perceived need to understand and accommodate the peculiarities of the Black Country sub region. This was geared towards an alternative labour utilization strategy for skills crisis. After the literature review which established the conceptual manpower planning framework and theoretical background to the research, the entirety of the research is divided into four iterative phases: information gathering; theoretical concept for evaluating the supply and demand for construction and building services skills; statistical analysis – this includes model testing and validation; and
research conclusions and recommendations. Figure 1.2 explains this in greater details.

Figure 1. 2: Structure of the dissertation - research methodology

*NKT = New Keynesian theory; *MRA = Manpower Requirements Approach; *MUL = Multiskilling
1.6. Research dissemination

The work spanned a successfully completed grant provided by the Black Country learning skills council\(^4\) (LSC), entitled, ‘A review of construction skills supply and demand in the Black Country’. Work undertaken for this grant remained a spur for the focus of this research.

Presentations of the initial research findings were made at meetings and seminars of industry stakeholders in the Black Country. A specially convened seminar was arranged by the steering group to allow the research methodology and some of the empirical findings to be appraised and evaluated. Feedback and support received during such sessions helped steer the entire work.

Nine technical papers were produced directly as a result of this research, the majority of which have now been published (see Appendix 7).

1.6.1 Contribution to knowledge

The contributions of this thesis and research project are presented as follows:

\(^4\) The Learning Skills Council (LSC) as a knowledge management organisation is rightly preoccupied with seeking information that would enable policy formulation at national, regional and sub regional levels. The Council has fully engaged with the issue of skills crisis in construction and building services and the consequential effects and is sponsoring aspects of this research to determine how: the LSC buys training provision from FE Colleges; LSC funded qualified trainees fair during their training and in employment market and; unemployed but qualified LSC funded trainees will migrate, re-train or leave the sector.
Introducing a ‘new’ framework for evaluating the concept of multiskilling as a labour utilization strategy in UK’s construction and building services sector;

- the peer review publications have enriched and promoted the application of the concept of multiskilling as a redress for skills crisis, particularly in the domain of construction and building services specific manpower modelling. These results (redundancy identification / elimination) reinforce the empirical assertion of earlier studies;

- development of a new trade equilibrium model and a partnership for training (PTP) framework;

- development of a trade equilibrium model for funding sustainable supply of traditional and new trades; and

- enriched the application of Information Technology by prescribing a transparent database management system for UK construction and building services industry, particularly in the aspect of data collection, disaggregating and dissemination, which is pivotal to contemporary manpower modelling. Thus, the contemporary response strategies in this research provides a novel benchmark that may be used and/or applied in other sub regions and regions.
addition, this would provide a sufficient base to facilitate further developments and even further application of Virtual Reality and multiskilling in empirically ascertaining the quantified effect of adopting the concept of multiskilling in UK’s construction and building services sector projects.

1.7. Structure of the thesis

This thesis is divided into eleven chapters. Chapter one introduces the research background, articulates the research problem, research aim and objectives, contribution to knowledge and outlines the research methodology and content structure – flow diagram - of this thesis. Furthermore, it lists the dissemination of the research to academics.

Chapter 2 – a working definition of manpower planning and modelling is discussed. Also included in this chapter is a holistic review of manpower planning literature, an analysis of a conceptual manpower planning framework and the signposting of ‘new’ and existing gaps of UK construction industry’s employment model.

Chapter 3 – this chapter emphasises the underlying stimuli of the research by introducing and defining the phenomenon of skills crisis, distinguishing between soft and hard skills, examining existing redress strategies and identifying factors influencing the supply and demand for skills.
Chapter 4 – following the review of three key labour market theories: manpower requirements approach, new Keynesian theory, and the concept of multiskilling - this chapter accepts the concept of multiskilling as a theoretical framework for addressing UK’s construction and building services skills crisis.

Chapter 5 – offers a detailed procedural approach for addressing the research question. Though largely quantitative, a multi-attribute analysis technique was adopted for the many attributes harnessed from the cross sectional and longitudinal data analysis.

Chapter 6 - this chapter draws on a quantitative insight into sub regional skills supply status (with particular emphasis on trades) of the research laboratory; emerging evidence purports supply data is currently confused, lacking in consistency and some instances in conflict.

Chapter 7 - Black Country current and future demand for construction and building services skills were reviewed and explored in this chapter. The findings support the reality of the sub region’s forecast skills crisis. In particular, the paucity of data makes it very unlikely to harness sufficient primary data needed to holistically quantify manpower demand.

Chapter 8 – in this chapter, the results of the trend estimation analysis of all 23 participating variables (dependent and independent) were evaluated in order to comprehend national trade picture – a macro
insight that will enable the conceptualisation of a framework for implementing the concept of multiskilling.

Chapter 9 – a longitudinal data set is explored towards the development of an optimisation demand led model for maximising existing pools of labour. Drawing on a chronological ‘suit’ of statistical analysis the exploratory models developed (by means of linear regression analysis) can help identify the underlying manpower variables, which influence construction and building services output and highlight possible ways of accommodating skills mismatch.

Chapter 10 – this chapter discusses paramount issues within this research as signposted by the surveys and Steering Committee discussions of the preceding chapters. Industry and Government initiatives to re-balance construction skills supply and demand include the Considerate Constructors Scheme; National Construction Week; Construction Skills Certificate Schemes, Investors in People initiative; New Deal employment scheme; CITB equal opportunities initiative; CITB training recruitment strategy.

Chapter 11 - this chapter is a conclusive summary of the research findings as well as recommendations of realistic but contemporary programmes to facilitate future planning directions in relation to the supply and demand for construction and building services’ skills in the Black Country.
Figure 1. 3 Content structure of the thesis
CHAPTER 2

A REVIEW OF MANPOWER PLANNING

2.1. Introduction

Manpower planning involves a great deal of speculation in many different areas – speculating about the labour market trends, technological changes, trends in industrial relations, economic trends, demographics trends, changes in training and educational practices and the movements and growth of different sectors (Bowey, 1974). In some industries, these speculations may be made quite accurately (which is arguably a prerequisite for effective manpower planning) but for some others, the uncertainty is high enough to render manpower planning practice to be both ‘onerous’ and ‘ineffective’.

In this chapter therefore, as a way of evaluating the certainty and/or uncertainty of manpower planning practice in the UK construction sector - the question of who should do the manpower planning exercise will be clarified; a distinction made between manpower planning and modelling; a framework of key manpower planning variables will be conceptualised; and some new and existing limitations of the Construction Industry Training Board’s (CITB) employment model identified as backdrop for achieving, in part, the comprehensive review of manpower planning literature.
A review of manpower planning
2.2. Who should do manpower planning?

The mere mention of the phrase ‘manpower planning’ raises questions of who, what, how and why of manpower planning and/or modelling? As is increasingly the case in any entity\(^5\), the responsibility for manpower planning and/or modelling must be vested on a person, unit or department. In the case of SMEs (Small Medium Enterprises) for example, this responsibility is upon the Director / CEO (Chief Executive Officers); in larger organisations or multinationals, this responsibility is likely going to be bestowed on the personnel manager and/or its department; and at the more sub regional, regional or national level, this responsibility too, is likely going to be assigned to the manpower planning and/or modelling unit (if any) of the sub region, or region.

It can therefore be argued that the act of making manpower effective correlates significantly with the organisational structure of the entity. That is, an entity which can afford to run a ‘functional’ manpower planning unit (for example, large organisations / multinationals) will most likely speculate better in the many different areas of change that may be associated with economic booms and bursts than one without a ‘functional’ planning unit (for example, SMEs). An argument, which comparatively, buttresses the point that the construction and building services sector, is more susceptible to the consequence of environmental\(^6\) changes than the manufacturing industry (DTI, 2005;  

\(^5\) Entity as used in this chapter encompasses an organisation, sub region, region, or nation

\(^6\) Environment as is used in this thesis is an encapsulation of technological, social, economical and political changes.
OECD, 2006). This is partly because the construction and building services sector is highly fragmented (approximately 95 per cent of construction and building services organisations are SMEs) - the implication of which is little or no speculative knowledge of the key manpower planning variables needed for determining the number and types of skills required by a company or organisation (or any entity) if it is to achieve optimum productivity (Parnes, 1962 and 1965).

2.3. Distinguishing between manpower planning and modelling

The intent of distinguishing between manpower planning and modelling in this thesis is to primarily enhance the robust conceptualisation of a manpower planning framework. The former (manpower planning) is defined in this thesis as the activity of determining the number and types of personnel required by a company or organisation to carry out current and future works. In broader terms the company or organisation can be substituted for a sub region, region or nation. While the latter (manpower modelling) is a statistical technique used for collating, analysing and extrapolating manpower specific information (for example, organisational, regional, sub regional or national data) for the primary purpose of effective manpower planning. On the whole, the manpower planner needs to have the ‘right’ information in order to conceptualize and speculate ‘purposefully’; the ‘better’ the information gathered, the more effective the speculation, and vice versa (Ejohwomu et al, 2005b).
2.4. A conceptual framework for considering manpower planning variables

Manpower planning has two main but inter-related functions – providing knowledge about current manpower resources and anticipating the future (Lynch, 1968; Price et al, 1980). The former allows for short-term plans to be made in order to cope with sudden changes in the labour market environment. While the latter, which is arguably the more important function (because it prepares the entity not only for expected changes arising from business plans, but also for the unexpected changes which results from rapid economic and environmental changes), allows for the speculation of long-term plans, which informs cutting-edge decisions. It is worth noting therefore that the practicality of the aforementioned functions of manpower planning do vary considerably with the different type of entities and/or variables concerned.

However, before manpower planning can become purposeful (as a basis for making effective speculations) the core variables influencing manpower planning must be identified and examined for the directions of change (if any). In allowing for effective speculation of manpower requirements, the conceptual framework presented in line with Figure 2.1 (which is a modification of Bowey (1974) – a framework of non-construction specific manpower planning variable) will be considering general but more construction specific manpower planning variables. In practice therefore, it is vital for the manpower planner to be in the know of the ‘how’ and ‘why’ of variables which are likely to influence
the purposefulness and/or failure of manpower modelling. To enable an entity plan for the future and make more effective use of its scarce resources, the manpower planner is bound to know and/or have a clear picture of how what it has, fits with technological, social, economical and political changes of its immediate and external environment. Therefore, using Figure 2.1 as an analytical aid for outlining the considerations involved in basic manpower planning - the conceptual framework (Figure 2.1) aims to simplify the core phases, which the manpower planner should execute. Notably, it is not a representation of the way these variables fully interact with one another to produce actual changes in manpower inventory and requirements, retention rate, acquisition, replacement demand and future labour force.
Figure 2. 1: A framework of manpower variables
(Source: adapted from Bowey, 1974)
The logic behind Figure 2.1, arguably, is that there is some correlation between effective manpower planning and having a clear understanding of the manpower variables, which interplay during manpower speculations. The goals of the three phases of the framework (Figure 1.2) is to enable the manpower planner plan (phase 1), analyse (phase 2) and forecast (phase 3) the supply and demand for construction and building services skills.

**Phase 1:** In Figure 2.1, this phase of the manpower planning framework aims to enable the manpower planner comprehend information on the status of an entity’s ‘manpower inventory’ in conjunction with current and future technological, social, economical and political changes.

It is worth noting that the severity of any occurring change will be dependent on its ‘rippling effect’. For example in a manufacturing industry, any change in technology may lead to new ways of manufacturing being adopted in one or more manufacturing units. The implication of which may be the need for different type of skilled employee. Alternatively, this may affect the employer’s ability to retain its workforce if the new recruits are more career oriented than their

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7 Focused on establishing an entities existing manpower base in relation to political, economical, social and technological changes.
8 An analysis of the other specific issues / factors, which impact on an entities business.
9 Drawing on phase 1 and 2, the manpower planner is in a better position to speculate in the many different areas of supply of, and demand for skills.
10 The manpower inventory is the total stock of employees and their full characteristics (for example, age, sex, qualification and function) of the employees workforce in relation to with its immediate and external environment
11 When the effect of a change completely extends the phase within which it was generated
predecessors. The ability to recruit staff may also be compromised if there is only a limited supply of people with required skills in the entity’s immediate environment. This in turn may feedback onto the ability to retain labour, if a shortage of employee leads to excessive workloads for the existing members of staff. In the case of an extreme situation arising, these manpower difficulties could even cause the employer to reconsider his plans to change the techniques of manufacturing and the classification of its future manpower requirements (Bowey, 1974).

Although technological change has the most direct impact on skills and occupations, social changes are also of major importance in the manpower environment. The major types of social change that affect manpower are population trends, education and social mobility. The working age structure of a population, the death and birth rates all influence the availability of manpower. Education facilities for example will influence the robustness of the manpower and social mobility will determine the extent to which educational attainments can be translated into occupational activities.

On economic issues - economic changes are perceived to be both consecutive and concurrent. That is, the rate of ‘economical’ change in different parts of the economy can vary considerably. It is a general pattern of growth, which is inter-related with both technological and social changes; and as a society develops its technology, much effort in the initial stages are devoted to capital and infrastructural formation.
This is routine in industries in which companies merge together in order to optimise the benefits of technological advances (economics of scale), particularly if these advances require considerable amounts of capital. Having used the capital to finance increased production capacity much effort is thus placed on improving the economic efficiency of that capacity. This, in turn, leads to a need for improved marketing in order to ensure the products are consumed and that demand is continuously sustained. At each of these stages – capital and infrastructural formation, production and marketing – the types of manpower required will vary (Lupton and Bowey, 1983). It is, therefore necessary for the manpower planner to be familiar with the economic changes of its micro and macro manpower environment.

Within the context of political change, the rate of economic development is interdependent with political changes. In particular, these changes are synonymous with foreign policy, industrial legislation and monetary policy (Lynch, 1968; Bowey, 1976). That is, the external relations of a country will to some extent determine its industrial structure. Also, industrial legislation relating to industry training, migration and social mobility all have direct impacts on manpower. To this end, the amount of manpower employed at any one time is likely going to be influenced by monetary policy and by fiscal measures such as taxes and government expenditures (Keynes, 1936).

**Phase 2**: Summarily, this phase of the framework should enable the manpower planner make a realistic assessment of an entity’s ability to
retain the manpower it has at present, and at the same time calculate the optimum manpower requirements, retention rate and acquisition. Also open to the manpower planner at this phase is the entity’s ability not to retain its manpower inventory if future requirements are likely to be less than the present ones.

**Phase 3:** Drawing on the argument that replacement demand due to regular and early retirement, disablement and temporary withdrawals of women owing to birth and child raising constitutes an important element of the future demand for new entrants into the labour market (Willems and De Grip, 1993), the third phase of the conceptual framework, in particular aid the future prediction (manpower modelling) of the entity’s short-term supply and demand for optimum manpower.

Overall, these three phases of the framework are interlinked (exhibit traces of dependency), in that, the future labour requirement(s) are largely influenced by the significance and consequences of the occurring technological, social, economical and political changes. This also indicates the amount and characteristics of manpower requirements, which needs to be retained and evaluated for the future (long term) labour force needs. However, by accepting acquisition, as a variable, the manpower planner is arguably privy to the status of the entity’s factor of production; this in turn informs both planning and modelling decisions.
2.5. A snap shot of UK employment models

Internationally, the Institute of Employment Research (IER), Warwick is regarded as UK’s main manpower planning unit (as a forecasting unit, the IER takes on board all industrial and non-industrial sectors). This institute uses full macroeconomic model with a Keynesian structure that incorporates an input-output system whilst approaching problems of manpower planning and modelling. The modelling technique utilized by the IER is purely econometric (see Heijke, 1994: p 9-81).

Nationally, the CITB-ConstructionSkills Employment and Training Forecasting model provides forecasts on employment and training needs for different trades within the construction industry in regions across England and in Wales, Scotland and Northern Ireland. This forecasting model, arguably, provide a crucial foundation and framework for planning exercise. That is, the model informs the sector, and will be informed by, the National Group of the Construction Skills Observatories (CITB-ConstructionSkills, 2005). Leaving the question of who then informs the latter\(^\text{12}\) (Ejohwomu et al, 2005a)? On the whole, “the CITB-Construction skills employment modelling approach relies on a combination of primary research and views from the observatory to facilitate it, although the model can initially be augmented with assumptions, based on UK data, and then adjusted later with the assistance of the observatory. Each region and country has a separate model.” More importantly, the CITB models work by forecasting

\(^{12}\)National Group of the Construction Skills and regional Skills Observatory
demand and supply of skilled workers separately; with the difference between demand and supply forming the training requirement.

2.5.1. Gaps in the current CITB-Construction Skills employment model

Some of the identified gaps of the CITB-Construction employment model are acknowledged below. Although, some of these gaps were adopted from literature (Meen, 2002; Ive, 2004 and Ejohwomu et al, 2005c); the conceptual manpower planning framework in Figure 2.1 and its following analysis arguably suggests that the current employment model is not being sufficiently holistic, because:

- the employment model has no complete consideration for its immediate environment (the effect of technological, social, economical and political changes are ignored);
- the employment model has no clear theoretical basis for its structural approach;
- except for differences in demand and supply (training requirement), the employment model has little or no consideration for retention and replacement demand. In other words, the model overlooks the different sources and degrees of skill acquisition and skill decay;
- the employment model has no consideration for gross recruitment and gross availability;
the employment model treats skilled labour supply and demand exclusively in terms of qualified works rather than being nested within a broader model of total demand for and supply of skilled labour;

the employment model divides non-trainee recruits to the industry in just two categories (skilled and unskilled);

the employment model lacks a well designed construction-employer-based survey of employer assessments of non-trainee recruits;

the employment model does not distinguish between young and old workers; and

the employment model is currently being powered by data from mainly LFS and ONS, which are not sufficiently robust to produce construction specific forecasts and prediction.

2.6. Summary

The underlying focus of this literature review chapter, which is to draw a link between skills crisis and a failure of manpower planning, has been largely achieved by:

- distinguishing between manpower planning and modelling;
- developing and analysing a conceptual framework of manpower planning variables;
- discussing UK’s employment models; and
identifying new and existing gaps in the CITB construction skills manpower planning model.

The focus of the next chapter therefore is on the consequences of a failure of UK’s manpower planning framework. It is worth noting that emphasis has been placed on the gaps of the CITB-Construction Skills model (and not the IER’s model) because the primary focus of this study hinges on UK’s construction and building services sector.
CHAPTER 3

CONSTRUCTION SKILL CRISIS: A FAILURE OF MANPOWER PLANNING

3.1. Introduction

The significance of a sufficient pool of labour in a labour intensive sector such as construction cannot be overemphasized. The preceding chapter examined in some great detail the basic but functional concepts of manpower planning as a backdrop for signposting new and established gaps of the current construction industry’s employment model. Inferentially, it would be safe to argue that the construction industry’s persistent skills crisis is in part, a failure of its manpower planning system. Furthermore, the relativity (confusion in the everyday labour market understanding of skills crisis phenomenon) in defining and interpreting the phenomenon of UK’s construction skills is exacerbating the consequences of skills crisis in the industry (Ejohwomu et al, 2006a).

As a prelude to understanding UK construction skills crisis, it is pertinent that the phenomenon of construction skills crisis be well understood and any areas of confusion clarified. This Chapter therefore introduces and defines the phenomenon of skills crisis, distinguish between soft and hard skills, examines existing redress strategies and identifies factors influencing the supply and demand for skills. This is
aimed at developing a theoretical framework for addressing skills supply and demand deficiencies.
3.2. Understanding the phenomenon of construction skills crisis

In this era of increased global competitiveness where ‘survival’ depends largely on labour optimisation, it is imperative that construction industry stakeholders (training providers, constructors and funding agencies) understand fully the phenomenon of ‘skills crisis’. Like most well understood phenomenon in life, defining skills crisis can be very difficult. For example, most people understand what tranquillity or joy is but would offer different definitions of this concept depending on their state or frame of mind (Olomolaiye et al, 1998). Refining such phenomenon concepts often leads not to a standard phrase one would expect in definitions, but rather explanations of the main characteristics of the subject. Defining skills crisis faces the same problem in the construction sector.

The Wikipedia encyclopaedia defines skills as “an ability, usually learned and acquired through training, to perform actions which achieve a desired outcome” and crisis as “a turning point or a sharp transition and/or recession”. Frogner (2002) defines skills as the ability to perform a task to a predefined level of competence; skills shortage as a “recruitment difficulties caused by shortage of individuals with required skills in the accessible labour market” and skills gap “as a deficiency in the skills of an employer’s existing workforce”. Leitch (2006) defined skills as capabilities and expertise in a particular occupation or activity. Buchanan (2005) defined skills crisis, as a failure of the skill formation system – failing to meet the current future needs
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of employers. Other known media led definitions of the phenomenon are skills gap – a deficiency in the skill of an employer’s workforce (employee lacking proficiency) and skills mismatch – this signifies the supply of irrelevant skills that are not desirable to its immediate labour market.

Although these definitions and perceptions of skill and skills crisis phenomenon offers a good start to explaining the phenomenon of skills crisis, it compliments the earlier mentioned difficulty of defining an abstract concept by using the words ‘competence’, ‘ability’ and ‘desire’ in defining the true meaning of skills crisis. Drawing on the many definitions of skills, three underlying components of the phenomenon of skills crisis are the ‘ability’ of the labour force; the ‘task’, which is the action to be performed and ‘output’ a representative measure of the work done. The definitions on the problem of skills crisis in different research studies are limited to one or two of the three underlying components highlighted above. The Employer Skills Survey\textsuperscript{13} (ESS) provides two definitions for lack of skills: skills shortage and skills gap. In this thesis, the phenomenon is encapsulated as skills gap, shortage, mismatch and all known associating attributes such as, unemployment and high wages.

\textsuperscript{13} A survey commissioned by the Department for Education and Skills (DfES)
training providers, employers, trainees and the unemployed). More importantly, emphasis should be placed on why the construction sector needs more of hard skills and not soft skills.

3.2.1. **Soft and hard skills: which is more beneficial to the construction sector**

There are a large number of different types of skills, which can be simplified using a skill hierarchy structure.
Adopting a top-down hierarchical structure, Figure 3.1 comparatively begins by grouping skills into two distinct groups - soft and hard skills. In other words are soft skills\(^{14}\) really any different from hard skills\(^{15}\)? Irrespective of industrial sectors, organisations are bound to seek both soft skill (transferable) and/or hard skill (non transferable). To this end, it can be argued that team working and communication skills are examples of transferable skills while technical trades are examples of non-transferable skills. What then is ‘transferability\(^{16}\)’? In Figure 3.1, the broken line denotes a skill transfer ‘boundary’ between two different industrial sectors (construction being a sector and

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\(^{14}\) In the context of this research, a soft skill is one which is transferable between industry’s / sectors with little or no need for training requirements. Example of soft skills thus include: a company secretary / administrator; human resource / personnel worker and helper.

\(^{15}\) In the context of this research, a hard skill is one which requires sufficient training prior to the transfer initiation between industry’s / sectors. Examples of hard skills include: plumbers; joiners and electricians.

\(^{16}\) Transferability in the context of this research is the ease and/or condition of labour movement between transfer boundaries.
manufacturing being another sector in this case). Common to both of these sectors are a defined set of skills, which have been grouped into soft and hard skills respectively. It is worth noting here that the individual components of each skill set (particularly hard skills) may vary between sectors. In the construction sector, hard skills have been grouped into trades and non-construction trades (were carpentry and joiners are examples of the former and civil engineers and construction project managers are examples of the latter) while hard skills have been grouped into technical and non-technical skills in the manufacturing sector. Also common to both sectors down the hierarchy are a ‘pool of labour\textsuperscript{17}. With particular reference to Figure 3.1, this pool of labour, which is a mix of both soft and hard skills, is accessible to the manufacturing and construction sectors. In other words, the ‘robustness’ of each pool will be dependent on key supply and demand factors (to be discussed in the subsequent sub section) and ease of transferability. Transferability between ‘pools of labour’ is to a great extent dependent on training requirements. This training requirement is particularly being constrained (hence the bold lines) in the construction industry because trainees are not able to secure the apprenticeship placement needed to acquire a training qualification (CITB, 2004). The implication of which is shortage of qualified tradesmen.

The most common measures of skills are qualifications. For the tradesman, qualifications provide ‘portability’ in the labour market,

\textsuperscript{17} A reservoir of manpower – consists of both soft and hard skills. Its status is very central for effective manpower planning.
thus allowing a tradesman to demonstrate the skills he/she has acquired (Leitch, 2006). For today’s employers, qualification and work experiences gained seem to provide valuable signals during recruitment and also motivate employees to complete their training. In other words, qualification and work experiences form a major part of employer recruitment strategies, especially screening of candidates prior to and post interviews. Anecdotal evidence suggests majority of entrant trainees are unknowingly studying towards a qualification, which is multiskilled – a qualification that is encapsulating of training and work experiences (NALS, 2002; PWC, 2005).
3.3. A general supply and demand relationship

In microeconomics term, general supply and demand economic models aim to describe, explain and predict the effect price changes have on consumer behaviour. In particular, the concept of demand, which represents the market activity of consumers can be defined as “the quantity of a good or service that consumers will be willing to purchase at any given price during a specific period of time, holding all other factors constant”. While the concept of supply can be defined as “the relationship between the price of a good or service and the quantity producers are willing and able to make available for sale in a given period of time, holding other things constant” (Klein, 1983). Many other factors other than price affect consumer behaviour – see Figure 3.3 for an in exhaustive list of some of these factors, which are commonplace in the construction and building services literature.

![Figure 3.2: A general supply and demand relationship](Source: Humphrey, 1992)
Supply and demand relationships can be illustrated in a schedule that shows how many units of a good or service consumers will purchase at several distinct prices and how many units of a good or service producers will make available for sale at several distinct prices. The X and Y axis of Figure 3.2 denote Price against Quantity relationship; together, the individual supply and demand curves emulate consumer and producer behaviour during price change. In particular, the demand curve, which slopes downward to the right, indicates that a greater quantity will be demanded when price is lower. The slope of the supply curve upward to the right suggests that as the prices increase, producers are willing to produce more goods. Notably, the point at which these curves intersect is the equilibrium point (also known as market clearing price). At price P*, producers will be willing to supply Q* units per period of time and consumers will demand the same quantity. In Figure 3.2 P* is the equilibrating price that tends to equate supply with demand (Cathberton, 1985). If the price is below P*, consumers will up bid the price and if the price is above the equilibrium price (P*), producers will bid down the price. It is only at the equilibrium price will quantity demanded equal quantity supplied and most market prices stabilize. Also, this is the only price for which consumers have no reason to offer a higher price and producers have no compulsion to offer a lower price (Humphrey, 1992).

3.3.1. Factors that influence a general supply and demand relationship
It would be unsafe to argue that the UK construction labour market can – one day – be at equilibrium at the wage for which the quantity demanded is equal to quantity supplied because all other factors cannot be held constant in reality. However, with a ‘good’ working knowledge of the factors that hinder the sufficient supply and demand for construction skills, achieving a labour market, which tends towards equilibrium, is not unrealistic. Although not an exhaustive list, Figure 3.3 (the square and rectangles boxes denote demand factors and the eclipse boxes supply factors) is a summary of both supply and demand side factors (which are known to influence the general supply and demand of construction and building services) that are commonplace in the literature. It is worth noting, however, that there are significant variabilities in the intent and ‘context’ within which these factors were investigated (Uwakweh and Maloney, 1991; Rosenfeld and Warszawski, 1993; Wong et al, 2004).

In line with the objectives of this research (see Section 1.4: p 8) - and amid some of the factors captured in Figure 3.3 - the research laboratory will be scoped for evidence of multiskilling framework and the impact (if any) of adopting this framework as a tentative redress for ameliorating shortage and proficiency of construction trades.
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Figure 3.3: A ‘bubble’ diagram of variables influencing supply and demand of construction and building services skills

(Source: Ejohwomu et al, 2005a)
3.3.2. Demand for skills

Since the advent of new technologies, there have been shifts in the occupational structure of UK construction manpower, from manual to non-manual labour. Whilst the degree of shift varies with different sectors, there is evidence of implied shift in the demand for skills from manual skills to skills related to cognitive ability (Frogner, 2002). That is, the quest for soft skills such as communication, team working and ability to use IT equipment is rising, while that of hard skills, which requires manual and physical strength is falling. In order to strike a balance there is increased need for upskilling and retention of hard skills because operatives need to ease boundary transfer requirements and at the same time update their knowledge of new products and processes. Skills transfer and upskilling is hands on in a labour intensive sector such as the construction industry where manual activity still predominates. In such a sector the scarcity of the skilled manual labour is bound to be severe when new trades are evolving. A factor, which the Confederation of British Industry (CBI) argues, is limiting the robustness and output of the average ‘pool of labour’. This brings to bare the question of what skill mixes in an existing pool of labour are appropriate for maximising UK’s economic growth, productivity and social justice (Leitch, 2006).

3.3.3. Supply of skills
Skills supply has to do with the provision of skilled or unskilled manpower at the point of need. There is greater demand for the former because of the significant contribution it makes to productivity - manpower per unit output. Within the construction sector, skilled manpower can itself be grouped into construction trades and non-construction trades; the most arguably sought after being construction trades - a fact that is partly responsible for disequilibrium in the supply and demand for manpower in the construction sector. In order to achieve utopia there must be equilibrium in the supply and demand for skills, which gives rise to the question “can researchers ever match the supply of skills to demand”? and “what is the implication of changing the shape and structure of the labour force for the construction industry”?

Arguably, the implication of changing the shape and structure of the UK labour force for the construction industry (such that there is improvement in quality and number of entrant trainees, better trainee and employee retention and the adoption of inward focused research that is, harnessing existing pool of labour) is a significantly improved match between skill supply and demand.

3.4. Skills crisis: an analysis of response strategies

Since the early 1990s UK recession, the growth rate in the construction and building services sector has been outstanding. Regardless, a much stronger growth rate is currently being predicted for 2007 after output
fell in 2005 for the first time in eleven years (Construction News, 2006; Ejohwomu et al, 2006b; Leicth, 2006). As a result of this growth the industry is expected to experience considerable skills crisis (Mackenzie et al, 2000; Ejohwomu et al, 2005a; Olomolaiye et al, 2005). The implication of which, is a potential exacerbation of existing disequilibrium in the supply and demand for construction and building services – severe skills crisis. Particularly when Leitch (2006) argued that given its present framework, more than 70 per cent of UK’s 2020 working age population will be over the age of 16. The implication of which is need to up the rates of skills improvement if UK is to achieve its skills projection for 2020.

To date, a number of factors have been documented as prime causes of UK’s skills crisis. Dominant amongst these factors, which researchers argue stem from the industry’s evolutionary developments over the last 20 years are: (i) the demographic decline in the number of entrant trainees (Ashworth and Harvey, 1994; Druker and White, 1996); (ii) the changing nature of construction markets and the demand for skills (CITB, 1991); (iii) introduction of new technologies (Agapiou et al, 1995; Gruenberg, 1997); (iv) the growth of self-employment and use of specialist / labour-only subcontractors (Clarke, 1992; Fellows et al, 1995); (v) the cyclic nature of the construction market (Agapiou et al, 1995; Morton and Jagger, 1995; Thompson, 1996) and (vi) the growing prevalence of output focused funding; the spread of over 25 years subcontracting in the sector decimated by the effects of recession. That is, the prevailing trend in the provision of craft training in the UK
construction sector is being marred by fragmentation of funding arrangements and a plethora of construction qualifications (Agapiou, 1998). More so, the somewhat persistent nature of the phenomenon (skills crisis) has led to the conceptualization of contemporary factors: (i) discrepancies in the definition or perception of skills crisis (Ejohwomu et al, 2006b); (ii) absence of data collection and dissemination frameworks (Olomolaiye et al, 2005; Briscoe, 2004); (iii) consequences of economic stability (Dainty et al, 2004); regional / sub regional peculiarity (Ejohwomu et al, 2006a); and (iv) failure to develop and imbibe the concept of multiskilling (Scot and Cockrill, 1997; Ejohwomu et al, 2007).

Given the significance of UK’s construction sector (see Chapter One), it is not a surprise that proposed response strategies – committing to achieving 2010 \(^{18}\) - completely extends the usual traditional response to shortage of any type of skilled labour – increased remuneration. To date, there are several known response strategies: industry and government response strategies; the considerate constructors scheme; the national construction week; the construction skills certification scheme; the investment in people initiative; the New Deal employment scheme; the CITB equal opportunities initiative; the CITB training recruitment strategy; alternative response strategies to the skilled labour shortage; women and ethnic minorities as alternative sources of

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\(^{18}\) 95 per cent of adults to have functional literacy and basic skills up from 85 percent literacy and 79 per cent basic skills in 2005; exceeding 90 per cent of the adult population qualified to at least level 2; shifting the balance of intermediate skills from level 2 to level 3; and world class high skills, exceeding 40 per cent of adult population qualified to level 4 and above.
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Construction labour; adult trainees as alternative sources of construction labour; new technologies and construction techniques; greater use of prefabrication; automating construction sites; greater economic stability within the industry; a return to direct employment; greater labour only subcontractors involvement in operative training; and long term industry wide training plans developed by stakeholders (industry and government) as redress for skills crisis. An empirical study of construction industry perception on UK construction skill’s crisis response strategies by Mackenzie et al, (2000) emphasized that the cyclical nature of the UK construction industry presents one of the greatest barriers to construction-related training and stable employment patterns. Growth of labour only subcontracting and self-employment were identified as chief factors causing deficiency in training provision; proposed development of long-term industry wide training plans; and integration of the people in investment standards were regarded as ‘meaningful’ response strategies. Thus, it should be safe to suggest that the majority of existing UK response strategies are somewhat misguided because they lack theoretical basis and have failed to fully exploit the prowesses of existing pools of labour. The implication of which is the likely persistence of the phenomenon (skills crisis).

Emerging evidence suggest ‘convergence’ on the reality of skills crisis and ‘divergence’ in the adoption of response strategies amongst the different nations of the world. A fact that somewhat compliments global cultural and structural diversities. For example, in the United States
emphasis is largely being placed on both information disaggregation Heijke (1998) and concept of multiskilling (Burleson et al, 1998) whilst the Netherlands, have championed the use of a robust information management system (Heijke, 1998). In the UK, Dainty et al, (2004) argued that overall, the understanding of the complex interplay of structural and cultural factors, which together define the industry’s employment and human resources management practices is a ‘prerequisite’ for developing holistic and sustainable policies; and a basis for prescribing sub regionally driven strategy for resolving the construction labour market skills crisis. In order to allow for a realistic understanding of this complex interplay, the subsequent sub sections will evaluate the trajectories of some existing theoretical frameworks in relation to achieving the state of equilibrium in the supply of and demand for construction and building services skills

3.5. Summary

The following points summarize this chapter.

Having criticised most existing research works on resolving the UK skills crisis for not developing sufficient understanding of its’ realities and consequences (Chan and Dainty, 2007). This literature review Chapter has not only defined the phenomenon of skills crisis but key areas of confusion has been clarified whilst distinguishing between soft and hard skills.
It would be unsafe, therefore, to argue that the supply of skills could be fully matched – realistically - to its demand because the factors, which impede cannot be held constant in practice during a specific period of time. A number of responsive strategies aimed at addressing the consequence of construction skills crisis have been prescribed; and aside being deficient in ‘theory’, they are mainly focused on populating and not harnessing existing pool of labour.

Subsequently, this research will try to exploit the prowess of existing pool of labour whilst drawing on a realistic theoretical framework.
4.1. Introduction

The preceding chapters have reiterated the significance of a ‘robust’ pool of labour to the construction and building services sector, which is bespoke and complex (Shenhar, 1996; Cooke-Davis 2000; Morton, 2002; Keskola, 2003; Ejohwomu et al, 2005b). Besides, the sector through the products that it creates has greater effect on the country’s wealth than any other industry (Hillebrandt, 1984). Subsequently, efforts to identify realistic theories and/or contribute even the slightest of labour market interpretation of skills crisis could have a positive effect on the sustainability of UK’s construction and building services industry.

Without underpinning manpower supply and demand studies on self-explanatory theories, which are testable, it would be very unlikely that a thorough understanding of the various labour market forces would be achieved. It is only when the evaluations of these labour market forces are grounded within a realistic framework would holistic redress strategies be conceivable for possible application (Fellows and Liu, 1997). A prelude to such strategy is the apt but critical review of the functional forms of three key labour market theories: manpower
requirements approach, New Keynesian theory and the concept of multiskilling. It is pertinent, noting that the selection of these theories were based largely on their ability to accommodate and/or simplify labour market forces which define the phenomenon of construction skills crisis.
4.2. Manpower Requirements Approach (MRA)

Since World War II, there has been growing awareness that human capital endowment is an important factor of economic growth (productivity), in addition to physical capital. Schultz (1961) and Baker (1962) were the first economists to state that education and training were every bit as important in contributing to productive capacity as raw manpower and physical capital. The postulation by these foremost economists informed the concept of conceiving the planning methodology known as the manpower requirements approach\(^\text{19}\) (MRA), which still remains an essential ingredient for developing labour market models (Parnes, 1962, Parnes 1965; Eijs, 1994; Grip and Heijke, 1998).

In the early sixties, the Mediterranean Regional Project (MRP) initiated by a bilateral agreements between the Organisation of Economic Cooperation and Development (OECD) and government of six Southern European countries – Greece, Italy, Spain, Turkey and Yugoslavia witnessed the development and acceptance of the theoretical framework for ‘employment planning’ - a Manpower Planning Approach (see Parnes, 1962 and 1965). The primary aim of the Mediterranean Regional Project was to resolve the problem of bad coordination, which they perceived, coexisted between the education system and the labour

\(^{19}\) The objective of this paradigm is to significantly improve economic growth and not entirely policy / information function by setting speculative target (Gripe and Heijke, 1998).
market – skills mismatch\textsuperscript{20} - which is a direct overlap and/or attribute of the phenomenon of skills crisis.

\textsuperscript{20} Skills mismatch: whilst this is a part symptom of disequilibrium in the supply and demand for skills, in specific labour market terms, it signifies the supply of irrelevant skills – skills not desirable to the immediate labour market.
4.2.1. Manpower requirements approach (MRA): criticism

Since the development of manpower requirements approach, various fundamental objections have been raised locally and internationally. Blaug (1967) methodological objections focused on the fixed coefficients used by forecasting models to translate economic developments into changes in employment differentiated by training and occupation and on the concepts of labour markets’ functioning, in which there is no place for the working of substitution and other adjustment processes.

The core criticism that led to the final rejection of manpower requirements approach (MRA) was centred on the use of ‘fixed coefficient’. The implication of which was scepticism amongst manpower planners with this criticism being mostly epitomized by statements such as “the art of manpower planning is certainly in disarray - after decades of manpower forecasting practice, it has come under repeated and sustained criticism; and those still practicing the art might rightly be confused as to the mandate, methodology and overall usefulness of what they are doing” (Psacharopoulos, 1991; Hopkins, 2000).

4.2.2. Manpower requirements approach (MRA): counter criticism

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Evidence from literature suggests there is consensus amongst critics and initiators of manpower planning approaches that a successfully coordinated match between the labour market and education system would improve economic developments (Briscoe and Wilson, 1991; Eijs, 1994; Heijke, 1998). Irrespective of the criticisms made over the introduction of manpower requirements approach and the suggested use of flexible approach there remains no definitive way of carrying out manpower planning, forecasting and modelling. Borghans and Willems (1998) whilst interpreting gaps in manpower forecasting models concluded that by incorporating the elasticity’s of demand and supply into the model the gap can be viewed upon as the distance to the equilibrium thereby purporting that the most important criticism on the theory of manpower forecasting does not hold.

4.3. New Keynesian theory

The Keynesian theory, which has been named after John Maynard Keynes, is perhaps best known for its “General Theory of Employment, Interest and Money” (Pugh and Garratt, 1993). Keynes (1936) did not agree with Classical economists, the core of Keynes’ argument, was however, hinged on market failures – “market would not automatically lead to full employment equilibrium”. Keynes’ believe emphasized that relying on market to achieve full employment was not a good thing. This was justified in the prescribing of four main Keynesian theories: the labour market theory, the market of loanable funds, the multiplier and Keynesian inflation theory. In line with the focus of this study
emphasis will be placed on discussing Keynes’ labour market theory, which is captured in Figures 4.1, 4.2 and 4.3.

Figure 4.1: Graphical representation of Keynes labour market theory
(Source: Pugh and Garratt, 1993)
Keynes’ lack of confidence in the labour market is centred on the effect of ‘sticky wages’ (Pugh and Garratt, 1993). In other words, employees will continually strive to resist pay cuts during recessions. The implication of which is continued unemployment. This is captured in Figure 4.1. That is, when the demand for labour falls from D1 to D2, the wage rate should fall in order for the market to clear. Given that wages are ‘sticky’ downwards, this would not happen and unemployment resulting from the fall in demand from point b to point a, would present what is termed as demand deficiency unemployment.

Figure 4.2 details the concept of the New Keynesian theory as applied to supply of, and demand for construction and building services skills labour market; this offers a logical explanation for interpreting the question “can researchers ever match the supply of skills to its demand”?

![Figure 4.2: Depicts wage rigidity with real wage above market-clearing wage](image)

---

21 A market clears at the point where the quantity demanded is equal to quantity supplied.
Figure 4.2 shows that if real wages were above the market-clearing wage the quantity (of labour) supplied would exceed quantity demanded. Where:

\[ W^{**} = \text{real wage} \]
\[ W^* = \text{market clearing-wage} \]
\[ NS = \text{number supplied} \]
\[ ND = \text{number demanded} \]

What is of paramount interest to construction and building services labour market at time (t) for project at any location (l) and project type (p) is the market price per unit labour (P/Labour). When market-clearing wage equals real wage (see Figure 4.3) then there is no involuntary unemployment. This wage is considered as the equilibrium wage, as there is no involuntary unemployment and resources are efficiently allocated (McPhail, 2005). Conceptually, this can be expressed as equation 1 and 2 of Figure 4.3.

\[
W^{**} + W^* = 0 .................................................................(1)
\]

**Figure 4.3: Depicts wage rigidity: market-clearing wage equals real wage**
(Source: Ejohwomu et al, 2006a)
A theoretical framework for optimising existing pools of labour

There will be no involuntary unemployment

If \[ W^{**} + W^{*} \neq 0 \] .............................................................................(2)

There will be involuntary unemployment

Where: \( W^{**} \) is real wage and \( W^{*} \) clearing wage
4.3.1. New Keynesian theory: criticism

Nobel Laureate Robert E. Lucas and Milton Friedman championed the two main critiques of the Keynesian model although the latter accepted Keynes definition of recession (Friedman, 2002). The core of Keynes’ theory was replaced by the policy of monetarism, that is, inflation, unemployment and output should be market and not government dependent. In addition, Lucas (2002) put forward the theory of rational expectations and argued that recessions are self-correcting – government intervention ranges from ineffectualness of harm.

4.3.2. New Keynesian theory: counter criticism

The criticism of Friedman (2002) and Lucas (2002) reached their implementation peaks amongst conservative economist while Keynesian theory ‘slumped’. However, with the passing of time the argument of Friedman and Lucas were dismissed for its deficiency in practicality; and today the New-Keynesianism has returned to prominence. The influences of government intervention in the way of policies is still being ranked high on the factors influencing disequilibrium in the supply and demand for construction and building services skills in the UK (CITB, 2001).

4.4. Multiskilling: a working definition
A justification for the existence of a plethora of multiskilling definitions\textsuperscript{22} is in the ‘rigidity’ of its applicability across individual sectors. Drawing on the multiskilling framework outlined in Table 4.1; a working definition for the concept of multiskilling was defined as “a labour utilization strategy that is ‘motive driven’, factor influenced – regardless of any impeding limitations and ‘benefit’ inclined” (Ejohwomu et al, 2006b). By standardizing the definition of multiskilling this research hopes to operationalize the instruments of survey and in part improve the wide applicability of the concept of multiskilling (Ofori, 1994; Ruddock, 2002).

\textsuperscript{22} The UK was omitted from Table 4.1 because it had no known definition of the on the functional concept of multiskilling.
A theoretical framework for exploiting the prowess of an existing pools of labour

<table>
<thead>
<tr>
<th>Industry</th>
<th>Country</th>
<th>Motivation</th>
<th>Definition</th>
<th>Dominant Factor(s)</th>
<th>Benefits</th>
<th>Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>USA</td>
<td>steady demand for improved productivity and the shortage of killed craft workers.</td>
<td>It's a labour utilization strategy where workers possess a range of skills appropriate for more than one work process and are used flexibly on a project or within an organisation; a multi-skilled construction trade worker is an individual who possesses or acquires a range of skills and knowledge and applies them to work tasks that may fall outside the traditional boundaries of his or her original trade.</td>
<td>Culture and characteristics of the sector.</td>
<td>5-10% labour cost saving; a 35% reduction in required forces; a 47% increase in average employment duration; increased earnings potential for multiskilled labourer (Burleson, 1998).</td>
<td>Paradigm shift required all through the industry; Ability to standardize and sustain training provision.</td>
</tr>
<tr>
<td>Health Care</td>
<td>Canada</td>
<td>Potential to impact positively on the quality of service received by clients</td>
<td>An approach to care / a concept in which staff are crossed trained but not professionally ab ducted into two or more tasks associated with at least two disciplines – this can be intra or interdisciplinary multiskilled (Makeley, 1998).</td>
<td>- role of the specialist and generalist - range of service providers that are needed to meet client needs - quality of service; competence in theoretical knowledge as well as task performance - impact of interactions on client satisfaction (CASW, 1998).</td>
<td>Cost effective, partial solution to recruitment problems; Supports flexible use of staff to increase job satisfaction and job security (CASW, 1998)</td>
<td>May compromise the complexity of the people and environments in which they function and does not preserve and foster the unique contribution of all professions (CASW, 1998).</td>
</tr>
</tbody>
</table>
A theoretical framework for exploiting the prowess of an existing pools of labour

Table 4. 1: Conceptual framework for deriving a working definition for the concept of multiskilling
4.5.1. Multiskilling: research trend

The concept of multiskilling is currently being accepted beyond the US construction and building services sector as a redress for skills crisis. This is because emerging evidence suggests the concept of multiskilling when imbibed, yields on average a 5-20 per cent labour cost savings, a 35 per cent reduction in required workforce, a 47 per cent increase in average employment duration, and an increase in earning potential for the multiskilled construction worker (Burleson, 1997; Burleson et al, 1998). To this end, Haas et al (1999) synthesized and formalized the methods that successful construction companies currently apply in implementing a multiskilled workforce. Dada and Ekpe (2006) in an empirical study of the place of multiskilling in the Nigerian construction sector – a developing country indicated that multiskilling reduces workers’ idle time and enhances employability of workers. The barrier to multiskilling includes lack of training, meeting license requirements and resistance to change (Dada and Ekpe, 2006). Although Carmichael and Macleod (1993) have argued that multiskilling is a key strategy for fostering change in Japanese firms, the overall merits of the concepts of multiskilling is believed to be ‘multidimensional’ and a redress for the demerits of implementing change, skills shortage, declining productivity, and un-employment stability (Burleson et al, 1997 and 1998; Cass, 1992; Thomas, 1991; Halpin, 1992; Carmichael and Macleod, 1993; Clough and Sears, 1994; Lathrop, 1991 and Livesay, 1996).
4.6. Multiskilling: criticism and counter criticism

The only known criticism of the concept of multiskilling has been associated with the consequences of ‘change’ implementation and a barrier to specialisation. Carmichael and Macleod (1993) argued that although training workers in several jobs is a successful redress for labour market shortfalls. There have been retrospective periods when a singly skilled workforce has resisted adopting labour saving changes for fear of losing their jobs. In response to this fundamental criticism, studies have shown that whilst employee resistance to change is a complex issue facing management in any evolving organisation or sector, it is possible to address this by theorising and understanding the unique circumstances within each individual or group causing the particular resistance (Bridges, 1991; Coetsee, 1999 and Goldberg, 1999).

4.7. Understanding the functional concept of multiskilling

To aid the understanding and applicability of the functional concept of multiskilling, this section of the thesis will be scoping known construction and non-construction multiskilled modelling frameworks.

4.7.1. Non construction specific multiskilling models
A theoretical framework for exploiting the prowess of an existing pools of labour

In an investigative study of the dimensions of multiskilling (with particular emphasis on consideration for educational audiology), Johnson (1999) argued that there are three central multiskilling models, which are appropriate to the practice of audiology, namely: subordinate, collateral and collateral-subordinate multiskilling models.

A subordinate model: This involves the health professional performing varieties of non-professional tasks at non-professional level of practice. For example, subordinate multiskilling is used to train the audiology professional to perform non-clinical tasks. This is particularly beneficial to a situation where the gap lies in the educational audiologist not having readily available support personnel.

A collateral model: In a collateral multiskilling model, professionals from other disciplines are up-skilled through cross training to perform non professional works. For example, nurses can be trained to perform pure-tone air-conduction hearing screening.

A collateral-subordinate model: In this type of model, support personnel of other professions are up-skilled through cross training to perform the duties of a non professional in a different section. Regardless of the distinct peculiarity of each of the aforementioned multiskilling model, it is commonplace in the literature that the concept of multiskilling can best function where manpower ‘gap’ persists.
4.8. Construction specific multiskilling models

In an exploratory effort to quantify, at project level, the potential benefits of utilizing a multiskilled workforce, Burleson et al (1998) derived four multiskilling modelling strategies, namely: dual, four, four skills helpers and theoretical maximum labour strategies.

A dual skill labour strategy: Burleson et al (1998) argued that the dual skill labour strategy was developed as a direct extension of the traditional wave theory of project scheduling. Drawing on this theory, it can be argued that the dual skill concept identifies craft combinations with complimentary workloads. Thus ensuring employees enjoy prolonged employment duration by being dual skilled. Notably, as a schedule is developed, the primary goal of a working gang will be to achieve maximum productivity whilst performing tasks. A pattern that is employed whilst dealing with allocated task (Coombes, 1990).

A four skill labour strategy: A four skill strategic model is a multiskilling framework for minimising sets of general craft classifications. If the skill requirements for executing a particular project from its conception to completion phase is classified into four general groups for instance, its multiskilling factor would then be centred on four different combinations. For example, in the development of CII model plant project, Burleson et al (1998) derived these four skill craft groupings: civil/structural workers, general
support workers, mechanical workers and electrical workers - a grouping that is specific to the CII model plant project.

**A four skill-helpers labour strategy:** This is a modification of the four skills labour strategy. In this case, each original craft group consists of workers from three skill levels: novice/helper, journeyman, and foreman. Although, the underlying concept of the four skill-helpers labour strategy is somewhat a direct translation of a collateral-subordinate multiskilling model, Burleson et al (1998) has argued that the theoretical basis of this strategy is dependent on factor flexibility across the project.

A theoretical maximum labour strategy: This multiskilling model assumes that the ‘construction worker’ consists of just one craft classification system. Theoretically, all construction workers are fully multiskilled and flexible – can be moved across most project task. A theoretical maximum labour strategy helps achieve the maximum benefits of utilizing a multiskilled craft framework (Burleson et al, 1998).
4.9. Theoretical framework: a case for multiskilling

It may be ‘difficult’ for the manpower planner to adequately addressing labour market irregularities without having a prior understanding of the labour market forces which influence their internal and external environments. The purpose of scoping these three labour market theories (as stated earlier) has been based largely on their ability to accommodate and/or simplify labour market forces, which better define manpower planning problems.

![Figure 4.4: Deriving a theoretical framework](image)

Drawing from Figure 4.4 (and the preceding discussions on MRA, New Keynesian Theory and multiskilling) it can be argued that all three theoretical frameworks have contributed to better understanding of the labour market peculiarities. Consequently, based on the merits and
demerits for all three theoretical concepts; the concept of multiskilling is accepted for its suitability for addressing the task of evaluating and maximising existing pool of labour. It is, however, evident from literature that there is no one ‘ideal’ theory for the resolution of skills crisis phenomenon. To this end, it is imperative that any theory, which leads to better understanding of labour market forces, could in turn provide a realistic methodology for addressing disequilibrium in the supply and demand for construction and building services industry.

4.10. Summary

The objective of establishing a theoretical framework for addressing skills supply and demand deficiencies has been achieved by accepting the concept of multiskilling as a key driver for the remainder of the research.

The US construction sector has come to accept the benefits of imbibing the concept of multiskilling as a redress for skills crisis while its UK counterpart is still lagging were other sectors are enthusiastic. That is, empirical evidence suggests the benefits of multiskilling are real in the developed and developing world.

More so, there are limited UK studies, which are currently focused on exploiting the prowess of existing pools of labour as an alterative
A theoretical framework for exploiting the prowess of an existing pools of labour

labour utilization strategy for UK skills crisis. The next Chapter is on a research methodology for exploiting UK existing pools of labour.
CHAPTER 5

PROCEDURE FOR GATHERING AND EVALUATING
MANPOWER PLANNING DATA

5.1. Introduction

The preceding chapters have brought about some understanding of the research context particularly on the significance of hinging skills crisis response strategies on realistic theoretical frameworks. Based on the literature review findings reported in the last three chapters and the information elicited during focus group sessions, sets of research questions were posed upon which this dissertation rests. The discussions in this chapter is organised around the following areas; research approach, research questions, questionnaire design, sample selection, operationalizing of survey instruments and data analysis.

5.2. Research approach

It is undoubtedly true that quantitative and qualitative methods of research are common to social science investigations. In particular, quantitative methods are used when the data have been collected in or are soon converted into numbers for analysis; while qualitative methods are used when data are in words and remain in words throughout the analysis (Blaikie, 2003).
Common to the conceptual manpower planning framework (see Figure 2.1) and accepted theoretical framework (see Figure 4.4) is the task of simplifying and comprehending the complexities of labour market forces. Driven by this task and the quest to derive numeric and quantitative measures to evaluate the impact of multiskilling on construction output necessitated the adoption of a ‘largely quantitative approach’. This is because evidence from literature suggests there are weaknesses in adopting a fully positivist approach - interpretivism is no exception too (Antwi, 2000; 2003; Hammond, 2006).

5.3. Project steering group (PSG)

In this research, it was important to understand the specific relationship that training providers (of construction trades) and trainees have with employers (constructors) and employees, and how this relates the issue of skills crisis to their own wider context. There was also need to compensate for the major weakness of adopting a fully positivist approach. A focus group research method was adopted to promote open discussions around the research context (see Chapter 1) from the perspective of the target population. More so, the focus group served as a ‘think tank’ for validating the results of the

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23 An approach, which considers additional research method for the benefit of enhancing data elicitation.
24 The major weakness of the pre-designed questions and answers approach has to do with the emphasis placed on the researcher’s ability to determine before hand the inclusion and validity of construct.
quantitative review of Black Country supply and demand for construction and building services skills.

Using the stratified sampling technique by Maisel and Perssel (1996) – a list of representatives from a wide range of agencies and companies across the sector was drawn out – purchased from an independently maintained database of regional companies across the sector - with additions made on an iterative basis as members enlisted (see Appendix 1 and 2 for letter inviting project steering group members as well as full list of project steering group members). In total, 43 participants took part in 10 focus group sessions\(^{25}\). These ranged in size from 15 to 30 individuals and were centred at the Wolverhampton Science Park for convenience of location and independence.

The project steering group when fully constituted served as a ‘think thank’ for evaluating and validating the quantitative review (micro insight of construction trades) of Black Country supply and demand for construction and building services skills.

**5.4. Research questions**

In Chapter 3, the study examined the consequences of skills crisis in UK construction and building services sector and emphasized the need for skill acquisition to be demand led.

\(^{25}\) The number of organised focus group sessions (10) was determined by the research objective being pursued and the robustness of each organised session (e.g. the number and spread of participants).
In Chapter 4, the study learnt that while the concept of multiskilling is being broadly utilized as a tentative redress for skills crisis in other industries, especially in the US construction sector; there is paucity of investigations on the level of application of multiskilling in UK construction sector. The review of the literature on manpower planning – research objective (i) highlighted a number of supply and demand side issues, which this research – together with the remaining objectives (see Section 1.4) - will address by answering the following research questions:

(i) what is the link (if any) between skills crisis and a failure of manpower planning?
(ii) what is the outcome of a quantitative review of Black Country supply and demand for construction and building services skills?
(iii) how realistic is it to examine existing patterns (if any) of the relationship between manpower attributes and construction output?
(iv) in what way could the impact of multiskilling on UK construction skills crisis be quantitatively assessed?
(v) how can the efficiency of construction specific manpower planning in the Black Country and other UK sub regions be enhanced?

5.5. Target group

It is not possible to cover every construction enterprise and training provider in a research such as this. It would be too expensive and time
consuming. The research therefore focused on constructors (including social housing, housing associations and the Metropolitan Borough Councils); FE colleges; and other training institute (e.g. CITB and the Carillion training centre). Constructors evaluated were largely SMEs. These categories of constructors and training providers represent a major population of the construction sector’s pool of labour.

5.6. Questionnaire design

In controlling the influence between variables – and to eliminate the influence of other variables in order to satisfy the criteria for inferring causation (Blaikie, 2003) – the procedure adopted for this thesis involved questionnaire design and survey / interview of selected construction organisations and training providers. The main tools for data collection were two sets of semi-structured questionnaires (see Appendix 3 and 4). This method of data collection was preferred to others such as recorded inspection, observation, and triangulation simply because (i) information was required from a large number of individuals over a large geographical area; (ii) a lot of data could be gathered quickly within a specific time frame; (iii) it is relatively cheaper; (iv) it takes up minimum of very busy staff’s time particularly those at the helm of affairs; and (v) data can be captured directly in machine readable form. This method of data collection also has its demerits: (i) questionnaire design and construct validity can be difficult; (ii) there is normally a poor response rate; and (iii) there is
risk of shallow (non usable) replies (Kometa, 1995; Maisel and Perssel, 1996).

Although record and triangulation may provide more quantitative but reliable data, documents are likely going to be out of date, disequilibrium in construct validity, information not immediately available in useable form; and may prove expensive in terms of analyst’s time. The variables identified from literature and somewhat ‘certified’ by the project steering group formed the core of the questionnaire design. Two sets of semi structured questionnaire were designed, one for the supply side and the other for the demand side.

5.6.1. Supply side questionnaire

This questionnaire, which is presented in Appendix 3, was designed to study training providers, using variables identified from literature as attested to by the PSG. The questionnaire was patterned to suit the SPSS software. At the design stage of the questionnaire the following were addressed:

1. variables to be measured;
2. the respondents to the questionnaire;
3. the purpose for each question asked;
4. the sequencing of the questions asked was carefully considered, that is, easy impersonal questions at the beginning until communication is well established;
5. questions were kept short, simple but concise;
6. questions wording was chosen with care as well no sending of questionnaires ahead of scheduled interview meeting to eliminate bias; and

7. likert scales have a number of advantages, foremost amongst which is that they are comparatively easy to construct and easy to administer (Baker, 2003). Five and seven point scales were used (that is, ‘this is important’ to ‘this is not important’) in order to provide greater depth to the subsequent interpretation and to avoid respondents getting into a mindset of automatically ticking the same box.

A letter of consent describing the aim and objectives of the survey was carefully written for both supply and demand sides of the study. The supply side questionnaire sought general information of training organisation namely work capacity, mobility, importance of the sub region in relation to where trainees come from and further descriptive information; and progressed to more specific questions about retention, proficiency, destination of trainees on completion of training and assessment of training facilities. Adopting the procedure used in designing the supply side questionnaire, the demand side sought general information of number of workers the organisation employed, its area of specialisation before progressing into more specific questions like the key challenges affecting your business, characteristics of the workforce, training efficiency and the skills relevant to your organisation in order to undertake future prospects. This questionnaire is presented in Appendix 3. The questionnaire was
then tested by means of pilot survey (see Section 5.9.1.1 and 5.9.1.2 for details of the supply and demand side pilot surveys). After the pilot survey, the questionnaire was also then modified and a semi-structured interview approach adopted. All interviews were conducted face-to-face with an average duration of approximately 40 minutes. To encourage robust responses, all interviewees were assured that, the views expressed would be anonymised and could not be attributed to them in any way within the reported findings.
5.7. Sample selection

After the questionnaire design, the next step taken was to search for a sample of constructors and training providers to reflect the variation within the sector. The constructors and training providers surveyed in this research were selected as follows.

5.7.1. Constructors (demand side)

The survey sample for constructors was selected in twofold (i) constructors listed in the Black Country Chambers of Commerce and Industry (BCCCI) (note that the database was extensive of the West Midlands region) and (ii) an independent but privately maintained and ‘active’ database of constructors in the Black Country sub region only. The decision to purchase this privately owned database was informed by the inadequacies\(^{26}\) of the former (BCCCI). From this, constructors were selected ensuring that they were evenly distributed across the sub region to give a representative sample. The Metropolitan Borough Councils (MBC) were contacted directly. It was necessary to ensure that a good proportion of the types of projects in the private and public constructors were selected (that is, housing and non housing projects). In each organisation, contact names were sought usually directors / managers, personnel managers and chief planning officers in each MBC. Advice was also sought from the project steering group; and to augment the results of operationalizing the instruments of survey.

\(^{26}\) A poorly maintained database – listed members were either retired or had moved address.
personal networks and previously established relationships with beneficial members of constructor organisations were exploited. To clarify survey findings, the construction project types were classified under five main groups namely: new built commercial, new built housing, housing refurbishment and maintenance, civil engineering and related works, and steel fabrication and installations.

Although the sample was not entirely randomly selected, sampling constructor organisations, which were largely SMEs, in this way was necessary because of mobility, employee characteristics and confidentiality. In fact, stratified sampling seems to be the norm in investigations of SMEs (constructors) and is not a deficiency in the context of ‘action’ research (see Bresnen and Haslam, 1991; Kometa, 1995).

5.7.2 Training providers (supply side)

Training providers were selected from an LSC list of training providers; included in this list are: private training providers, the Construction Industry Training Board (CITB) and FE colleges. It is pertinent to note that majority of the training providers are LSC funded. To best capture the characteristics of trainees and instructors at these institutions the category of those interviewed were either School Heads (principal), Head of Departments or training managers. In total a sample size of 20 training providers were selected.
5.8. The survey

After the sample selection, a pilot and major survey were conducted on the supply and demand sides of the industry. The pilot survey for both sides of the industry was mailed simultaneously while interviews for the main survey were secured and conducted based on availability. An additional resource was employed primarily for interview appointment confirmation.
5.9.1. Pilot Survey

5.9.1.1. Demand side pilot survey

This involved the postal survey of fifty constructors in the region (Black Country and beyond). The purpose was to significantly scope the validity of the construct in relation to disequilibrium in the demand for construction and building services skills. The questions were re-worded after the pilot study to limit the number of open-ended questions. That is, factors were added and removed depending on which was deemed appropriate. More importantly because the BCCCI’s listing lacked sufficient ‘maintenance’ the member listing was largely blamed for the poor response rate of ten per cent. Consequently, the pilot and breakfast styled seminars with the PSG were relied upon as a means of further testing the validity of construct particularly on questions that deal with retention, training provision and future challenges facing businesses. Overall five such seminars were organised.

5.9.1.2 Supply side pilot survey

The questionnaire was tested on 20 training providers for comprehensibility through a pilot study. These training providers were a mix of private training schools, CITB and FE colleges. Universities were exempted, as this research was limited to construction trades and not professional skills. A letter of consent briefly explaining the objectives of the research was attached to the questionnaire. Twenty
per cent of training providers responded. A semi-structured interview approach was adopted following the initial (pilot) operationalization of the survey instrument. The semi-structured interview then formed the basis of an all Black Country wide focus interview survey.

5.10.2. Main survey

Following the modification of the two different questionnaires after the pilot studies, the next priority was to conduct the semi-structured interview of ‘certified’ construction and building services constructors and training providers. Those interviewed were contacted by phone for a convenient time to visit.

5.11.2.1. Major survey for the supply side

All project steering group ‘certified’ Black Country training providers were contacted and 83 per cent of the total were interviewed; and the target population and response rate was considered appropriate because of the nature of the information required and more importantly it is an aggregate representative of LSC and government funded establishments which provide training for construction and building services trades.

5.11.2.2. Major survey for the demand side

On the whole, 43 out of the 50 PSG ‘certified’ Black Country constructors were interviewed. Though not representative of all
construction related agencies / companies in the Black Country, the focused nature of those interviewed – as well as the manner in which this was done – ensured that the findings reported here provide an in-depth and highly indicative picture of the views held across the Black Country. In particular, respondents were encouraged to elaborate upon their responses whenever possible, this being reflected in a number of direct quotations. Operationalizing the survey tool in this way also provided the basis for ensuring its veracity and robustness in relation to future iterations, which adopt a larger-scale postal/telephone approach (more appropriate for the more structured element of the survey). See Dainty et al (2004) for details of a semblance approach as applied to the East Midlands region of United Kingdom.

5.12. Secondary data

The decision to harness available secondary but construction specific longitudinal data was informed by the absence of sufficient primary data for evaluating the concept of multiskilling and the need to satisfy the objective of examining existing and underlying patterns of manpower and output variables. For consistency and error reduction, harnessed secondary data were extracted directly in a machine ready ‘mode’ be it a PDF document or hard copy document.

5.12.1. Missing data
Although all efforts were made to collect complete sets of data, two likely sets of missing data were anticipated, those occurring due to participants’ incomplete responses or time series data with missing variables. The former was, however, minimal given the adopted instrument of survey technique (semi structured interview). Missing data in the latter were managed using the mean substitution importation method for missing data. Of the different imputation methods that exist for missing data management (case substitution, mean substitution, cold deck imputation, regression imputation and multiple imputation); mean substitution is one of the most widely used methods as the mean is considered the most appropriate approach for single replacement value (Hair et al, 1995; Field, 2000).
5.12.2. Data analysis

The supply and demand side instruments of survey were operationalized along side the exploration of construction specific time series data to generate answers to the research questions posed in Section 5.4. Using Statistical Package for the Social Sciences (SPSS) and Excel, the analysis was multivariate in nature; and the following statistical techniques were employed:

1. time series decomposition analysis;
2. trend estimation and analysis;
3. relative index ranking technique;
4. correlation analysis;
5. principal component regression;
6. validation; and
7. factor analysis.

Each of these analytical techniques will be fully explained and applied in the relevant part of this thesis.

5.13. Summary

Research questions were posed and questionnaires designed in pursuit of the objectives outlined in Section 1.4. This Chapter also detailed the procedural approach of how the experiment was carried out in order to understand the analysis, discussion and findings reported in
subsequent Chapters. Although the implications of continued disequilibrium in the supply and demand for construction and building services skills were quite difficult to capture largely because of inadequacies in already existing information gathering and disaggregation frameworks, a multi-attribute analysis technique was devised for the many attributes harnessed from the primary and secondary data analysis. The measuring technique adopted aided by statistical analysis helped enhance the understanding of the supply and demand for construction and building services skills. Next is an analysis and discussion of supply and demand side findings.
CHAPTER 6

A SURVEY OF SUPPLY SIDE ISSUES INFLUENCING TRAINING PROVISION IN THE BLACK COUNTRY

6.1. Introduction

This Chapter draws on a general survey of Black Country training providers and stakeholders as well as a semi-structured survey of four of the five Further Education Colleges in the sub-region. Issues analysed and reviewed in a bid to address some of the research questions include:

- skill classification, supply trends in Black Country FE Colleges and training providers;
- quantity and quality of Black Country tradesmen;
- funding sources;
- gender, age, women and ethnic minority;
- achievement, source and destination of trainees;
- staffing issues – characteristics, strategies, recruitment and retention;
- causes of skill gap / mismatch, future relevance of trades; and
- provider assessment of factors that have hindered construction skill acquisition.
A survey of supply side issues influencing training provision in the Black Country
6.2. The classification of construction skills

Construction skill can be categorized into low, medium and high level skills. Labourers and/or helpers are two distinct examples of low-level skills. Civil engineers, project managers and quantity surveyors are good examples of high-level skills while bricklayers; plumbers and joiners are examples of medium-level skills. Overall the construction and building services sector is dominated by low and medium-level skills (approximately 72 per cent).

6.2.1. Trends in construction skill supply

There is an apparent paucity of basic construction skill supply data. This is not peculiar to the Black Country alone but other regions of the UK (ECOTEC, 2003; CITB, 2003). It would seem that construction skill supply decisions are largely driven by gut feelings and the media. Enrolment figures tend to increase during periods of high demand. The media-led interest in plumbing within the sector is a poignant example. It is likely that the lack of adequate information on supply and labour market trends may result in unemployment of some trainees on completion of their training.

It is unbelievable that this non-factual skill supply base has been allowed to exist for such a long time and has continually reinforced the generally held view that a career in construction is unstable. It is
opined that with better supply and demand information a career in construction can be as stable as any other.
6.2.3. Training enrolment in FE colleges

There is conflict in information in the literature from various reports about construction skill supply levels. The investigator thus limited the study to data (between 2003 / 4 and 2004 / 5) as garnered from the survey of four out of the five local FE Colleges in the Black Country namely: Dudley College; Sandwell College; Stourbridge College; City of Wolverhampton College.

Regardless of the benefits associated with the acquisition of a data management system at this level and beyond, there is little or no readily available construction data source for the sub-region. The absence of a clear framework for collecting and storing skill supply data means that training providers were unable to provide robust data sets which would have aided specific trend analysis of trainees.

Table 6.1: FE total enrolments by mode of attendance (2003/4 and 2004/5)
(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dudley</td>
<td>168 432 -</td>
<td>933 1769 -</td>
<td>- - -</td>
<td>383 540 -</td>
</tr>
<tr>
<td>Sandwell</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
</tr>
<tr>
<td>Stourbridge</td>
<td>- 1285 -</td>
<td>- 854 -</td>
<td>- - -</td>
<td>- 612 -</td>
</tr>
<tr>
<td>W'ton</td>
<td>- 144 163 -</td>
<td>- 593 699 -</td>
<td>- 15 7</td>
<td>473 561</td>
</tr>
<tr>
<td>Total</td>
<td>168 1861 163</td>
<td>933 3216 699</td>
<td>- 15 7</td>
<td>383 561 1625</td>
</tr>
</tbody>
</table>
A survey of supply side issues influencing training provision in the Black Country

- Data not available when surveyed.

Table 6.1 illustrates FE total enrolments by mode of attendance. The pattern of enrolment varies yearly. Short part-year courses are more popular. One may wonder why Colleges start most courses in September (the implication of which is that FE Colleges are closed to enrolment and training for most of the summer season). Some form of semesterisation may help build on the popularity of short part-year courses and may make the Colleges more accessible to employers at other times of the year apart from September.

Table 6.2 captures the enrolment in year 2004 / 5 by trade. This suggests that most trainees enrol on traditional trades rather than non-traditional trades – in the context of this research, see Appendix 5 for examples of traditional and non-traditional trades. With the demand side investigation (constructors) suggesting future increases in demand for ‘new’ trades (for example, multiskilling), it would seem appropriate to direct training to new and emerging trades.

<table>
<thead>
<tr>
<th>Trade Area</th>
<th>No enrolled</th>
<th>% of all enrolment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trowel trades and plastering</td>
<td>789</td>
<td>14</td>
</tr>
<tr>
<td>Wood trades, carpentry and joinery</td>
<td>579</td>
<td>10.4</td>
</tr>
<tr>
<td>Heating &amp; ventilation, industrial pipe work and plant maintenance</td>
<td>985</td>
<td>17.7</td>
</tr>
<tr>
<td>Mechanical services and plumbing &amp; gas fitting</td>
<td>1716</td>
<td>30.8</td>
</tr>
</tbody>
</table>
The data was disaggregated by College and trade as illustrated in Table 6.3. Dudley is the dominant College for wood works, joinery and carpentry, mechanical services and plumbing, OCN and other general courses including top-ups. Wolverhampton dominates in heating & ventilation, industrial pipe works, plant maintenance, electrical and painting & decorating, while Sandwell dominates in multiskilling, and Stourbridge painting & decorating. The study is aware from its convenience survey, which Walsall participated in, that the College is well resourced and supported for painting and decorating.

Table 6.3: Trade enrolments per college as a proportion of all trainees in the Black Country
(Source: Ejohwomu et al, 2007c)
6.2.4. Dependency on LSC funding

Table 6.4 illustrates the dependency of the Colleges on LSC funding. City of Wolverhampton College is the least dependent College on LSC funding while Stourbridge College is 100 per cent dependent, as suggested by the data collected. The study is certain of company / industry funded trainees at Stourbridge and it may be that the College reported only on LSC funded students in their returns.

<table>
<thead>
<tr>
<th>Colleges</th>
<th>% LSC1*</th>
<th>% LSC2*</th>
<th>% LSC3*</th>
<th>% LSC4*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dudley</td>
<td>74</td>
<td>55</td>
<td>46</td>
<td>-</td>
</tr>
<tr>
<td>Sandwell</td>
<td>67</td>
<td>95</td>
<td>49</td>
<td>-</td>
</tr>
<tr>
<td>Wolverhampton</td>
<td>80</td>
<td>88</td>
<td>42</td>
<td>0</td>
</tr>
<tr>
<td>Stourbridge</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

% LSC1-4* represents percentage of LSC funding at levels 1 – 4

Colleges should not expose themselves and be solely dependent on one funding source and should actively seek alternative sources of funding. In particular, this research suggests that trainee achievement may vary with funding sources. Direct company-funded trainees often achieve more since successful training leads to promotion or more pay; and the company selection mechanism of who to train is more thorough than
public funded trainee schemes. There may be a case for more LSC funds to be channelled through companies to improve general achievement level. Most non-LSC funded programmes are at levels 3 and 4, with people who are already committed to the industry. The challenge to achievement is therefore how to optimize achievement using LSC funds at levels 1 and 2, and to pull and retain new entrants onto construction trades.
6.2.5. Gender, age, women and ethnic minority

Figure 6.1 and Table 6.5 illustrate trainee enrolment in percentage terms by gender and ethnicity. Despite the plethora of initiatives aimed at improving the image of Construction and Building Services Industry to women and ethnic minorities the data from Black Country FE Colleges fail to show any sign of an improvement in percentage terms with continuing dominance of the white male of approximately 97 per cent – 100 per cent at all levels.

![Figure 6.1: FE enrolments in % by gender for 4 levels (1 - 4)](source: Olomolaiye et al, 2005)

Table 6.5 presents the total number of Work Based Learners by gender and ethnicity for 2004 / 5 academic year. Work Based Learning is not yet popular; with average dominant age of 18 years and mainly white male. Stourbridge College is the most popular provider of Work Based
Learning at Foundation Apprenticeship level. Work Based Learning will only continue to reinforce white male dominance of construction trades until employers make a conscious policy to employ women and ethnic minorities. The 14 per cent Asian population at Wolverhampton College shows that employers are already responding to this challenge and is commendable.

**Table 6. 5: Number of FE work based learners by gender & ethnicity for (2002/3) academic year**
(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>FE colleges</th>
<th>Total AA</th>
<th>Total FA</th>
<th>Total NVQ</th>
<th>% Male</th>
<th>% Black African</th>
<th>% Asian</th>
<th>% White</th>
<th>% Others</th>
<th>Average Domina nt age Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dudley college</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>W’ton college</td>
<td>-</td>
<td>9</td>
<td>13</td>
<td>100</td>
<td>0</td>
<td>14</td>
<td>86</td>
<td>-</td>
<td>17</td>
</tr>
<tr>
<td>Sandwell college</td>
<td>24</td>
<td>60</td>
<td>-</td>
<td>100</td>
<td>7</td>
<td>0</td>
<td>83</td>
<td>-</td>
<td>19</td>
</tr>
<tr>
<td>Stourbridge College</td>
<td>140</td>
<td>641</td>
<td>70</td>
<td>91</td>
<td>0</td>
<td>1</td>
<td>96</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>Total average</td>
<td>82</td>
<td>355</td>
<td>42</td>
<td>97</td>
<td>2%</td>
<td>5</td>
<td>88</td>
<td>3</td>
<td>18</td>
</tr>
</tbody>
</table>

* Advanced Apprenticeship (AA), ** Foundation Apprenticeship (FA)

6.2.6. Achievement by trainee

In evaluating achievement data for 2004 / 5 the study compared percentage of trainees completing with those enrolled in colleges and at levels 1 to 3. Tables 6.6 and 6.7 below illustrate achievement rate by trade and level at the Colleges.

**Table 6. 6: Average level of achievement by FE Colleges (2004/5)**
(Source: Ejohwomu et al, 2007c)
A survey of supply side issues influencing training provision in the Black Country

<table>
<thead>
<tr>
<th>Colleges</th>
<th>% Level 1</th>
<th>% Level 2</th>
<th>% Level 3</th>
<th>% Total average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dudley</td>
<td>74</td>
<td>55</td>
<td>46</td>
<td>44</td>
</tr>
<tr>
<td>Stourbridge</td>
<td>-</td>
<td>30</td>
<td>21</td>
<td>13</td>
</tr>
<tr>
<td>Wolverhampton</td>
<td>49</td>
<td>43</td>
<td>54</td>
<td>37</td>
</tr>
<tr>
<td>Sandwell</td>
<td>21</td>
<td>58</td>
<td>55</td>
<td>34</td>
</tr>
</tbody>
</table>
Table 6.7: Achievement rate by trade for Black Country FE Colleges (2004/5)
(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>Trade Areas</th>
<th>% Level 1</th>
<th>% Level 2</th>
<th>% Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trowel trades and plastering</td>
<td>29</td>
<td>46</td>
<td>0</td>
</tr>
<tr>
<td>Wood trades, carpentry and joinery</td>
<td>6</td>
<td>6</td>
<td>34</td>
</tr>
<tr>
<td>Heating and ventilation, industrial pipe work and plant maintenance</td>
<td>10</td>
<td>36</td>
<td>27</td>
</tr>
<tr>
<td>Mechanical services and plumbing &amp; gas fitting</td>
<td>38</td>
<td>45</td>
<td>39</td>
</tr>
<tr>
<td>OCN WM</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Multiskilling</td>
<td>5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Painting and decorating</td>
<td>14</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Others including general top-ups</td>
<td>20</td>
<td>24</td>
<td>-</td>
</tr>
</tbody>
</table>

Achievement varies by colleges and levels. Dudley College is exceptional at level 1 and Sandwell at levels 2 and 3. Wolverhampton College seems most consistent at between 40 – 50 per cent. There may be a number of explanations for this level of variation in achievement levels but the central question is that of ‘retention’ of trainees on courses, once they have started. Are construction trades so difficult to ‘teach’ or ‘learn’? Can the question go beyond learning and teaching issues to the environment and basic skills? Why is so much money spent training those who wouldn’t complete the course and invariably become ‘cowboy’ builders? Are colleges training for the ‘cowboys’ market? As far as this study is concerned, ‘retention’ is the most significant issue in supplying sufficiently skilled tradesmen to meet demand.
6.2.7. Where Trainees come from

Table 6.8 illustrates the percentage of students that come from each borough at each FE College. It would normally be expected that residents would prefer their immediate local college for proximity. This is not necessarily true for Black Country residents, as it seems residents consider all Colleges ‘local’. Forty per cent of Dudley residents choose Stourbridge College and as many as 27 per cent from Wolverhampton also choose Stourbridge. In contrast however, Dudley College enjoys more National presence with 67 per cent of trainees from the rest of Great Britain to the sub-region choosing to study at Dudley. This may be a result of the College’s diversification of income streams to direct company sponsorships. Also, Dudley has a vigorous international recruitment policy, especially in South East Asia and also attracts more from the rest of West Midlands at 46 per cent. The foregoing analysis confirms the homogeneity of the sub-region and the need for Colleges not to be insular but consciously attract trainees from other regions. Perhaps the Colleges in the region could strategise to compete less with themselves and assign some element of geographic specialisation. The data also seem to suggest that it may not be prudent to locate all construction trade training in just one of the boroughs. Only Wolverhampton College attracts more than 30 per cent from other boroughs (i.e. from Walsall).
Table 6. 8: Importance of Borough / Region in Relation to Where FE Trainees Come From in % Terms
(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>Boroughs &amp; Regions</th>
<th>% Dudley College</th>
<th>% Sandwell College</th>
<th>% W’ton College</th>
<th>% Stourbridge College</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dudley borough</td>
<td>7</td>
<td>33</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Sandwell borough</td>
<td>17</td>
<td>33</td>
<td>22</td>
<td>28</td>
</tr>
<tr>
<td>Walsall borough</td>
<td>25</td>
<td>25</td>
<td>31</td>
<td>19</td>
</tr>
<tr>
<td>W’ton borough</td>
<td>13</td>
<td>20</td>
<td>40</td>
<td>27</td>
</tr>
<tr>
<td>Rest WM</td>
<td>46</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>G – Britain</td>
<td>67</td>
<td>11</td>
<td>11</td>
<td>11</td>
</tr>
</tbody>
</table>

6.2.8. Trainee destination on completion

Only Dudley College supplied data on this and it is logical to argue that other Colleges do not have this information readily available.

Table 6. 9: FE trainees destination on completion
(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>Trade Area</th>
<th>% Employed</th>
<th>% Continuing Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trowel trades and bricklaying</td>
<td>7</td>
<td>93</td>
</tr>
<tr>
<td>Wood trades, carpentry and joinery</td>
<td>34</td>
<td>66</td>
</tr>
<tr>
<td>Heating and ventilation, industrial pipe work and plant maintenance</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Mechanical services and plumbing &amp; gas fitting</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>OCN WM</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Others including general top-ups</td>
<td>100</td>
<td>-</td>
</tr>
</tbody>
</table>
The low percentage employment in Trowel Trades may be linked to the domination of level 1 training at Dudley confirming that trainees in Trowel Trades are unemployable at this stage. It is heartening that most are continuing education (93 per cent) and would hopefully be employable after level 2. With ongoing and future regeneration works including high growth in the repairs and maintenance sector needs in the sub-region, current training in trowel trades may be growing through training to meet future demand.

6.2.9. Factors that have hindered construction skills acquisition

The following five significant barriers to enhancing skill supply emerged from this research:

- sub-contracting;
- work placement;
- assessors – shortage of and quality; and
- lack of trainers (people working to become trainers);
- Lack of physical resources e.g. not enough workshops.

The introduction of the concept of sub-contracting into construction and building services sector has improved flexibility and completion within the industry. Because the current skills crisis still remains unresolved there is a gradual clamour for a return to the concept of direct employment amongst some stakeholders. A more in-depth
analysis of the merits and demerits of both concepts is over due and would influence the direction of future training.

There is firm belief amongst employers and trades employees that work placement is integral to trainees’ learning process. The high wage differential between working in industry and as trainers in an FE College, has resulted in few young vocationally competent qualified trainers / assessors in Black Country FE Colleges. In turn, trainees are unable to acquire competent / basic skills needed for surviving labour market ‘odds’, which further compounds the issue of skills crisis by limiting supply and retention levels of trainees. The introduction of online assessment facility as an alternative means of assessing trainees currently has a negligible effect. This could be attributed to trainee’s deficiency in ICT skills or the sectors ‘unwillingness’ to fully imbibe construction IT by Black Country constructors. Although this is, arguably, a national issue, anecdotal evidence would suggest that the adoption of a sub-regional focused response strategy would enable a fuller understanding of factors hindering construction skill acquisition and transfer by Black Country trainees and trainers.

6.2.10. Staffing related issues

Table 6.10 is an aggregate representation of staffing proportion for Black Country Further Education Colleges.
A survey of supply side issues influencing training provision in the Black Country

(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>S/N</th>
<th>Colleges</th>
<th>Total</th>
<th>% Support</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dudley</td>
<td>60</td>
<td>20</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
</tr>
<tr>
<td>2</td>
<td>City of Wolverhampton</td>
<td>28</td>
<td>32</td>
<td>4&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>3</td>
<td>Stourbridge</td>
<td>63</td>
<td>46</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
</tr>
<tr>
<td>4</td>
<td>Sandwell</td>
<td>31</td>
<td>32</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>182</strong></td>
<td><strong>33</strong></td>
<td><strong>-</strong></td>
</tr>
</tbody>
</table>
Thirty three per cent of construction and building services staff in Black Country colleges are support staff. Stourbridge has the highest number of support staff while Dudley has the least.

A 20 – 46 per cent range in support staff is significant given the persistent need for sufficiently skilled trainers.

Staffing in Black Country Colleges is completely focused on traditional trades and aged. See Table 6.10.1. The Colleges indicated some degree of satisfaction in relation to staff, quality and number.

6.2.11. Staff recruitment and retention

College respondents were asked to elaborate on the obstacles to staff recruitment and retention in detail, with the following comments emerging.

**Case 1**: ‘The high wages currently earned by skill labour in the construction trades inhibits the move to salaried employment’.

**Case 2**: ‘Salary is a problem to recruitment / poor initial skills have as candidates are attempting to enter education with no qualifications which are too narrow thereby reducing the utilisation of staff’.

**Case 3**: ‘Retention: workload and additional training on entry- new staffs have to achieve Professional Teaching Qualifications, plus A1 A2
awards for assessment status plus IV awards and thus also have to get used to teaching and preparing lessons when they start work as a teacher / lecturer’.

**Case 4**: ‘Terms + Conditions of employment; low salary level in comparison to industry; unqualified potential workforce’.

**Case 5**: ‘Lack of suitable qualified staff. Also salaries are not as attractive in colleges as they used to be. Construction workers can often earn much more’.

Table 6.10.1 is an aggregate representation of staffing in four out of the five FE Colleges in the Black Country by Age and Trade. This suggests that the current workforce is aged and calls for serious redress.

### Table 6.11: FE staff characteristics by Age and Trade
(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>Trade Area</th>
<th>% &gt;40 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trowel trades and bricklaying</td>
<td>55</td>
</tr>
<tr>
<td>Wood trades, carpentry and joinery</td>
<td>64</td>
</tr>
<tr>
<td>Electrical</td>
<td>64</td>
</tr>
<tr>
<td>Plumbing</td>
<td>80</td>
</tr>
<tr>
<td>Painting and Decorating</td>
<td>38</td>
</tr>
</tbody>
</table>

6.11.1. Staff development strategies
Respondents were asked to elaborate on staff development strategies in relation to demand for current and future skills in detail including comments on any issue regarding supply provision.
Case 1: ‘All staff attending industrial, upskilling and technological training sessions’.

Case 2: ‘Training centres being given dedicated training status’.

Case 3: ‘There are particular issues with regard to securing the services of part-time staff. Clearly, the West Midlands is suffering like the rest of the country in securing suitably qualified staff that have met the requirements of CCE check1. We have of recent times struggled with our staff age profile and have addressed this. However, in doing so, we have retired candidates attending interviews without qualifications. These are limiting trainers’ skill range’.

Case 4: ‘We need to ‘rethink’ more – there was a time when the sector had a voice in what goals were proposed and how best they ought to be implemented across the sector. At present, we have little input or little opportunity or platform to voice concerns. Similarly, we have to do excessive amount of paper work that is becoming a practical skills industry as we are all sinking under the weight of assessment /IV/BSI/ofsted/ inspections and we are losing staff back to industry because of it. [We need to review the frameworks as the expected achievement required is well beyond the capabilities of students with the time allocated to the provision and funding associates!]’.

Case 5: ‘All trainers have staff development to keep abreast of current regulations. Staff wise, we are finding it increasingly difficult to recruit
part-time staff. Thus many full time staff are working overtime to compensate for this inability to attract more staff.
6.11.2. Facilities in relation to construction training

A self-assessment of facilities in relation to Black Country construction and building services training provision reveals that facilities are generally of sufficiently good quality but being mostly used at certain times of the day may suggest some capacity problems at peak periods. Colleges and training providers may consider the off-peak period for generation of additional income streams.

Table 6.12: Assessment of facilities in the colleges
(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>Traditional &amp; Non-Traditional Trades</th>
<th>Dudley College</th>
<th>Stourbridge College</th>
<th>City of W’ton College</th>
<th>Sandwell College</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiskilling/ General</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>Trowel Trade – Bricklaying</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>Trowel Trade – Plastering</td>
<td>6</td>
<td>-</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Roofing</td>
<td>6</td>
<td>-</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Electrical Trades</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Ground Engineering Works</td>
<td>6</td>
<td>-</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Carpet, floor, and tile installers and finishers</td>
<td>6</td>
<td>-</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Construction and equipment operators</td>
<td>6</td>
<td>-</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Wood works, Joinery, and Carpentry</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Painting and Decorating</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Structural and reinforcing iron metal</td>
<td>6</td>
<td>-</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Curtain Walling</td>
<td>6</td>
<td>-</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Modular Building Works</td>
<td>6</td>
<td>-</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Cladding System Works</td>
<td>6</td>
<td>-</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Prefabrication of Building Components Works</td>
<td>6</td>
<td>-</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Heating and Ventilation, Industrial pipework and Plant maintenance</td>
<td>1</td>
<td>-</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Mechanical Services, Plumbing and Gas Fitting</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A survey of supply side issues influencing training provision in the Black Country

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th>6</th>
</tr>
</thead>
</table>

*(6 not applicable (N/A) while 1 being Excellent and 5 Poor)*
Sandwell College – Facilities are generally rated as poor and with this recognition the college is already taking steps towards upgrading.

Stourbridge College – has an excellent rating for training facilities. There are excellent facilities for trowel trades, electrical, woodworks, painting and decoration and mechanical services and plumbing.

Dudley College – Good training facilities are available for multiskilling, trowel trades and wood works. Excellent provision for mechanical and heating and ventilation trades.

City of Wolverhampton College- Facilities are ranked OK for roofing, electrical, woodworks, painting and decoration trades. The College has a good facility in place for mechanical services and plumbing.

6.2.12. Adequacy of current training

As illustrated in Table 6.12, the Voluntary Sector is categorical that current training provision is not adequate and would not meet future demand. The Architects are as nearly as sceptical with Constructors and FE Colleges in the medium range and the CITB rather optimistic about current training provision. Discussions in the Steering Committee meetings indicate a consensus that traditional skills are fairly well provided for. The Traditional Trades of Bricklaying, Carpentry, Painting and Decorating were ranked 7 on the 7-point agreement scale by the CITB and consistently higher by the FE
A survey of supply side issues influencing training provision in the Black Country

Colleges. The Architects and Constructors seem to know more of the difficulties with newer trades and are categorical that the current training gap for new trades be quickly addressed.
A survey of supply side issues influencing training provision in the Black Country

Table 6. 13: Adequacy of current training
(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>Perception of Adequacy by Trade</th>
<th>FE Colleges</th>
<th>Architects</th>
<th>Contractor</th>
<th>CITB</th>
<th>Vul’ Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCN Construction</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Bricklaying</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Carpentry</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Painting and Decorating</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Electrical/Electronic</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Ground Engineering</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Heating and Ventilation</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Plastering</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Plumbing</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

1 – strongly disagree, 7 strongly agree

The Colleges and CITB were lukewarm when asked if there are enough construction trade employees in the Black Country for all construction and building service works. The Architects, Contractors and Voluntary sectors were categorical that current numbers are insufficient. There was a fair level of agreement by all respondents that most tradesmen who live in the Black Country work outside the boroughs. They also believe that advancing technologies in the construction and building services industry will exacerbate the skills crisis in the industry.

With some evidence of the responses being polarised along Supply and Demand boundaries, there is much need for Trainers and Users of labour to dialogue more and constructively seek solutions to clear
structural imbalances in the provision of skilled labour for the industry. Against a backdrop of huge ongoing and anticipated regeneration works the study would support the motion that the demand for traditional skills may plateau while the demand for new trades is likely to increase.

**6.2.13. Future relevance of trades**

With the exclusion of OCN construction, the architects and the voluntary sector strongly believe that all of the listed trades in Table 6.13 below were exceedingly relevant to future building styles and technologies in the Black Country. Colleges were silent on the relevance of OCN, electrical / electronics, ground engineering, and heating and ventilation to future building styles. Judging by the overall collective mean values of respondents, bricklaying, carpentry, painting and decorating, and plumbing would remain of very high relevance to future building styles and technologies in the Black Country. This may imply that there is a perception amongst respondents that most of the traditional trades are of relevance to future building styles and technologies and would not necessarily experience a dramatic step-change. However, there is an opaque perception as to how much of these traditional skilled trades would be required i.e. would they remain as they are currently practised or subsumed by multiskilling?
Table 6. 14: Supply - styles and technology
(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>Traditional &amp; Non-Traditional Trades</th>
<th>FE Colleges</th>
<th>Architects</th>
<th>Contractors</th>
<th>CITB</th>
<th>Vul’ Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCN Construction</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Bricklaying</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Carpentry</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Painting and Decorating</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Electrical/Electronic</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Ground Engineering</td>
<td>0</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Heating and Ventilation</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Plastering</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Plumbing</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

1 = least fit and 7 = strongest fit

6.3. Summary

Together with evidence from the literature there is overwhelming evidence to suggest that there are shortages of medium and high-level skills and not low-level skills in the UK construction sector. These shortages are particularly more severe in the area of trades. The focus of this chapter therefore has been somewhat biased towards investigating the supply issues thought to be influencing training provision - search for sustainable redress.

Overall, the findings reported in this chapter offer insight into construction trade supply issues at the sub regional level. That is, a majority of the previous studies investigating sub regional manpower supply have either been reliant on secondary data or qualitative in
A survey of supply side issues influencing training provision in the Black Country

draws further on the quantitative analysis reported in this chapter, the summary result indicates: supply data are currently confused, lacking in consistency and in some instances in conflict.
CHAPTER 7

A SURVEY OF DEMAND SIDE ISSUES INFLUENCING FUTURE SKILLS DEMAND IN THE BLACK COUNTRY

7.1. Introduction

This Chapter addresses research objective (ii) – a quantitative review of Black Country supply and demand for construction and building services skills (a micro insight). The main findings are outlined below and are collated under the main themes attributed within the questionnaire structure. Using the methods identified in Chapter 5 the representatives of a total of 43 companies were interviewed (that is, 86 per cent response rate), these being selected – stratified sampling method - upon their ability to provide the required level of detail in respect to the questions asked (most commonly they were the individuals who were charged with dealing with personnel issues within their companies).

7.2. Activity groupings of respondent

The 43 respondents represented a broad spread of businesses across the four boroughs in terms of both size and activities. Table 7.1 below summarises the number of businesses within the sample engaged with

---

27 This is 44.79 per cent of the sample size; this sample size was determined using \( n = (z \times \text{standard deviation (SD) / confidence interval})^2 \). Where \( z \) is a constant, which relates to the confidence level and SD is the square root (Prop * Non-prop).
specific activities. However, some of the businesses undertake more than one area of construction and building services.
Table 7.1a: Aggregated totals of activities
(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>Activity Type</th>
<th>No of businesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>New built commercial</td>
<td>21</td>
</tr>
<tr>
<td>New built housing</td>
<td>20</td>
</tr>
<tr>
<td>Housing refurbishment</td>
<td>26</td>
</tr>
<tr>
<td>Civil engineering</td>
<td>11</td>
</tr>
<tr>
<td>Steel fabrication</td>
<td>7</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
</tr>
</tbody>
</table>

Within the sample there was limited evidence of specialisation, with majority engaged in at least two of the defined activities. Amongst the 43 respondents there was a relatively even spread in relation to the importance of each borough for respective businesses (e.g., as ‘most important’: 28 per cent for Walsall; 24 per cent for Wolverhampton; 24 per cent for Sandwell; and 24 per cent for Dudley), reflecting the overall geographic spread of the sample. Please note that some respondents considered more than one of the boroughs as ‘most important’ hence the total of 54 in this example from 43 respondents.

7.2.1. Workforce characteristics

The characteristic nature of any workforce arguably remains a deterministic factor strategising current and future supply and demand
for manpower. Table 7.2 is a summary of the workforce characteristics in the Black Country.
From Table 7.2 it is quite apparent that the existing workforce is aging, though considerably skilled. Majority of the skilled workforce are aged over 50 years. Seventy seven per cent are skilled while only 11 per cent of those aged between 26yrs – 35 years are skilled. Inferring that the Black Country construction and building services industry might need to rely on either migrant skilled workforce or ‘informal’ labour market if it is to satisfy current and future demand.

With only 7 per cent of the workforce aged below 18, the immediate question would be how to replace the older workers with so few new entrants. This would need to be improved upon for the Black Country to become a sustainable community of construction and building services workers. The average number of women considered to be working in the sector is reasonably higher than what is obtained.
A survey of demand side issues influencing future skills demand in the Black Country

nationally. This may reflect the inclusion of all workers including office based assistants while that of national figures are fully construction site based.

7.2.2. Training protocol

The responses to questions relating to ‘training protocol’ have been summarised in percentage terms and in a descending hierarchy below (most respondents had someone responsible for training and development at director level):

- 58 per cent of respondents had someone responsible for training at director level;
- 51 per cent had someone responsible for training and development below director level;
- 47 per cent had regular review process for evaluating the effectiveness of training and development, and a regular and formal appraisal system covering all staff;
- 40 per cent of respondent had a formal training and development process that is linked to the business plan;
- 38 per cent were equipped with a training and development plan.

Implementation of national directives (e.g. on the CSCS scheme) is seen by the respondents as being unduly bureaucratic deterring participation in such schemes. There is a clear need for local ownership of national directives for any effective employment. It is not yet evident
from the literature as to what the exact benchmark is for measuring training or rating training protocol. But if the percentage aggregation above is a true reflection of Black Country construction and building services businesses, then the sub-region has significant scope for improving its construction skills through inculcation of appropriate training and development shortages.
7.2.3. Perception of importance of training in construction and building services trades

Different skill sets require different training periods. Also, this may be dependent on the level of skill possessed by the trainee. A perception of importance of training in construction and building services trades will likely influence the quality and quantity of Black Country training provision. Table 7.3 below is an aggregate representation of survey responses across all businesses.

Table 7.3: Shows the aggregate responses across all businesses within the sample (* no response)

(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>Traditional &amp; Non-Traditional Trades</th>
<th>Very Little Importance</th>
<th>Little Importance</th>
<th>Important</th>
<th>Very Important</th>
<th>Extremely Important</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-skilling</td>
<td>*</td>
<td>1</td>
<td>8</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Brickmasons, brickmasons, and stonemasons</td>
<td>*</td>
<td>*</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Cement masons, concrete finishers, and pavers</td>
<td>*</td>
<td>*</td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Ground Engineering Works</td>
<td>*</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Carpet, floor, and tile installers and finishers</td>
<td>*</td>
<td>1</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Construction and equipment operators</td>
<td>*</td>
<td>1</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Wood works, Joinery, &amp; Carpentry</td>
<td>*</td>
<td>*</td>
<td>5</td>
<td>7</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Painting and Decorating</td>
<td>*</td>
<td>*</td>
<td>10</td>
<td>4</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Structural and reinforcing iron metal</td>
<td>*</td>
<td>*</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Curtain Walling</td>
<td>*</td>
<td>*</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Modular Building Works</td>
<td>*</td>
<td>*</td>
<td>7</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Cladding System Works</td>
<td>*</td>
<td>*</td>
<td>9</td>
<td>*</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Prefabrication of Building Components Works</td>
<td>*</td>
<td>*</td>
<td>9</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Heating &amp; Ventilation</td>
<td>*</td>
<td>*</td>
<td>5</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Mechanical Services and Plumbing</td>
<td>*</td>
<td>*</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td>*</td>
<td>*</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
cladding system works, painting and decorating, and woodworks, joinery and carpentry;

- mechanical services and plumbing, and multi-skilling;

- heating and ventilation, prefabrication of building component works, construction and equipment operators, cement masons, concrete finishers, segmental pavers, brick masons; and

- ground engineering, carpet, floor, and tile installers, structural reinforcing and curtain walling.

7.2.4. How difficult is skill acquisition in a trade?

It is evident from the literature that the construction and building services industry is faced with the issue of skills mismatch and retention difficulties at level 1. With the very high retention difficulties it becomes necessary to determine the relative levels of difficulties with regards to skill acquisition. Results are as illustrated in Table 7.4.
Table 7.4: Respondent aggregate score on ease and difficulty of skill acquisition
(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>Traditional &amp; Non-Traditional Skills</th>
<th>Very Difficult</th>
<th>Difficult</th>
<th>OK</th>
<th>Easy</th>
<th>Very Easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-skilling</td>
<td>7</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Brickmasons, blockmasons, and stonemasons</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Cement masons, concrete finishers, segmental pavers, and terrazzo skilled works</td>
<td>2</td>
<td>5</td>
<td>6</td>
<td>1</td>
<td>*</td>
</tr>
<tr>
<td>Ground Engineering Works</td>
<td>*</td>
<td>4</td>
<td>7</td>
<td>1</td>
<td>*</td>
</tr>
<tr>
<td>Carpet, floor, and tile installers and finishers</td>
<td>*</td>
<td>2</td>
<td>8</td>
<td>1</td>
<td>*</td>
</tr>
<tr>
<td>Construction and equipment operators</td>
<td>*</td>
<td>2</td>
<td>10</td>
<td>1</td>
<td>*</td>
</tr>
<tr>
<td>Wood works, Joinery, &amp; Carpentry</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>*</td>
</tr>
<tr>
<td>Painting and Decorating</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>*</td>
</tr>
<tr>
<td>Structural and reinforcing iron metal</td>
<td>*</td>
<td>1</td>
<td>6</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Curtain Walling</td>
<td>*</td>
<td>1</td>
<td>5</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Modular Building Works</td>
<td>1</td>
<td></td>
<td>7</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Cladding System Works</td>
<td>*</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>*</td>
</tr>
<tr>
<td>Prefabrication of Building Components Works</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Heating &amp; Ventilation</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>*</td>
</tr>
<tr>
<td>Mechanical Services and Plumbing</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>*</td>
</tr>
<tr>
<td>Others (please specify)</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>49</td>
<td>88</td>
<td>11</td>
<td>2</td>
</tr>
</tbody>
</table>

* - Indicates no response.

**Multi-skilling:** 35 per cent of respondents said it was ‘very difficult’ acquiring skills in this area. 40 per cent said ‘difficult’ while 5 per cent of respondent said it was ‘easy’ to acquire.
Woodworks, joinery and carpentry: 29 per cent said it was ‘very difficult’ acquiring this skill, 35 per cent said difficult while 6 per cent said it was ‘easy’ to acquire.

Modular building works: 13 per cent of respondents said it was ‘very difficult’ to acquire as against 80 per cent saying it was okay.

The overall perception of respondents was that it was generally ‘okay’ for them to acquire skills for the purpose of developing their business over the course of the next five years.

Although, the general consensus was that multiskilling is the most difficult skill to acquire, closely followed by woodworks, joinery and carpentry, in-depth interviews with respondents however revealed that respondents did not experience much difficulty sourcing for specialist sub-contractors who were skilled in the trades listed below. If the term ‘acquire’ in the question 29 (see Appendix 4 for full text) was limited to training providers in the Black Country only, the entire perception might have been different. This assertion can be attributed to the characteristic sub-contracting nature of the industry. But interviewees were of the opinion that there where little or no provision for the following skills (trades) by current training providers in the sub-region regardless of their significance to current and future developments:

- ground engineering;
A survey of demand side issues influencing future skills demand in the Black Country

- curtain walling;
- modular building walls;
- structural and reinforced iron metal;
- cladding system work.
7.2.5. Quality of training

Respondents were asked to indicate and assess the level of training received by tradesmen in their businesses in the previous year. Table 7.5 illustrates the percentage trained in each trade:

<table>
<thead>
<tr>
<th>Level of training</th>
<th>% Trained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trowel Trades</td>
<td>23</td>
</tr>
<tr>
<td>Wood trades</td>
<td>26</td>
</tr>
<tr>
<td>Painting and decorating</td>
<td>1</td>
</tr>
<tr>
<td>Mechanical services</td>
<td>6</td>
</tr>
<tr>
<td>Ground engineering</td>
<td>22</td>
</tr>
<tr>
<td>Heating and ventilation</td>
<td>15</td>
</tr>
<tr>
<td>Curtain walling</td>
<td>0</td>
</tr>
<tr>
<td>Carpet, floor and tiling</td>
<td>1</td>
</tr>
<tr>
<td>Construction and equipment</td>
<td>1</td>
</tr>
<tr>
<td>Structural</td>
<td>0</td>
</tr>
<tr>
<td>Prefabrication</td>
<td>0</td>
</tr>
<tr>
<td>OCN Construction</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
</tr>
</tbody>
</table>

The four key trades receiving most training as identified by the 43 Respondents ranked in descending order are: wood trades; trowel trades; ground engineering; heating and ventilation. Please note the low level (near absence) of training in ‘new trades’ from local colleges. Training occurs in new trades outside the sub – region. Colleges at the
steering committee meeting expressed readiness to commence training in new trades if employers could promise a critical mass.

The consensus amongst respondents was that quality of the training received had been either ‘ok’ or ‘good’ – inferring that constructors (respondents) believe there are adequate and effective training provisions in place within the Black Country for wood trades, trowel trades, ground engineering and heating and ventilation. The key trades on which most training went are the traditional trades. A likely explanation for this might just be the absence of adequate training provision to accommodate ‘new trades’ in the Black Country and the usual fears associated with taking new directions by colleges. The respondents identified that colleges in the Black Country generally provide good training but agree that standards do vary with regards to facilities and quality of training received. On this basis, participants were asked what more could be done in order to improve and standardise training offered by Colleges in the Black Country in the construction and building services sector, their suggestions being summarised into themes below:

- a dedicated training college in the Black Country focused upon the construction industry;
- better development of existing courses to meet needs of employers and employees;

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28 New trades in the research context encompasses ground engineering, curtain walling, structural, prefabrication, construction and equipment operators, modular building works, cladding system works, fencing.
greater emphasis upon C&G courses which are seen by as providing a more comprehensive system of learning than NVQ which is seen as varying from college to college;

- more input from Government to support colleges;

- a need for colleges to be more flexible towards construction industry particularly in relation to supporting block release of staff for training purposes;

- colleges seen as needing to concentrate more on construction and engineering and less on ‘media hype’ programmes;

- courses seen as needing to appeal to young people (‘they need to have a job at the end of it’);

- develop a league table of results for each provider to provide transparency in relation to quality and a guide for employees;

- pre-apprenticeship courses possibly running alongside 6th form at school level; and

- financial help to fund (partly/wholly) apprenticeships and other forms of training (particularly for smaller firms).

### 7.2.6. Which training provider?

In descending order are the training providers the respondents had engaged with in the last 2 years:

- University of Wolverhampton;

- CITB;

- Walsall College and others;
- Private Training Providers;
- Wolverhampton City College;
- Dudley College; and
- Sandwell College, Stourbridge College and Voluntary sector.

The University being a HE provider can be discounted from this survey leaving the CITB possibly the training provider most engaged with by the respondents in this survey. It would seem that the CITB effectively converts advice to training. Combining advice and training at one point might be an effective way forward in the provision of training in the sub-region.

### 7.2.6.1. Rank order of where to get training advice from

The following were identified by respondents as the rank order of places of contact if they need advice in relation to issues of training, the most common responses being summarised as a descending hierarchy below (CITB being the most popular):

- CITB;
- external consultants;
- the Jobcentre;
- ‘in house’ within firms;
- the Learning & Skills Council;
• fellow companies;
• colleges.

7.2.7. Experiences of apprenticeship scheme

Respondents were also asked to describe their general experiences of apprenticeship in more detail, with the following case studies emerging.

**Case Study 1**: ‘[it’s a] scheme [run] through JTL. They select, we interview and we employ. JTL pay us for college fees but it is an expensive scheme. CITB used a different scheme, the more you trained the more you got. We were happy with that. With JTL it’s a scheme which suits the industry but doesn't necessarily suit the employer’.

**Case Study 2**: ‘[Our] apprentice goes to college at Walsall and I am pleased with him so far. I would not take on anyone else at the moment due to the size of the company. I am concerned that it costs me £135 per week and on that he goes to college for two days effectively’.

**Case Study 3**: ‘Following national press coverage regarding plumbers alleged salaries we have no problems with recruits. We do have problems with the quality of applicants and that placements are only made pro rata to employment’. 
Case Study 4: ‘[we find it] difficult finding them meaningful work once their apprenticeship ends at Bradley Lane. So may have to work at other locations outside the Black Country’.

Case Study 5: ‘[it’s] difficult to find full spectrum of work to satisfy the NVQ scheme. Colleges do not really want to be involved because it’s too costly for them. On-site assessments can be difficult to do. Most colleges are full - no further training places. We need more financial support from Government to encourage employees to take on more apprentices’.

7.2.8. Broader training issues

The most commonly raised issues focused upon the need for Government help in providing more support both to employees and training bodies to ensure appropriate level of resources. In tandem is the need to enhance the attractiveness of the construction industry in general for young people. Suggestions include financial incentives (similar to those available for teachers) as well as a closer association between training and employment opportunity. Colleges were seen as having a vital role in improving the image of the construction industry. Other issues are:

“The first two years of a P&H apprentice has no financial rewards to the employing company, [but] it is obvious we require financial support,
possibly coming in the form of scholarships from large national builders” [Respondent 7];

“Big construction companies need to be proactive in getting apprentices through the system. Colleges need to be flexible and deliver courses that meet the needs of the market. Good solid training needed rather than short-term courses [which is] no good for industry” [Respondent 4];

“[We] currently run programs for sub-contractors to get training in the areas specific to the business. Hence any assistance from the LSC toward training subcontractors to NVQ levels would help the industry and business. Need more training providers assessor” [Respondent 29];

“Customers of the construction and building services sector require to be educated to ensure that they fully understand the benefits of them employing suppliers who are actively seeking to improve health and safety in the industry” [Respondent 35];

“[There is a need for] financial help to small companies to employ apprentices. Proper apprenticeships are necessary to get the right skills in the trade. Not “I'm a bricklayer I've done six months training” [Respondent 19];

“Keep in regular touch with companies doing the job - and the biggest and best suggestion which I have banged on about for years is that any
subcontractor or main contractor should have trainees before any contract was awarded to them by any Government department or responsible organization” [Respondent 16].

7.2.9. Meeting future challenges

Respondents have identified the following to be what they thought was needed in order to meet future challenges:

- all types construction skills (multiskilling);
- contract management;
- craft skills – need for more training – support for industry as a whole;
- electrical skills; building construction;
- every sort of tradesman, electricians, bricklayers and plasterers in particular;
- identifying where staffing can be resourced from; and
- management courses.

7.2.10. Predicted changes in skills demand

To enable the Black Country construction and building services sector supply side (training providers) accommodate current and future technological changes there should be a fair way of understanding and
A survey of demand side issues influencing future skills demand in the Black Country predicting changes in skill needs. Table 7.6 is an aggregate response to future skills demand.
Table 7. 6: Shows aggregate responses in % terms in Relation to future consideration for trades
(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>Trade Area</th>
<th>Predicted % Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trowel trades and plastering</td>
<td>24</td>
</tr>
<tr>
<td>Painting and decorating</td>
<td>22</td>
</tr>
<tr>
<td>Wood trades, carpentry and joinery</td>
<td>21</td>
</tr>
<tr>
<td>Mechanical services and plumbing</td>
<td>19</td>
</tr>
<tr>
<td>Others</td>
<td>16</td>
</tr>
<tr>
<td>Prefabrication and building</td>
<td>15</td>
</tr>
<tr>
<td>Construction and equipment operations</td>
<td>13</td>
</tr>
<tr>
<td>Curtain walling</td>
<td>12</td>
</tr>
<tr>
<td>Carpet floor and tile installers</td>
<td>12</td>
</tr>
<tr>
<td>Heating and ventilation</td>
<td>12</td>
</tr>
<tr>
<td>OCN construction</td>
<td>11</td>
</tr>
<tr>
<td>Ground engineering</td>
<td>9</td>
</tr>
</tbody>
</table>

In relation to area of specialty respondents were of the opinion (speculative judgment) that the number of employees currently working in trowel trades, plastering and brickwork would likely increase by 24 per cent over the next 5yrs (see Table 7.6).

If this were so, it would be logical to infer that there will be increased demand for this type of skill set and there would be need for training providers to take cognisance, for efficiency and optimisation of scarce resources. As well as being able to match supply to demand, and with the ranking of the responses in a descending order both entrant trainees and recruitment agencies would be in a ‘fairly good’ position to make the future labour market a demand driven one:
A survey of demand side issues influencing future skills demand in the Black Country

- trowel trades and plastering;
- painting and decorating;
- wood trades, carpentry and joinery;
- mechanical services and plumbing;
- others;
- prefabrication and building;
- construction and equipment operations;
- heating and ventilation, curtain walling and carpet, floor and tile installers;
- OCN construction; and
- ground engineering.

Judging by this ranking, it is apparent that a few ground engineering activities will be carried out in the area of road construction, excavation, tunnelling, etc. in the next five years. Hence, most of the on-going and perceived regeneration works would come under housing refurbishment and there will be little works in the areas of ground engineering. It is pertinent to note that the forecast has been limited to the next five years only. But because the projected changes might be completely different if the survey of this same sample is conducted in another five years some caution should be applied to this interpretation.
7.2.11. Predicted demand changes by type of project

Table 7.7 below captures predicted percentage change by project type. Respondents in their judgement strongly believe that the number of future projects (see list below) they would undertake will increase in the next five years. This speculative prediction has been ranked in descending order in Table 7.7 (repairs and maintenance being the most occurring).

Table 7.7: Predicted % change by type of project  
(Source: Ejohwomu et al, 2007c)

<table>
<thead>
<tr>
<th>Type of future project</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repairs and maintenance (DIY)</td>
<td>47</td>
</tr>
<tr>
<td>Painting and decorating</td>
<td>42</td>
</tr>
<tr>
<td>Heating and ventilation</td>
<td>31</td>
</tr>
<tr>
<td>Wood trades, carpentry and joinery</td>
<td>28</td>
</tr>
<tr>
<td>Brickmasons, blockmasons and stonemason,</td>
<td>28</td>
</tr>
<tr>
<td>New built commercial</td>
<td>26</td>
</tr>
<tr>
<td>New built housing</td>
<td>24</td>
</tr>
<tr>
<td>Others</td>
<td>24</td>
</tr>
<tr>
<td>Mechanical services and plumbing</td>
<td>26</td>
</tr>
<tr>
<td>Ground engineering works,</td>
<td>18</td>
</tr>
<tr>
<td>Cladding system works</td>
<td>18</td>
</tr>
<tr>
<td>Structural and reinforcing iron metal</td>
<td>15</td>
</tr>
<tr>
<td>Construction and equipment operator</td>
<td>12</td>
</tr>
<tr>
<td>Carpet Floor, and tile installers and finishes</td>
<td>11</td>
</tr>
<tr>
<td>Cement masons, concrete finishes, segmental, and terrazzo</td>
<td>10</td>
</tr>
<tr>
<td>skilled works</td>
<td></td>
</tr>
<tr>
<td>Modular building works</td>
<td>10</td>
</tr>
<tr>
<td>Prefabrication of building components</td>
<td>9</td>
</tr>
</tbody>
</table>
Respondents have identified repairs and maintenance as a sector where changes would occur the most. If this were true, then there would be high demand for multi-skilled apprentices and low demand for prefabrication of building components related skills. Overall, training providers would need to take cognisance of this perceived future changes if they are to meet demand changes.
7.2.12. **A summary of skill challenges to the construction and building services sector**

The following were identified by respondents as what they perceived to be the main challenges facing their businesses:

- dealing with demand with a lack of capacity and skilled / qualified labour;
- engaging with training bodies to ensure appropriate skills are being taught and to specialist level;
- uncertainty caused by need to keep up to date and adhere to new legislative requirements / frameworks in relation to health and safety and other labour laws, impinging upon ability to be competitive within the market places;
- getting sites through the planning process;
- lack of skilled tradesmen.

It is most significant that 19 per cent of the respondents indicated the feeling that they would be unable to meet the challenges that they defined for themselves because of inadequate skill supply.

7.3. **Summary and application of findings**
Together Chapters 6 and 7 have enabled the understanding of how supply and demand issues influence construction trades’ supply and demand at the sub regional level. The demand findings reported in this chapter purport the reality of the sub regions forecast skills crisis. In particular, the paucity of data makes it very unlikely to harness sufficient primary data needed for evaluating the impact of multiskilling on construction and building services output – an overarching aim in this research. Yet, there are some evidence on the case for adopting multiskilling as tentative redress for skills crisis.

Thus, in order to allow for the development of a holistically conjoined strategy – a drawback of Dainty et al., (2004) concluding argument and other sub regional reports (CITB, 2001; Parson and Welsh, 2004; ECOTEC, 2003); the subsequent chapter whilst drawing on the concept of multiskilling will focus on examining existing patterns (if any) of the relationship between construction manpower and output variables.
CHAPTER 8

TREND ESTIMATION FOR CONSTRUCTION MANPOWER AND OUTPUT VARIABLES: A MACRO INSIGHT

8.1. Introduction

Existing approaches for delivering skills (tradesmen) have been based on Government asking training providers to articulate their needs and then planning supply to meet this (Olomolaiye, 2005; Leitch, 2006). This approach, which is somewhat consistent with the criticized manpower requirements approach has led to a mismatch of skill demand and supply and a plethora of advisory, strategic and qualification bodies within the industry.

In the process of conjuring a realistic redress for this mismatch and its consequences, the preceding chapter has furnished an insight into how supply and demand side issues influence construction trades supply and demand at the regional level. In this chapter, a longitudinal approach is favoured for examining existing patterns (if any) of the relationship between manpower and output variables at the national level (Agapiou, 1995; Wong et al, 2006).
8.2. Presentation and analysis of time series data

This study data - a 43 year time series data on construction manpower and output variables is harnessed from the 2003 edition of Construction Annual Statistics following a quantitative and literature review of supply and demand for construction and building services skills. It is pertinent to note that the rationale for investigating this secondary information stems largely from the research quest to comprehend national trade picture – macro insight (see research objective (iii). Perhaps such an insight will enable the conceptualisation of a framework for implementing the concept of multiskilling.

The suitability of the harnessed data rests in its ‘wholeness’ that is, the annual construction statistics report (primary source of the secondary data) reliably compiles information on the goings-on of the UK construction and building services sector.

8.2. Reliability of the data

Drawing on the argument for and against the reliability of UK construction data (Pearce, 2003; Briscoe, 2006), the main constraint (in relation to the focus of this research), which relates to the non-disaggregation and inconsistencies in the reporting of the available data were considered. That is, sufficient data exploration and utilization of a one-source data from the department of trades and industry (dti). The data (dependent variable) were also indexed in order
to allow for reliability in the unit value of work done (output). That is, an indexed data is a statistical estimate of the movement of prices of goods and service (ONS, 2006). Notably, the two main uses of indexing a data are: as a measure of inflation, and for the evaluation (or indexation) of wages or salaries.

8.3. Trend estimation for manpower and output variable

Statistically, a time series is a sequence of data points, measured typical at successive times, spaced at time intervals. This time series analysis adopts a statistical method (trend estimation\textsuperscript{29}) in an attempt to understand the underlying theory of the data points (such as, how have skills been responding to economic booms and bursts, and technological advancements?) and allow an insight into construction trade at the national level.

8.3.1. Construction output trend 1961 - 2003

Figure 8.1 shows the construction output (total value of work done at current prices) for 1961 – 2003 in actual terms. The construction output is the output by constructors, which includes unrecorded estimates by small firms and self-employed workers. An estimation of the trend in Figure 8.1 shows that over these decades, the total output in real terms has demonstrated a steady increase in construction output between 1965 and 1970. This increase in output continued

\textsuperscript{29} Trend estimation is the application of statistical techniques to make and justify statements about trends in a time series data.
Trend estimation for construction manpower and output variables

sharply and steadily between 1977 and 1990 until it fell in 1990. By 1995, growth in output had not only returned to its peak but it is likely to reach a new peak, if this recovery growth continues.

Figure 8.1: Construction output for total value of work done
(Source: adapted from the 2003 edition of Construction Annual Statistics)
On the whole, the growth rate in the UK construction sector has been outstanding regardless of output falling significantly for the first time in 1990. A trend which forecasters argue will peak higher between 2005 and 2010 (Construction News, 2006). A logical explanation for this growth in trend may be associated with increased government and private capital expenditures – with the sudden changes in the direction of the trend line indicating economic booms and bursts. The expectation, however, is that changes in output are likely to reflect on manpower employment trend.

8.3.2. Manpower employment trend 1961 - 2003

There is no denying the fact that employment in the sector fluctuates with workload, more so when the industry is labour intensive and heavily craft based. The implication of this behavioural structure is that jobs are lost during downturn and vice versa during economic booms.

Figure 8.2: Construction manpower trend for total manpower employed
(Source: adapted from the 2003 edition of Construction Annual Statistics)
Under close inspection, it can be argued that the trend shown in Figure 8.2 is complimentary of the behavioural pattern described. But in this case, the aggregated employment trend seems to be fluctuating steadily downwards; the peaking and falling of the trend line are indications of economic boom and burst periods. The implication of which is that the number of people in employment are in decline during recessions and vice versa during economic booms. If Figure 8.2 is mapped against Figure 8.1 to illustrate increasing manpower productivity, what will be the implication of this for a demand led model (see Section 9.8)? In its disaggregated form, what behavioural pattern will each of the different skills exhibit? What are the implications (if any) of these skills behavioural patterns on output?

8.3.3. Disaggregated manpower

In line with the 2003 Standard Industry Classification (SIC) the aggregated manpower was disaggregated into 22 different construction skills (traditional and non-traditional trades) and analysis of each is presented below to enable a comparative analysis of aggregated manpower and output trends. Note that the framework for collating the longitudinal data was also SIC compliant.

8.3.3.1. General builders (GB)

In accordance with UK’s standard industry classification, the variable general builder signifies manpower expended in establishments
engaged in the construction, improvement and repair of both residential and non-residential buildings. This includes specialists engaged in sections of construction and repair work such as bricklaying, building maintenance and restoration, carpentry, roofing, scaffolding and the erection of steel and concrete structures for buildings. The trend for general builder, which is shown in Figure 8.3, suggests that as output increases the actual number of manpower engaged decreased. More importantly, the trend fluctuation depicted by the variable (general builder) is an indication of the effect of economic recessions and booms. It is pertinent to note that comparatively the underlying behaviour of general builders trend is somewhat ‘sticky’ since its response to economic booms and bursts is not very immediate. For example, recessions which occur whilst the constructor has already mobilized and commenced construction activities would need to be renegotiated or completed under existing or new contractual agreements. Finally, it can be argued that the trend exhibited by the variable ‘general builder’ is highly complimentary of the aggregated manpower trend as captured in Figure 8.3.
Figure 8.3: DTI Data Series on MpE\textsuperscript{30} in the GB Trade 1961 – 1996
(Source: adapted from the 2003 edition of Construction Annual Statistics)

\textsuperscript{30} Manpower employed (MpE)
8.3.3.2. Building and civil engineering contractor (BCEC)

Under the revised Standard Industry Classification (SIC) Building and Civil Engineering Contractors (BCEC) are concerned with the construction of roads, car parks, railways, airport runways, bridges, buildings and tunnels. Hydraulic engineering (e.g. dams, harbours and canals), irrigation and land drainage systems, laying of pipelines, sewers, gas and water mains and construction work at oil refineries, gas installations (and other large sites) are considered to be part of BCEC.

The manpower activity trend in Figure 8.4 suggests that the bulk of employees are engaged within this sector and the trend line reflected here is a better mirror image of aggregated manpower. It is comparatively less ‘sticky’ – response to economic boom and bursts seems to be swifter. This can be attributed to the structure of organisations involved with huge building and civil engineering projects. That is, regardless of the total project cost, construction activities are often executed (or outsourced) in a working gang culture; thus resulting in flat hierarchical structures where decision taking are swift and far less bureaucratic (Dawson, 1986).
Civil engineers are highly skilled construction and building services professionals. Their duties revolve around the activities of construction of roads, car parks, railways, airport runways, bridges, buildings and tunnels. The trend shown in Figure 8.5 undoubtedly suggests that whilst there is an overall decline in the number of trained civil engineers, comparatively, the behavioural pattern exhibited in the trend is somewhat ‘erratic’ in its reaction to boom and burst periods. That is, a significant number of civil engineering employees are lost during recessions and vice versa during economic booms. A likely explanation for this ‘erratic’ behaviour can be associated with the theory of human capital and the concept of multiskilling. Where both
theories argue in favour of upskilling, that is, increased job earnings and flexibility are synonymous with upskilling. It would seem the civil engineer is able to work and attract comparatively equal level of earnings even whilst working outside the construction sector (Hillibrandt, 1974). Drawing from the economics of demand, the seeming stability between 1983 and 1990 can be ascribed to the concept of ‘demand elasticity’ – were in this case, it can be argued that the effect of economic activities on demand for civil engineers has been inelastic.

![Graph of Trend estimation for construction manpower and output variables](image)

**Figure 8.5: DTI Data Series on MpE in the CE Trade 1961 - 1996**

8.3.3.4. Demolition contractors (D)

The works of a demolition contractor, under the present standard industry classification (SIC) refers to establishments engaged in building and civil engineering works, not sufficiently specialised to be
classified else where in Division 5 and demolition work. This includes direct labour establishments of local authorities and government departments. The behavioural pattern captured in Figure 8.6 is moderately erratic and somewhat stable. In order words, demolition contractor employees are less susceptible to economic booms and bursts. This behavioural pattern can be attributed to a significantly low number of manpower employed within the sector at any one time. Perhaps it can be hypothesized too, that manpower susceptibility or resistance during booms and bursts is dependent on labour market demand for this manpower. In order words, the higher the demand the more responsive it is to economic trends and vice versa.

Figure 8.6: DTI Data Series on MpE in the D Trade 1961 – 1996
(Source: adapted from the 2003 edition of Construction Annual Statistics)

8.3.3.5. Reinforced concrete specialist contractors (RCS)

The duties of a reinforced concrete specialist under the present SIC can be associated with establishments engaged in the construction,
improvement and repairs of both residential and non-residential buildings, particularly specialist reinforced concrete works. In Figure 8.7, the behavioural pattern of this specialist trade is a reflection of its aggregated manpower trend. That is, its responses to booms and bursts are as expected.
8.3.3.6. Roofers (R)

The activity profile of this set of construction employees is associated largely with construction and repairs of buildings. That is, establishments engaged in the construction, improvement and repair of both residential and non-residential buildings. The behavioural pattern of the trend shown in Figure 8.8 is comparatively distinct, that is, while total manpower fluctuated steadily downwards (see Figure 8.3) the behavioural pattern of roofers peaked before declining steadily. This pattern, therefore, suggests that some construction trades correlate negatively with economic booms and burst. In order words, some repair and maintenance works are ‘requirements’ and not economically dependent. For example, a malfunctioning boiler must be replaced during wintry weather regardless of any evidence of boom and burst. With the seasonality component missing from the trend, it would be
unsafe to draw any significant inference on actual economic effect, which booms and bursts have on roofing trade. However, it can be argued that demand was particularly elastic between 1976 and 1992. The sharp decline in 1990 is perhaps a reaction to early 1990s recession. On the whole the behavioural pattern can be best simplified using the economic concept of opportunity cost. Where the opportunity cost of repairing a malfunctioning boiler in the aforementioned analogy is ignoring the immediate effect of economic down turns.

![Figure 8.8: DTI Data Series on MpE in the R Trade 1961 – 1996](source)

(Source: adapted from the 2003 edition of Construction Annual Statistics)

8.3.3.7. Asphalt and tar sprayers (ATS)

In line with the SIC, asphalt and tar spraying employees can be grouped under road construction activities, which is a sub set of the civil engineering classification works. Therefore, superficially, it would
be expected that the behavioural pattern captured in Figure 8.9 would mirror the happenings of Figure 8.5. Under close scrutiny, it should be safe to suggest that the behavioural pattern exhibited is as expected but for some slight variations at the closing end of the trend. A variation, whose implied characteristics, can be associated with its dual classification (asphalt and tar spraying works can be associated with its road repair and maintenance work) status.

On the whole the number of asphalt and tar sprayers have decreased somewhat steadily since 1973. This downward trend can be attributed to changes in technology (for example, the introduction of inter locking tiles as an alternative to tar). Anecdotal evidence thus however suggests that there is increasing demand for inter locking tiles largely because of its flexibility - it can be removed and replaced easily during maintenance works.

Figure 8.9: DTI Data Series on MpE in the ATS Trade 1961 – 1996
(Source: adapted from the 2003 edition of Construction Annual Statistics)
8.3.3.8. Scaffolding specialist (SS)

In the standard industry classification, scaffolding specialist employees work in establishments engaged in the construction, improvement and repair of both residential and non-residential buildings. This includes specialists engaged in sections of construction and repair work such as bricklaying, building maintenance restoration, carpentry, roofing, scaffolding and erection of steel and concrete structures for buildings. This unique behavioural pattern in Figure 8.10 is similar to that exhibited in Figure 8.8 – see sub Section 8.3.3.6 for already discussed behavioural pattern. In particular, the steady increase in trend between 1973 and 1989 suggests demand for specialist-scaffolding tradesmen were positively elastic because scaffolding frameworks are required for both repairs and maintenance works and new construction activities. Alternatively, this change in scaffolding trend can be blamed largely on increased use of mobile cranes on both construction and building services maintenance sites.
Figure 8.10: DTI Data Series on MpE in the SS Trade 1961 – 1996
(Source: adapted from the 2003 edition of Construction Annual Statistics)
8.3.3.9. Insulating specialist (IS)

These are construction and building service employees concerned with installation of fixtures and fittings. In line with the SIC, these employees deal with establishments engaged in works such as gas fitting, plumbing, heating and ventilation plant, sound and heat insulating, and electrical fixtures and fittings. The behavioural pattern of the trend shown in Figure 8.11 also reflects that which is presented in Figure 8.6. On the whole, this is a behavioural pattern with some cyclical components. In addition to fluctuation in demand for economic activities, it is worth noting that technological advances (productivity), too, may have influenced the peaking and falling of the number of insulating specialists employed in the sector at this time.

![Figure 8.11: DTI Data Series on MpE in the IS Trade 1961 – 1996](source)
(Source: adapted from the 2003 edition of Construction Annual Statistics)
8.3.3. 10. Plumbing (P)

Under the SIC, plumbing activities should be associated with establishments engaged in the installation of fixtures and fittings. However, surprisingly, there is little or no variation in the behavioural pattern of aggregated manpower variable (see Figure 8.3) and disaggregated manpower attribute (see Figure 8.12) given that they have both declined somewhat steadily. Inferentially, it should be safe to argue that this declining trend does not necessarily signify a decline in demand for plumbing skills but perhaps the effect of inelasticity demand for plumbing trade. Alternatively, it could be suggested that this downward trend in demand for plumbers is as a result of new design changes to modern day buildings or because capital expenditures have been fixated on non civil engineering works. Overall, it would be safe to argue that plumbers have become more efficient and can do more by way of increased productivity.
Figure 8.12: DTI Data Series on MpE in the P Trade 1961 - 1996
(Source: adapted from the 2003 edition of Construction Annual Statistics)
8.3.3.11. Heating and ventilation engineer (HVE)

In line with the 2003 edition of SIC, heating and ventilation engineers can be classed under installation of fixtures and fittings. This too, encompasses organisations engaged in gas fittings, and plumbing activities. The demand for heating and ventilation engineers in Figure 8.13 reached its peak in the early seventies before dropping to its lowest point (which is not very significant) in 1996. The peaks and troughs also suggest that the heating and ventilation trade is more responsive to seasonality than economic booms and bursts. Consequently, training providers should be informed of the consequences of drawing-up school calendars that graduate trainees during periods of low demand. It is likely that a multiskilled graduate will be exempted since he/she can execute a variety (seasonal and non seasonal) works. The demand for heating and ventilation engineers has on the average fluctuated between 100 and 140 thousand in the past 35 years.

Figure 8.13: DTI Data Series on MpE in the HVE Trade 1961 – 1996
Trend estimation for construction manpower and output variables

(Source: adapted from the 2003 edition of Construction Annual Statistics)
8.3.3.12. Plastering (PL)

Plastering (as a construction and building services trade) is associated with building completion works, such as painting and decorating, glazing, tiling, on-site joinery and carpentry, flooring, and installation of fire places. Since the demand for plastering in Figure 8.14 peaked in the early sixties, it has declined steadily, which raises the question - could industry stakeholders get to a stage where there will be zero demand for plasterers? The answer may be yes, because that is what the data suggests and not because industry stakeholders would continue to demand the services of plasterers – particularly when executing repair and maintenance works. A more realistic explanation would be that the plastering trade is gradually being ‘reinvented’ in the form of curtain walling and dry building. Evidence suggests that with the increasing demand for curtain walling and glass finishes there will be less demand for plasters; and training providers as evident from the cross sectional survey may push for the closure of plastering colleges in the search for profit making schools. The implication of which will exacerbate already existing disequilibrium in the supply and demand for certain construction and building services skill. Drawing from the emerging trend estimation and analysis, the current supply of plasterers will not be able to cope with forecasted increase in demand.
Joiners and carpenters (JC)

These tradesmen are renowned for woodwork related activities, which encompasses roofing, ceiling, doors and cabinet fittings and furniture making. The demand for joiners and carpenters in Figure 8.15 peaked in late sixties but dropped sharply between 1968 and 1973. While there is insufficient information in the trend to infer the cause of this sudden change, there is enough to argue that joinery and carpentry trades are somewhat insensitive to economic booms and burst, technological, social and political changes. That is, training providers should not anticipate increasing demand for these tradesmen during economic booms and vice versa during bursts.
8.3.3.14. Flooring contractors (FC)

Flooring contractor activities are a sub set of building completion works. In Figure 8.16, the captured trend suggests flooring contractor activities was stable between 1961 and 1966 before plunging steadily in the early 1970s. Although, this disaggregated manpower activity has not peaked, it is fluctuating steadily. But how realistic is it to attribute this stable fluctuation to equilibrium supply and demand for flooring contractor skills? Whilst it can be inferred from the pattern exhibited in Figure 8.16 that the participating labour market forces are somewhat in equilibrium between 1961 and 1986, and 1973 to 1996, there is insufficient information within this trend to deduce a realistic explanation for the sudden change in trend line between 1968 and 1972.
8.3.3.15. Floor and wall tiling specialist (FWTS)

This is a specialist trade – specialist tradesmen are required for performing specialist services. For example, most listed buildings would require specialist floor and wall tiling tradesmen for any of their floors and wall tiling maintenance work. However, since 1961 the total number of floor and wall tiling specialists in Figure 8.17 at any one time has not exceeded eleven thousand, which is an indication that the supply of specialist trades are likely to be limited now and in the future. A logical argument for this decline can be linked to difficulty in obtaining planning permission particularly where the building is listed. It can be inferred that while the demand for this trade has waned with time it will not diminish completely.
8.3.3.16. Suspended ceiling specialist (SCS)

It can be argued that all repair and maintenance works on a listed building requires the services of a specialist. Suspended ceiling specialists execute specialist duties relating to ceiling design and repairs. The trend exhibited in Figure 8.18 is somewhat cyclical, which is an indication of a trend that is both economic and demand responsive. The demand for suspended ceiling specialist in Figure 8.18 seems to have increased with economic ‘booms’ and vice versa. However, the trend is not seasonally sensitive. A probable explanation for the difference in trend (comparing Figures 8.18 and 8.17) is that planning permissions restrictions has constrained the latter than the former.
8.3.3.17. Painting (PA)

It is fairly normal for ‘painting’ activity to be associated with establishments specializing in building completion works. It may be controversial to suggest that the emerging trend in Figure 8.19 is as expected because it is highly complementary of Figure 8.2 (aggregated manpower). However, it may also seem as if entrant trainees do not think painting as a trade is lucrative enough, or perhaps the increased demand for curtain wall and changes in building design remains a more logical interpretation since aggregate output (see Figure 8.1) has been increasing steadily. This inference should be treated with some caution since emerging evidence suggests there could be significant differences between aggregate output and disaggregated attribute. However, it can be argued that the underlying pattern of the trend is
that demand for painting trade is tending towards ‘zero’ demand. Alternatively, the growing DIY culture can be blamed for the decrease in demand for painters and not specialist painters.

![Diagram showing trend of employees in thousands from 1961 to 1995](image)

**Figure 8.19: DTI Data Series on MpE in the PA Trade 1961 – 1996**
(Source: adapted from the 2003 edition of Construction Annual Statistics)

8.3.3.18. Glaziers (G)

Under the SIC, Glaziers and Painters are sub sets of building completion works. Consequently, it would be logical to think that both their behavioural trends would exhibit the same characteristics. The emerging behavioural pattern shown in Figure 8.20 seems to suggest otherwise. The demand trend for glaziers fluctuated steadily between 10 and 20 thousand in the first 14 years before peaking at between 50 and 60 thousand in 1990. This sharp change in trend can be attributed to both economic booms and burst eras and an increasing demand for
glaziers in the wake of glass frenzy building designs. The underlying pattern however suggests that UK constructors may be commissioning building projects with more glass and curtain walling designs. The demand for glaziers is not likely going to drop below its lowest point of 10 thousand glaziers annually because of forecasted increase in future demand for curtain walling.

![Figure 8.20: DTI Data Series on MpE in the G Trade 1961 – 1996](image)

(Source: adapted from the 2003 edition of Construction Annual Statistics)

**8.3.3.19. Plant hirers (PH)**

There is no clear SIC classification for the variable plant hirers but it should be logical conceptualizing that plant hirer activities cut across board. That is, a plant hirer activity is required during construction and demolition works, construction and repairs of buildings, civil engineering, and installation and building completion works. The trend exhibited in Figure 8.21 suggests a fairly stable increase and decrease
in plant hirer activities. On the whole, comparatively speaking, the behavioural pattern of a steady increase than a steady decrease is unique when considered for the full stretch of the trend line. Perhaps this is due to advances in technology – the manufacturing of smaller power tools. Alternatively, there may be strong negative correlation between huge investments in repair and maintenance works and declining plant hirer activities.

![Graph of Trend Estimation](image)

**Figure 8.21: DTI Data Series on MpE in the PH Trade 1961 – 1996**
(Source: adapted from the 2003 edition of Construction Annual Statistics)

### 8.3.3.20. Electrical constructors (EC)

As prescribed in SIC, electrical contractors are sub sets of the classification installation fixtures and fittings. These sets of craftsmen are associated with establishments engaged in the installation of fixtures and fitting, plumbing, heating and ventilation plant, sound and heat installation, electrical fixtures and fittings. Comparatively, the
behavioural pattern exhibited in Figure 8.22 is significantly stable regardless of any economic boom or burst. This finding compliments largely the argument that electrical trades are exempted from experiencing full blown disequilibrium in the supply and demand for electrically inclined craftsmen because they run a parallel demand led training structure. See Chapter 7 for fuller details. It is worth noting that the variable label, electrical constructor and not electrician is as adopted from the secondary data source.

![Figure 8.22: DTI Data Series on MpE in the EC Trade 1961 – 1996](Source: adapted from the 2003 edition of Construction Annual Statistics)

### 8.3.3.21. Construction engineers (CEng)

Construction engineers align with construction of roads, car parks, railways, airport runways, bridges and tunnels, hydraulic engineering, harbours and dams, irrigation and land drainage systems as well as construction of overhead lines, line support and area towers.
Construction work at oil refineries, steel works, electricity and gas installations, shaft drilling and mine sinking and manufacture of construction steelwork all fall within the classification. The trend captured in Figure 8.23 however depicts a significant but fairly stable decline in the number of ‘hands on’ construction engineers. But it will be unsafe to infer that there has been a steady decline in overall demand for works associated with construction engineers. Perhaps a more logical interpretation will be advances in technological equipment and tools, increased productivity and innovations, declining figures of entrant trainees as well as other economic factors. On the whole, the existing trend, too, has exhibited some signs of tending towards ‘zero’ demand. In guarding against severe shortage of construction engineers training providers should consider the benefits of adopting the concept of multiskilling. Alternatively, FE colleges in conjunction with constructors may have to embark on massive recruitment campaigns to boost trainee enrolment on construction engineering – a strategy that is currently being executed (CITB, 2005).
8.3.3.22. Miscellaneous (M)

The term miscellaneous as used in this report addresses total manpower expended whilst executing works that are not clearly defined in SIC. The emerging trend shown in Figure 8.24 contains no obvious pattern which is as expected because ‘miscellaneous’ seems to be an irregular activity and no meaningful deduction can be deduced or inferred from the trend captured in Figure 8.24.

8.4. Summary

The research objective (see Section 1.4: p.8) – a macro insight into UK manpower variables has been achieved following the trend estimation
of a set of time series data. That is, emerging evidence suggests the underlying pattern of a disaggregated manpower variable is ‘unique’ and significantly different from that of its aggregated counterpart.

Whilst the aggregated manpower trend depicts productivity growth, the disaggregated trend estimation is suggesting otherwise, that is, the following skills (Plastering, Painting, Construction Engineers, Reinforced Concrete Specialist and Building and Civil Engineering Contractors) are tending towards ‘extinction’. The implication of which is immense shortage of the above listed skills.

Any evidence of a significant correlation between an ‘endangered’ and ‘non-endangered’ skills is in itself a direct (but beneficial) application of the concept of multiskilling as a tentative redress for skills crisis.

It is worth noting that while the overall aim of this research suggests a trade focussed investigation; the data available to the study, however, encompasses constructs, which are not really of construction trades only. To this end, the developed conceptual framework (see summary Table 9.3) will aim to evaluate both trades and non-construction trades. In the next Chapter are demand led models for testing the impact of multiskilling on construction output.
9.1. Introduction

Existing approaches for delivering skills have been based on government asking training providers to articulate their needs and then plan supply to meet this (Olomolaiye, 2005; Leitch, 2006). This approach and findings from the trend estimation analysis - that some construction skills are likely to exhibit ‘unique’\textsuperscript{31} behavioural patterns under economic ‘booms’ and ‘bursts’, when responding to the introduction of new technologies and when examined using the concept of elasticity - has led to a mismatch and shortage of skills and a plethora of advisory, strategic and qualification bodies within the industry.

In this chapter, a longitudinal data set is explored towards the development of an optimisation demand led model of construction skills. Recent reforms have attempted to emphasize the need for a demand responsive system, which will respond to demand rather than trying to plan supply. The time series data of aggregate manpower and

\textsuperscript{31} Unique in the sense that demand for certain skills can be fairly stable, fluctuating and more worrying, declining sharply and steadily.
total value of work done (output) was explored prior to fitting models using regression analysis. It should be noted that the disaggregated manpower variable consists of 22 independent variables. This modelling technique is very well established in the construction management research (Drui, 1963; Schaeffer, 1974; Bright, 1976; Rudelius, 1976; Briscoe and Wilson, 1993; Kometa, 1995; Kao and Lee, 1996 and 1998; Goh, 1998 and 1999; Xiao and Proverbs, 2003; Chew and Tan, 2004). These modelling steps: initial test running of multiple regression, observation of the value of $R^2$ and checking the validity of the regression assumptions were executed using SPSS. Next is a robust analysis of the modelling parameters and follow up are development and discussions leading to the optimisation model.

### 9.2. Data exploration

Given that the adopted statistical methods of modelling requires parametric data the assumptions of a parametric data were considered and the Kolmogorov-Smirnov test$^{32}$ was found to be non significant at $p^{33} > 0.05$. That is, the distribution of the sample is not significantly different from a normal distribution. In turn, the nature of any existing pattern was investigated for manpower and output variables. However, it should be noted that the disaggregated form of the harnessed

$^{32}$This is an objective test to decide whether or not a distribution is normal. In particular, the kolmogorov-Sminov test compares the set of scores in the sample to a normally distributed set of scores with the same mean and standard deviation (Field, 2000).

$^{33}$P is the significance value of the test with a confidence interval (for the mean) of 95 per cent; if $p < 0.05$ it indicates a deviation from normality.
manpower variable consists of 22 independent variables. See preceding chapter for details of the independent variables including trend estimation analysis.

9.2.1. A scatter plot of aggregate variables

Following the explorative data analysis, a measure of the relationship of the participating variables became imperative in order to allow for a robust modelling process. Figure 9.1 is a scatter plot of aggregate output and manpower variables. See Section 8.2 and Appendix 6 for details and source of data for the scatter diagram shown in Figure 9.1. A scatter plot tells us whether there seems to be a relationship between the variables, what type of relationship it is, if all and whether any cases are markedly different (outlier) from the others.
Figure 9.1: Scatter plot – output against total manpower employed

On the whole, the resulting scatter plot suggests a negative linear relationship exists, that is, as output increases aggregate manpower decreases. Also, there are no obvious traces of outliers in that most points seem to fall within the vicinity of the other points. Note that a scatter plot of aggregate output and the 22 disaggregated manpower attributes showed semblance characteristics which is enough justification for adopting a linear modelling approach. See Appendix 5 for 3-D scatter plot of the aforementioned. The inspection method used in interpreting the scatter plot shown in Figure 9.1 is consistent with that which is obtained in the analysis involving quantitative data (see Blaikie, 2003: p. 107).

9.3. Pearson’s correlation coefficient (PCC)

On completing the preliminary glance of the data, correlation analysis was conducted in SPSS using Pearson’s correlation coefficient. The decision to perform the PCC was informed by the parametric nature of the data. Tables 9.1 and 9.2 provide a correlation coefficient for output and manpower variables. Underneath each correlation coefficient both the significance value of the correlation and the sample size (N) on
which it is based are displayed. In Table 9.1 aggregate output and aggregate manpower are negatively correlated with a Pearson correlation of $r = -0.938$ and there is a less than 0.00001 probability that a correlation coefficient this big would have occurred by chance. The significance value suggests that the probability of this correlation being a ‘fluke’ is considerably low and the confidence that the relationship between manpower and output variables is acceptable (statistically valid). Table 9.2 is a giant matrix of the correlation coefficients for aggregate output and disaggregate manpower (22 independent variables); and the participating variables are not all positively correlated which is a reflection of the complexities that coexist amongst manpower variables.

On the average, the variables seem to poses significantly high Pearson’s correlation, $r$. The implication of which is immense difficulty in fitting the data to any model given the consequences of multicollinearity. For this primary reason, the theory and application of principal components regression (PCR) – a method for coping with multicollinearity amongst independent variables was adopted. See Section 9.5 for details and application of theory and concept of principal component regression (PCR). Notably, the two tailed and not one tailed test of significance was selected since the research aim is not intending to establish a directional hypothesis. Inferences from the giant matrix correlation table (Figure 9.2) were particularly useful for conceptualising the multiskilling framework (Table 9.3) because it
enabled a detailed exploration (correlating and non correlating) of all participating variables in relation with one another. In other words, only positively correlated variables are eligible for ‘sieving’. For example, in Table 9.2, reinforced concrete specialist (rcs) variable correlates positively with general builders (gb), building and civil engineering contractors (bcec), civil engineering (ce), plumbers (pl), joiners and carpenters (jc), painting (pa), roofers (r), plasterers (pls) and demolition (d) variables; and negatively with glaziers (g) and scaffolding (s). Therefore, based on its (Table 9.3) underlying logic glaziers and scaffolding cannot be combined with reinforced concrete specialist. Next is the activation of the ‘sieving’ processing – this suggests (on the basis of like and unlike skills) that only gb, pl, jc and pa can be considered for multiskilling.

Table 9.1: Correlation coefficients for aggregate output and manpower

<table>
<thead>
<tr>
<th></th>
<th>total manpower employed</th>
<th>Total value of work done in millions by trade of firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>total manpower employed</td>
<td>1</td>
<td>-.938**</td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td></td>
<td>.000</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.000</td>
</tr>
<tr>
<td>Sum of Squares and</td>
<td>33276791.8</td>
<td>437570225.8</td>
</tr>
<tr>
<td>Cross-products</td>
<td>073444.896</td>
<td>14115168.54</td>
</tr>
<tr>
<td>Covariance</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Total value of work done | Pearson Correlation      | 1                                         |
| in millions by trade of firm | Sig. (2-tailed)          | .000                                      |
|                           | Sum of Squares and       | 6540132219                                |
|                           | Cross-products            | 210972007.1                               |
|                           | Covariance               | 32                                        |
|                           | N                        | 32                                        |

Table Caption
**.Correlation is significant at the 0.01 level (2-tailed).

34 This is a process which brings like skills together on the bases of phase of work, for examples, skills required during ground work activities are like skills and vice versa.
An optimisation model for evaluating the impact of multiskilling on construction output
An optimisation model for evaluating the impact of multiskilling on construction output

Table 9. 2: A giant matrix of participating variables (dependent and independent)

| Variable                          | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|-----------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1) total value of work done       | 1  |
| 2) general builders               | -0.941(*) | 1 |
| 3) building and civil engineering contractor | -0.909(*) | 0.935(**) | 1 |
| 4) civil engineering              | -0.383(*) | 0.919(*) | 0.924(**) | 1 |
| 5) plumbers                        | -0.844(*) | 0.909(*) | 0.971(*) | 0.892(*) | 0.961(*) | 1 |
| 6) joiners and carpenters          | -0.906(*) | 0.980(*) | 0.968(*) | 0.901(*) | 0.972(*) | 0.954(*) | 1 |
| 7) painting                        | -0.371(*) | 0.565(*) | 0.386(*) | 0.324 | 0.497(*) | 0.480(*) | 0.570(*) | 1 |
| 8) roofers                          | -0.911(*) | 0.961(*) | 0.987(*) | 0.909(*) | 0.982(*) | 0.963(*) | 0.984(*) | 0.460(**) | 1 |
| 9) plastering                      | -0.928(*) | -0.827(*) | -0.847(*) | -0.900(*) | -0.756(*) | -0.746(*) | -0.794(*) | -0.088 | -0.839(*) | 1 |
| 10) glaziers                       | -0.709(*) | 0.752(*) | 0.613(*) | 0.739(*) | 0.588(*) | 0.617(*) | 0.686(*) | 0.499(*) | 0.634(*) | -0.592(*) | 1 |
| 11) demolition contractor          | -0.863(*) | -0.505(*) | -0.379(*) | -0.628(*) | 0.264 | 0.360(*) | 0.406(*) | 0.216 | 0.337 | -0.510(*) | 0.689(*) | -0.225 | 0.427(*) | 1 |
| 12) scaffolding                    | -0.606(*) | 0.764(*) | 0.802(*) | -0.655(*) | -0.864(*) | -0.829(*) | -0.669(*) | -0.799(*) | -0.437(*) | 0.542(*) | -0.547(*) | 0.826(*) | 0.198 | 1 |
| 13) reinforced concrete specialist | -0.822(*) | -0.873(*) | -0.821(*) | -0.802(*) | -0.831(*) | -0.850(*) | -0.878(*) | -0.702(*) | -0.836(*) | -0.655(*) | -0.717(*) | -0.514(*) | 0.839(*) | 0.535(*) | 0.786(**) | 1 |
| 14) heating and ventilation engineer | -0.603(*) | -0.505(*) | -0.379(*) | -0.628(*) | 0.264 | 0.360(*) | 0.406(*) | 0.216 | 0.337 | -0.510(*) | 0.689(*) | -0.225 | 0.427(*) | 1 |
| 15) electrical constructors        | -0.720(*) | -0.821(*) | -0.927(*) | -0.762(*) | -0.967(*) | -0.942(*) | -0.898(*) | -0.402(*) | -0.927(*) | -0.652(*) | -0.465(*) | -0.820(*) | 0.912(*) | 0.074 | 0.851(*) | 0.705(*) | -0.211 | 1 |
| 16) asphalt and tar sprayers       | -0.814(*) | -0.890(*) | -0.955(*) | -0.854(*) | -0.945(*) | -0.938(*) | -0.917(*) | 0.349 | 0.944(*) | -0.754(*) | -0.576(*) | -0.860(*) | 0.945(*) | 0.292 | 0.814(*) | 0.730(*) | 0.022 | 0.939(**) | 1 |
| 17) plant hires                    | -0.427(*) | 0.283 | 0.124 | 0.445(*) | -0.016 | 0.079 | 0.143 | 0.021 | 0.112 | -0.419(*) | 0.531(*) | -0.007 | 0.179 | 0.856(*) | -0.146 | 0.314 | 1 |
| 18) flooring contractors           | -0.720(*) | -0.821(*) | -0.927(*) | -0.762(*) | -0.967(*) | -0.942(*) | -0.898(*) | -0.402(*) | -0.927(*) | -0.652(*) | -0.465(*) | -0.820(*) | 0.912(*) | 0.074 | 0.851(*) | 0.705(*) | -0.211 | 1 |
| 19) construction engineers         | -0.814(*) | -0.890(*) | -0.955(*) | -0.854(*) | -0.945(*) | -0.938(*) | -0.917(*) | 0.349 | 0.944(*) | -0.754(*) | -0.576(*) | -0.860(*) | 0.945(*) | 0.292 | 0.814(*) | 0.730(*) | 0.022 | 0.939(**) | 1 |
| 20) insulating specialist           | 0.091 | 0.045 | -0.21 | -0.216 | -0.061 | -0.106 | 0.09 | 0.176(*) | -0.106 | 0.345 | 0.079 | 0.600(*) | -0.161 | -0.017 | 0.177 | 0.313 | -0.066 | -0.374 | -0.394 | 1 |
| 21) suspended ceiling specialist    | 0.111 | 0.1 | -0.158 | -0.081 | -0.072 | -0.088 | 0.076 | 0.507(*) | -0.026 | 0.209 | 0.261 | 0.470(*) | -0.051 | -0.03 | 0.133 | 0.244 | 0.13 | -0.248 | -0.066 | 0.604(**) | 1 |
| 22) floor and wall tiling specialist | -0.584(*) | 0.720(*) | 0.525(*) | -0.539(*) | -0.589(*) | 0.531(*) | 0.712(*) | -0.653(*) | 0.601(*) | -0.336 | 0.681(*) | 0.003 | 0.569(*) | 0.671(*) | 0.417(*) | 0.748(*) | 0.700(*) | 0.307 | 0.435(*) | 0.552(*) | 0.603(**) | 1 |
| 23) miscellaneous                  | 0.416(*) | -0.31 | -0.171 | -0.419(*) | -0.048 | -0.147 | -0.212 | -0.265 | -0.123 | 0.241 | -0.494(*) | -0.05 | -0.255 | -0.804(*) | -0.113 | -0.349 | -0.713(*) | 0.152 | -0.062 | -0.103 | 0.105 | -0.600(*) | 1 |
9.4. A case for adopting regression as a better modelling tool

In modelling the supply and demand for construction and building services skills, the regression modelling method was chosen in favour of other possible analysis methods (for example, multivariate analysis of variance and artificial neural network) because of the variables and the aim of the modelling.

Multivariate analysis of variance was not suitable because it is designed to deal with circumstances in which there are several dependent variables and in a case such as this – single dependent and several independent variables – the general linear model is favoured to detect group difference on a single dependent variable (Bray and Maxwell, 1995).

Artificial neural networks (ANN) can capture functional forms automatically and allow the uncovering of hidden non-linear relationships between the variables, but its ‘black box’ characteristic, limits its explanatory capabilities (Sengupta, 1995; Goh, 1999), which are the most desired functions of this research. In addition, the relatively small number of cases involved and large numbers of input variables makes ANN inappropriate for evaluating the impact of multiskilling on construction output.
With multiple regression analysis being the most widely used multivariate technique to analyse the relationship between a single dependent variable and several independent variables (Kachigan, 1986; Makridakis and Wheelwright, 1987; Hair et al, 1995; Xiao, 2002b and 2003), the application of multiple regression can be classified into two broad categories of research problems: prediction and explanation. The former uses the independent variables whose values are known to predict the single dependent value while the latter provides a means of objectively assessing the degree and character of the relationship between the dependent and independent variables by forming the variate of independent variables (Xiao, 2002a).

However, in line with the main aim of this research (see Section 1.4) the explanation function multiple regression analysis is utilised. That is, through multiple regression analysis, the combination of factors influencing output can be identified, the relationships between dependent and independent variables established, and the relative importance of each combination of independent variables determined.

9.4.1. Model conceptualization

The conceptual model captured in equation 9.1 is a linear model developed to mimic the impact of a fluctuating manpower attribute(s) on construction output. Wherein a linear model is based upon the algebraic details of a straight line. This multiple linear regression
model consists of one dependent variable and many independent variables.

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n \]

Where \( Y = \) is aggregate output or the dependent variable; \( \beta_0 \) is the intercept (constant); \( X_{i-n} \) = manpower attributes or independent variables.

9.4.2. Assumptions of regression analysis

In drawing conclusions about the population based on a regression analysis carried out on a sample, several assumptions must be satisfied in order to allow for statistical validity of the finding Makridakis and Wheelwright (1989), which are as follows:

- linearity - that the mean values of the outcome variable for each increment of the predictor(s) lie along a straight line. The implication of modelling a non-linear relationship using a linear model is a limitation in the generalizability of the findings;
- evidence of homoscedasticity\(^{35}\) – constant variance of the regression error;
- that the residuals are independent (random) of one-another – autocorrelation; and

\(^{35}\) A uniform spread of points on both sides of the length of the line of best fit in the scatter plot of two associated variables.
multicollinearity – when two or more independent variables are highly correlated.

9.5. Principal component regression (PCR): the underlying concept

Principal component regression is a method for combating multicollinearity and results in estimation and/or predictions, which are better than that of an ordinary least square when used productively (Massy, 1965; Draper and Smith, 1981; Myers, 1986). With this method, the original $p$ climatic variables are transformed into a new set of orthogonal or uncorrelated variable called principal component of the correlation matrix. This transformation ranks the new orthogonal variables in order of their importance and the procedure then involves eliminating some of the principal components to effect a reduction of variance. After elimination of the least important principal components, a multiple regression analysis of the response variable against the reduced set of principal components is performed using ordinary least squares estimation. Because the principal components are orthogonal, they are pair-wise independent and hence ordinary least square becomes appropriate. Once the regression coefficient for the reduced set of orthogonal variables have been calculated, they are mathematically transformed into a new set of coefficients that correspond to the original or initial correlated set of variables. These
new coefficients are principal component estimators (Feledelegen et al, 2002).

9.5.1. Computational technique

Factor analysis is a data reduction technique, which attempts to identify underlying variables, or factors that explain the pattern of correlations within a set of observed variables. Factor analysis procedures offer a high degree of flexibility including factor extraction, rotation and computation. In particular, factor analysis was used in this part of study for computing factors scores for each of the 22 independent variables for subsequent analysis (principal component regression). The key of the analysis was to take P variables $X_1, X_2 \ldots X_p$ and find linear combinations of these to produce indices $Z_1, Z_2, \ldots Z_p$ that are uncorrelated, so they measure different dimensions of the data. The indices are such that, $Z_1$ displays the most variation, $Z_2$ the second most, and so on. Consequently, the principal component technique of extraction with rotated component matrix was performed using the Statistical Package for the Social Sciences (SPSS) on the 22 independent variables. The non-correlating variables were then computed automatically, that is, SPSS software was tasked with the responsibility of generating, tabulating and reassigning of new variable labels. Even though the new variables are orthogonal, the same magnitude of variance has been retained (Feledelegen et al, 2002).
9.6. Stepwise analysis

There are four approaches to deriving a principal component regression equation: Enter, Backward selection, Forward selection and Stepwise selection. Whilst the latter can be grouped under variable selection approaches the former (Enter) remains distinct. That is, the Enter approach requires all independent variables to be entered at a time, which in turn returns the standard multiple regressions excluding any independent variable. With the Forward selection approach, all relevant independent variables that are not in the equation are evaluated according to the selection criteria for entry and those eligible are entered one at a time until no more are eligible. The Backward selection approach begins with all of the relevant independent variables in the equation and proceeds by eliminating the least useful variables one after the other according to the selection criteria for removal until no more are eligible. In the stepwise multiple regression analysis, the independent variable not in the equation are evaluated for entry one at a time, and those already in the equation are evaluated for removal one after the other at a time being determined by statistical considerations until no independent variable is eligible for entry or removal (Norusis, 1995, Xiao, 2002 and Planet, 2005). For this analysis, the stepwise method of regression analysis was chosen because the study aims to evaluate the impact of multiskilling as a tentative redress for skills crisis. However, it is worth noting that the stepwise method in SPSS is the same as the forward method, except
that each time a predictor is added to the equation, a removal test is made of the least predictor (Field, 2000). Thus, following the successful disaggregating and identification of underlying variables – trend estimation - and in line with the concept of multiskilling, eleven exploratory models were developed based on the modelling framework presented in Table 9.3. In particular, this modelling framework should allow for the functional testing and systematic selection and combination of all participating variables (dependent and independent variables) whilst drawing on substantive theoretical inferences (Burleson, 1997 and Carley et al, 2003).

Consequently, eleven principal component regression models were developed based on the framework provided in Table 9.3. Table 9.4 is a summary of the developed exploratory models showing the values of $r$, $r^2$, Durbin-Watson, p-value and full regression equations.
An optimisation model for evaluating the impact of multiskilling on construction output

Table 9.3: A skill combination framework for traditional trades

<table>
<thead>
<tr>
<th>Traditional Trades (TT)</th>
<th>2 Step Skill Combination</th>
<th>3 Step Skill Combination</th>
<th>4 Step Skill Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Plumbers</td>
<td>1 &amp; 6 = A</td>
<td>1, 6, &amp; 7 = A</td>
<td>1, 6, 2 &amp; 4 = A</td>
</tr>
<tr>
<td>2) Joiners &amp; Carpenters</td>
<td>2 &amp; 4 = B</td>
<td>2, 4 &amp; 7 = B</td>
<td>2, 4, 3 &amp; 5 = B</td>
</tr>
<tr>
<td>3) Painting</td>
<td>3 &amp; 5 = C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) Roofers</td>
<td>2 &amp; 6 = D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) Plasterers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6) Heating &amp; Ventilation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) Electrical Contractors</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9.4: Summary of developed exploratory models

<table>
<thead>
<tr>
<th>Predator Variables</th>
<th>R</th>
<th>R²</th>
<th>P-value</th>
<th>D-Watson</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Un-factored TT</td>
<td>0.99</td>
<td>0.99</td>
<td>0.000</td>
<td>1.227</td>
<td>Y=1165.938 + (10.23 Heating&amp;Venti) + 14.52 Joiners&amp;Carpenters</td>
</tr>
<tr>
<td>2) Factored TT</td>
<td>0.96</td>
<td>0.92</td>
<td>0.000</td>
<td>0.208</td>
<td>Y=22819.731 + (12944.45 TT)</td>
</tr>
<tr>
<td>3) 2 Step Multiskill A</td>
<td>0.99</td>
<td>0.99</td>
<td>0.000</td>
<td>1.704</td>
<td>Y=747.550 + (15.66 Heating &amp; Venti)</td>
</tr>
<tr>
<td>4) 2 Step Multiskill B</td>
<td>0.97</td>
<td>0.94</td>
<td>0.000</td>
<td>0.169</td>
<td>Y=3548.792 + (40.068 Joiners &amp; Carpenters)</td>
</tr>
<tr>
<td>5) 2 Step Multiskill C</td>
<td>0.92</td>
<td>0.85</td>
<td>0.000</td>
<td>0.062</td>
<td>Y=3264.533 + (28.447 Painting)</td>
</tr>
<tr>
<td>6) 2 Step Multiskill D</td>
<td>0.99</td>
<td>0.99</td>
<td>0.000</td>
<td>1.727</td>
<td>Y=1165.938 + (10.23 Heating &amp; Venti) + (14.52 Joiners&amp;Carpenter)</td>
</tr>
<tr>
<td>7) 3 Step Multiskill A</td>
<td>0.99</td>
<td>0.99</td>
<td>0.000</td>
<td>1.704</td>
<td>Y=747.550 + (15.663 Heating &amp; Venti)</td>
</tr>
<tr>
<td>8) 3 Step Multiskill B</td>
<td>0.99</td>
<td>0.99</td>
<td>0.000</td>
<td>0.562</td>
<td>Y=-5360.506 + (31.47 Joiner&amp;Carpenter) + (31.44 Elec Contr) + (8.77 Roofers)</td>
</tr>
<tr>
<td>9) 4 Step Multiskill A</td>
<td>0.99</td>
<td>0.99</td>
<td>0.000</td>
<td>1.227</td>
<td>Y=1165.938 + (10.23 Heating &amp; Venti) + (14.52 Joiner&amp;Carpenter)</td>
</tr>
<tr>
<td>10) 4 Step Multiskill B</td>
<td>0.97</td>
<td>0.94</td>
<td>0.000</td>
<td>0.169</td>
<td>Y=3548.792 + (40.07 Joiner&amp;Carpenter)</td>
</tr>
<tr>
<td>11) Factor TT &amp; N_TT</td>
<td>0.99</td>
<td>0.99</td>
<td>0.000</td>
<td>0.967</td>
<td>Y=22819.73 + (12944.45 TT) + (3571.94 N_TT)</td>
</tr>
</tbody>
</table>

* TT = Traditional Trades; N_TT = None Traditional Trades
An optimisation model for evaluating the impact of multiskilling on construction output

As shown in Table 9.4, model 11 with predictor variables factored TT and $N_{TT}$ explained the most variance in output ($R^2 = 0.999$). This is because, all of the 23 manpower variables were considered; but in reality, it would be rarity for a tradesman to be skilled in all 23 trades.

Model 5 with predictor variables painting and plasterers explained the least variance in output ($R^2 = 0.857$). A finding that can be attributed to considerable poor mix (correlation not being significant) of skills. Also, Models 1, 6 and 9, regardless of their different combinations of predictor variables explained precisely the same amount of variance in output ($R^2 = 0.995$). Which is a clear indication that given the ideal mixes of skills the concept of multiskilling can only be beneficial.

However, the overall implication of these finding were that, the concept of multiskilling obeys the economic theory of diminishing returns. That is, as more units of a variable input are added (for example, labour) to fixed amount of construction output, which is the variance explained will first rise and then fall. Therefore, based on these analyses, the optimum number of manpower attributes is two – were two denotes dual skill labour strategy (see Section 4.8) -, a finding that is highly complementary of earlier studies (Gomar et al, 2002). Research involving optimisation models indicates that there is almost no marginal benefit to being semi-skilled (or greater) beyond three combinations of manpower attributes. More so, the negative coefficient derived in Model 8 is a clear indication that the wrong combination of skills can result in negative productivity. In addition to the eleven
An optimisation model for evaluating the impact of multiskilling on construction output

Models being statistically valid (by virtue of their R-squares and p-values only), conclusively, emphasis will be placed on Model 6 because it is arguably the most efficient and/or economical as suggested its Durbin-Watson value of 1.727.

9.7. Model validation

Validation is defined as an assessment of whether a tool or model is in congruence with reality (Brink, 2003). The process tries to ensure that the model represents the characteristics of the general population and not limited to the samples used in the estimation (Good and Hardin, 2003). That is, if the model is applied to a different sample and there is a severe drop is its predictive power, then the model clearly does not generalize (Field, 2000). It is advisable therefore to validate all regression models; and the act of assessing the accuracy of a model across different samples is known as cross-validation. There are two main methods of cross-validation: adjusted $R^2$ and data splitting.

The adjusted value indicates the loss of predictive power or shrinkage. Comparatively, the $R^2$ is an indication of how much of the variance in the dependent variable is accounted for by the regression model from the sample, while the adjusted $R^2$ is an indication of how much variance in the dependent variable would be accounted for if the model had been derived from the population from which the sample was taken. It should be noted that in SPSS, not only are the values of $R$ and $R^2$ calculated, but also an adjusted $R^2$. However, the Wherry’s equation

36 The SPSS derives the adjusted $R^2$ using Wherry’s equation.
An optimisation model for evaluating the impact of multiskilling on construction output

has been heavily criticized for its inability to indicate how well the regression model would predict an entirely different set of data sample. The version of $R^2$, which is symptomatic of how well the regression model cross-validates, uses the Stein’s formula (Stevens, 1992).

The approach obtained in the later (data splitting) involves randomly splitting the study data set in half, computing a regression equation on both halves of the data and then comparing the resulting model(s). However, in addition to the argument that researchers rarely have large enough data sets to perform this kind of analysis Field (2000); the effect\(^{37}\) of the evolving SIC on the modelling data (construction specific secondary data) is the reason why the study has favoured an adjusted $R^2$ method of validation, which uses the Stein’s formula shown in equation 9.2.

\[
\text{Adjusted } R^2 = 1 - \left( \frac{n - 1}{n - k - 1} \right) \left[ \frac{n - 2}{n - k - 2} \right] (1 - R^2) \quad \ldots \ldots
given \quad 208
\]

(Source: adapted from Field, 2000)

Where, $R^2$ is the unadjusted value, $n$ is the number of cases and $k$ is the number of predictors in the model.

\(^{37}\)That is, the set of data, which was reserved primarily for validation, was somewhat at variance with the test data. The implication of which is an inappropriate validation.
An optimisation model for evaluating the impact of multiskilling on construction output

In validating the optimisation model (Model 6), the values of $R^2$, n and k were computed into equation 9.2; and the resulting (calculated) adjusted $R^2$ is 0.993, which is an indication of a small drop (shrinkage) in the predictive power of the optimisation model. In other words, the result of the validation suggests that the optimisation model (Model 6) can be generalized\(^{38}\).

The key point therefore - from the test and validating models - is that, the concept of multiskilling has a realistic impact on UK skill crisis. Specifically, evidence suggests a workforce that is dual skilled (equipped with the right combination of skill trades) will help stimulate and possibly sustain productivity, retention, employability and increased earnings in most sectors experiencing skills crisis. In contrast, a singly skilled workforce amid declining numbers of entrant trainees and forecasted increase in economic growth (a peculiar region) will cause the sector to under achieve, which is enough evidence that the concept of multiskilling is fit for purpose.

9.8. Application of the model

The exploratory demand led models reported is based largely on the complex interaction of manpower attributes. The model was originally developed to be used by policy makers (Black Country LSC) but it is envisaged that regional and national LSC along side construction and

\(^{38}\) That is, the optimisation model is capable of accurately predicting the same outcome variable from the same set of predictors in a different group of people.
building services stakeholders (supply and demand sides) can also use the model with some slight modifications (mathematical scaling for example).

Ideally, the model should be implemented when funding agencies and policy makers like the LSC have enough information on the actual number of ‘actively’ disaggregated manpower (quantified demand). Early implementation of the model should enable funding agencies like the LSC appreciate redundancy identification when ‘buying’ trades and hence take corrective measure(s). The model should in its initial phase be implemented by person(s) that possess an understanding of manpower planning in relation with thinning supply and increasing demand for construction and building services skills.

The implication of having an optimised model in a demand led system can, however, only be beneficial to the construction sector and its stakeholders. For example: a reduction in skills mismatch should be anticipated because constructors will be better placed to inform training providers of their immediate manpower needs and other manpower related deficiencies which affect their businesses; sustained productivity because employees would have become proficient (a redress for skills gap); and an enhanced labour force through sustained employability.

9.9. Summary
An optimisation model for evaluating the impact of multiskilling on construction output

In order to satisfy clients more effectively as well as strengthen UK’s global competitiveness in today’s emerging markets, constructors need to be equipped with adequate but proficient supply of ‘needed’ manpower. Drawing on a chronological ‘suit’ of statistical analysis (trend analysis, time series de-seasoning and decomposition, correlation, principal component regression and factor analysis) which is an effective ‘tool kit’ to explicate the relationship of the participating dependent and independent variables, the exploratory models developed by means of linear regression analysis, can identify the underlying manpower variables, which influences construction and building services output and highlight possible ways of accommodating skills mismatch. In addressing research objective (iv) (see Section 1.4: p.8), this Chapter has developed a conceptual framework for implementing the concept of multiskilling, evaluated (using principal component regression) the impact of manpower attributes on construction output and validated the optimum relationship between manpower attributes and output. It is worth emphasizing that the decision to develop 11 and not 20 or more models rested on the provisions of the conceptual framework (see Table 9.3) whose derivation drew largely on inferences from the trend estimation and two tailed giant correlation matrix of all 23 variables (dependent and independent).

A limitation of the optimisation model, however, is that it cannot be applied concurrently on an ongoing project because the dependent variable is an outcome of a completed action. Simply put – the
An optimisation model for evaluating the impact of multiskilling on construction output

construction employee or tradesman, firstly, must be trained (multiskilled) in Heating and Ventilation and Joinery and Carpentry. On the contrary, while not yet perfect at least, the optimisation Model (Model 6) can be used as a tentative framework for addressing skills crisis having been tested and validated. A virtual reality concept is required to further validate the functions of the Model – that is, empirically quantify the developed model’s impact on a construction project. Apart from this, it would be safe to argue that the optimisation model through ‘careful’ application would enable constructor and training providers assess the combining prowess of one or more skills as demonstrated in Chapter 9. With this model the manpower planner and/or industry stakeholder can better justify which skills should take funding priority in training programmes.
CHAPTER 10

SKILL SUPPLY AND DEMAND STRATEGIES

10.1. Introduction

This chapter discusses paramount issues within this research as signposted by the surveys and Steering Committee discussions of the preceding chapters. Although yet to fully imbibe the concept of multiskilling, industry and government initiatives to re-balance construction skills supply and demand include the Considerate Constructors Scheme; National Construction Week; Construction Skills Certificate Schemes, Investors in People initiative; New Deal employment scheme; CITB equal opportunities initiative and CITB training recruitment strategy. Other response strategies to the construction skill shortage include: women and ethnic minorities and adult trainees as alternative sources of construction labour; new technologies and construction techniques; greater use of prefabrication; automating construction sites; greater economic stability; a return to direct employment; greater labour only subcontractors involvement in operative training and long term industry wide training plans. See literature review Chapter (Section 3.4) for details.
These initiatives have made some difference to some of the issues that plagued the industry and, by a combination of factors; it should be safe to state that the industry is currently enjoying better perception from the public. However, structural issues abound and attempt is made in this Chapter to discuss them and move towards developing a set of supply and demand side response strategies – research objective (v) (see Section 1.4).

10.2. Development of a transparent Black Country construction data management system

The usefulness of ‘data’ and the economic strength of construction and building services industry were addressed in preceding chapters. Data paucity in the construction and building services industry is seemingly becoming a regular feature of all sub regional reports (see Bridging the Gap West Midlands, 2001; Bridging the Gap East Midlands, 2003; Construction Nottinghamshire; Leitch, 2006 and CIOB, 2006) and some of the other sectors whether engineering, automotive, packaging energy or aerospace. The Black Country is not an exemption to this data problem. It would seem that there is resistance at every level to get engaged with collection and analysis of ‘real’ construction data. Construction models are sometimes conflicting and rarely holistic. Supply and Demand data are most poorly collected and engaged with.

This emanating trend necessitates the development of a ‘Transparent Black Country Data Management System (TBCDMS)’, which can only
be beneficial to all. Some of the likely characteristics of the Transparent Black Country Data Management System model, will be discussed in the following sub Sections 10.2.1 (census profile of Black Country training providers and constructors; census of current and possible future projects on a time line; and disaggregation of future projects into skill sets) and 10.2.2 (current and future number of trainees; recruitment trends; types of training available, demand trend; and achievement and employability measures. See Olomolaiye et al (2005) for more details on TBCDMS.
10.2.1. Demand side

Since the recession of the early nineties, the instability in the supply of construction and building services skills has resulted in skills shortage, skills mismatch, high unemployment and claimant rate, migration and immigration. As a contemporary redress, stakeholders will need to draw on the already developed exploratory demand-led skill acquisition models. Evidence to date, confirms the use of a variety of response strategies and models which have lacked theoretic foundations and have had very little successes (Mackenzie et al., 2000; Keskola, 2000; Keskola, 2003; Courtney, 2004). The developed demand led models were hinged on the concept of multiskilling and based on their characteristics that has accepted the inferences of the prescribed demand led optimisation model limiting multiskilling to a minimum of two and a maximum of three combination of skills. However, indications would suggest that with careful disentangling\textsuperscript{39}, it is clearly possible to match construction skills demand to supply in a more scientific way than current subjective guesstimates.

Theoretically, future construction demand could be quantifiable for the 10 – year physical plans produced by each Local Authority with comparison made between ‘plan’ and ‘actual’, by checking the building approval and control processes. Attempts were made to explore these data avenues during this research and the investigator was encouraged by the willingness of the four boroughs to work with available data.

\textsuperscript{39} Inferences from trend estimations, variable correlation and factor analysis
Also the Black Country Investment was able to supply details of proposed projects in the sub-region. Capturing the ‘private sector’ initiated projects was more difficult. The investigator’s engagement with these tentative data indicates a highly dynamic and volatile construction demand scene, which would need to be further, analysed before realistic prediction can be achieved – a limitation of the model developed in the preceding chapter.

10.2.2. Supply side

The key word is ‘transparency’ i.e. the information system would be accessible to all and sundry. Construction stakeholders, be they new recruits or investors, would be in a position to harness information on any matter relating to current and future status of the construction and building services sector.

With this information system in place, policy makers would be better informed and ensuing strategies will fully reflect the peculiarities of the sub-region. With such a system, the Black Country Learning Skills Council would be better positioned to make funding decisions based on future projects and skill trend. It would however be impossible to improve physical regeneration programmes if the training providers and constructors are unaware of the characteristics of existing workforce.
Overall, a Transparent Black Country Data Management System – such as this, founded on the driving logic of a Decision Support System (DSS) (Yang, 2001) - if properly developed, help identify and simulate current and future market fluctuation in periods of surplus and scarcity. This would represent an ideal prerequisite for modelling the ‘long term’ supply of and demand for construction and building services skills in the Black Country. Such a system could be developed as an extension to the Black Country Observatory. Table 10.1 and Figure 10.1 and 10.2 are expressions of the Black Country Construction Data Management System.
Skills supply and demand strategies

Figure 10.1: A schematic view of the model's metadata showing the development of a construction specific database from micro/macro information (Source: adapted from Olomolaiye et al, 2005)

Figure 10.2: A two-tier transparent Black Country data management system
Table 10.1: A specimen report that may be generated by the transparent Black Country data management system
(Source: adapted from Olomolaiye et al, 2005)

<table>
<thead>
<tr>
<th>S/N</th>
<th>Project Location</th>
<th>Duration</th>
<th>Required skill</th>
<th>Project phase</th>
<th>Future works</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High Way Walsall</td>
<td>6 yrs</td>
<td>Equipment operators, Surveyors, Civil &amp; Mechanical Engineers.</td>
<td>Site clearing</td>
<td>Repairs &amp; Maintenance, Curtain Walling.</td>
</tr>
<tr>
<td>2</td>
<td>New Built Commerci al W’ton 4 yrs</td>
<td>Multi-skilling, New trades and 10% traditional trades</td>
<td>Procurement</td>
<td>Painting and decorating</td>
<td></td>
</tr>
</tbody>
</table>

10.3. Recruitment and retention

The construction and building services industry has its own unique characteristic in relation to products and services. Most of its output are designed to specification and geographically widely distributed. However, the physical nature of products in association with the construction sector, its diversity and often complexity, as well as the very wide geographical spread and fluctuations in demand make it difficult to capture both current and future skills requirements (primary data).

The survey of Black Country constructors and training providers indicate that there are hard to fill vacancies especially in the newer trades, skills mismatch and a male dominated industry. A recent survey by Tarmac claims that of the 1600 people surveyed across the UK, 75
per cent said they would not consider a career in the construction and building services industry with the chief reasons being:
Skills supply and demand strategies

- industry is too physically challenging;
- a lack of job security;
- pay too low;
- lack of prestige.

This confirms an age long and established fact of an industry, which is unattractive to young and bright trainees, which is further exacerbated in an economically and socially challenged sub-region like the Black Country. It is, in itself, enough justification for inward focused research. That is in addition to the current recruitment campaign drive on image redemption (CITB, 2005); research efforts and agenda’s should fully embrace theories and/or the concept of multiskilling which is focused on maximizing existing pools of labour.
With fewer skilled labourers in the workforce to recruit from, the current policies of ‘recruitment campaigns’ will not suffice. The Construction and Building Services industry in the Black Country is attracting new trainees but failing to convert them to rectitude employees. A demand-led strategy founded on ‘Retention’ and Training Quality Enhancement will enable the sub-region meet future demand and possibly aspire to attracting trainees from other regions. Figure 10.3 illustrates a proposed strategy with a ‘total’ 4-way approach to construction skill retention for the sub-region. There are 4 possible pools to address recruitment:

1. ‘traditional trades’ - new entrant teenagers;
2. ‘new construction trades’ - new entrant teenagers;
3. new entrants – from the declining manufacturing industry; and
4. new entrants – older people from peripheral industries.

The first two planks are easily understood while the third builds on the post-industrial peculiarity of the sub-region by aiming at re-training those who have become unemployed with the decline of manufacturing in the sub-region. Training providers would need to offer courses based on current and future demand for unemployed manufacturing workers along side the recruitment of teenagers. Most attention seems to be directed at 14 – 19 year olds but researchers need to complement this with a pulling strategy for ex-manufacturing workers to be engaged in construction and building services. In order to do this the age and
experience profile of trainees would need to be captured through the Transparent Black Country Data Management System and analysed. Curriculum can then be developed for accelerated construction and building services skill acquisition programme for those with transferable skills and experience. Figure 10.3 is a diagrammatic expression of the proposed retention strategy.

The 14-19 strategy is being vigorously engaged by training providers and this should continue with clear targets for engagement by each major provider in the sub-region. Engaging and not monitoring has been the bane of new policies and initiatives. It should be possible to quantify results of colleges’ engagement with 14-19 agenda within 2-3 years i.e. when the current 14 year olds finish school at 16, by how many actually progress to construction trades. The LSC and funding agencies should endeavour to capture this most essential data for the purpose of policy effectiveness.

The higher unemployment rate in the sub-region has largely been created by the declining manufacturing industry. With so much attention on regenerating the region by the Government and private sector there are opportunities for converting the existing pool of ‘manufacturing’ unemployed skills to ‘new construction’ – skilled tradesmen. These skilled factory operatives needn’t be trained to become the ‘traditional tradesmen (e.g. bricklayers) but converted into ‘new construction’ tradesmen with specialism in ‘prefabrication’, ‘cladding’ and as near to their previous trades as possible. This research confirms that traditional trades do not provide for advances in
Skills supply and demand strategies

construction technologies. These new technologies are founded in manufacturing principles and practices which most ex-manufacturing workers already have.

Retention remains the most challenging issue to increasing the pool of skilled workers in the Black Country. This research confirms that most retention difficulties are at level 1 with better figures at levels 3 and 4. With the observation that more are becoming ‘cow-boy’ builders with damaging impact on the reputation of the industry, industry stakeholders now need to engage with this problem with some focus. Firstly, retention should be recognised as an unbearable cost to the LSC and the taxpayer. It should therefore be measured and attacked as a waste and as a measure of the difficulty of student experience. The investigator did not find much evidence of rigor in the selection of new entrants to the trades. This is due to increased demand for plumbers, and colleges to demand some GCSE in Maths and English. An investigation of Trainee Retention on Construction courses is therefore long overdue. It is pertinent to ask the reasons why students leave and why they fail to achieve. It is convenient to say that trainees do not have basic skills but is this so?

Anecdotal evidence will suggest that trainees who latter become ‘cowboy’ builders are not able to complete the construction courses they enrolled for because, they are lured into labour markets by the offer of soaring wages during periods of skills crisis (see Section 4.3 for details of the New Keynesian theory as applied to the supply of, and...
Skills supply and demand strategies

demand for construction and building services skills). This is compounded by the pitiable quality of entrant trainees who do not have the basic skills.

10.4 Apprenticeship scheme

It is evident from the analysis of Black Country constructors survey data that the sub-region is dominated by SMEs, which is not any different from what is obtained regionally or nationally. Consequently, it is difficult for trainees to secure apprenticeship placements. In turn, this has hindered trainees from achieving construction and building services qualifications (NVQs and others).

Black Country constructors have identified skills mismatch and the acquisition of ‘zero’ skills by trainees at the time of seeking apprenticeship placement as the main reasons for not engaging apprentices. The perception however, is that, for sustainability, the Black Country Learning Skills Council, Local Government authorities, ‘Big’ construction companies like Carillion and other reasonably sized organizations need to be proactive in getting apprentices through the system. A likely strategy for consolidating Black Country apprenticeship scheme would be the introduction of a Conversion Apprenticeship Scheme in addition to the Traditional Apprenticeship Schemes. The new scheme will secure apprenticeship placements for the unemployed individuals with high level of manufacturing skill.
On the whole, the industry’s workforce is presently aged, very skilled but not multiskilled (Ejohwomu et al, 2006b; Ejohwomu et al, 2007b). An immediate consolidation of the Black Country apprenticeship scheme with the help of the aforementioned will facilitate the harnessing of multiskilled tradesmen for the aging workforce.

10.5 Variable quality of training

The construction and building services dependence on effective delivery of quality of training cannot be over emphasized. However, there is evidence to suggest variable quality of training amongst resident training providers. For optimum supply of skills in the sub-region there is need to address the issue of variable quality of training. Some of the likely ways of addressing these issues may include a:

- dedicated Construction training college in the Black Country;
- better development of existing courses to meet needs of employers and employees;
- develop a league table of results for each provider to help achieve transparency in relation to quality and a guide for employees;
- greater emphasis upon C&G courses which are seen by a number of stakeholders as providing a more comprehensive system of learning than NVQ which is seen as varying from college to college;
- more input from Government to support colleges;
Skills supply and demand strategies

- need for colleges to be more flexible towards construction industry particularly in relation to supporting block release of staff for training purposes;
- colleges seen as needing to concentrate more on construction and engineering and less on ‘media type’ courses;
- courses seen as needing to appeal to young people (‘they need to have a job at the end of it’);
- pre-apprenticeship courses possibly running alongside 6th form at school level; and
- financial help to fund (partly or wholly) apprenticeships and other forms of training (particularly for smaller firms).

10.6. Collaboration between providers and employers

Evidence thus far suggests that both sides of the industry (training providers and constructors) are not working together as they should. Hence, apprenticeship trainees rarely secure placement with employers because in most cases there is a mismatch between skills supplied and skills required (CITB, 2003; Ejohwomu et al, 2006a). The peculiarity of the industry entails that apprenticeship trainees require some form of work-based learning if they are to completely acquire basic and competent skills (certified qualification e.g. NVQ). An ‘active’ Black Country Construction and Building Services Forum, consisting of major and minor stakeholders, constructors, training providers, Learning Skills Council, research groups, local authorities etc is a likely
way of eliminating current and future skills mismatch. The Steering Committee that directed this research programme could become the foundation for such improving collaboration between training providers and constructors, and could be developed as the Black Country Construction Forum. The COVE and the Black Country LSC have expressed the desire for this to happen.

The Sector Skills Agreement (SSA) “offers significantly increased employer commitment to training and skills through their supply chains”. It is heartening to note in SSA documentation that employers have agreed to provide £120 million for the collective training activity with three key elements of:

1. improving Business Performance;
2. quantifying Existing Workforce; and
3. recruiting Qualified New Entrants.

The challenge is interpreting the SSA at the sub-regional level, which a Black Country Construction Forum would facilitate.

More recent CITB reports purport that “the landscape of education and training has been affected by a series of regular and significant policy eruptions affecting academic and vocational curricula, the relationship between and status of education and training providers, funding levels and targets, the role and responsibilities of teachers, trainers and guidance workers, and the choice and future of routes available to
school leavers” (CITB, 2003 and 2005). Within the confines of this study particular reference has been made to the Construction Skills Certificate Scheme (CSCS) cards and the inclusion of non-binding clauses in new contract documents. The Construction and Building Services Industry in general (nationally) should be made to identify with the industries failure on issues relating to policy formulation and enforcement. More importantly there should be improved collaboration in the CITB policy formulation at sub regional levels in order to improve its contact with SME constructors that will truly reflect the yearnings and aspirations of the industry. Black Country constructors need to actively engage with CITB policy formulation process and learn the act of imbibing the sub regional peculiarities during policy and policy related formulation. Reason being that the ‘proven’ existence of varying peculiarities amongst different regions and sub regions arguably makes the formulation of a one fits all policy inappropriate.

10.7. Plethora of qualifications

The term ‘qualification’ within the context of this review can simply be defined as a document which states very clearly a person’s level of competence in relation to a type of work / service. The popularity of any qualification within the labour market confines makes it an indirect recruitment tool for potential and qualified trainees. Bearing this in mind it should be mandatory for the construction and building services sector to issue and recognize a unique qualification rather then foster unknowingly a plethora of qualifications.
Emanating evidence from recent literature confirms the existence of a plethora of qualifications in the construction and building services sector. Thus, the industry is very confused about what the various qualifications represent. Changing NVQ level 3 to level 2 for some trades has left everyone confused about what the level really means. However, it might be strategically beneficial to all stakeholders if the BC Learning Skills Council would strive to immediately circulate an interpretation of the various levels qualifications to constructors pending the introduction of a more general but unique qualification for all sectors of the industry. It is heartening to note that vocational qualifications would be harmonised and would hope that Construction one of the ‘specialized’ vocational sectors.

10.8. An equilibrium training model for funding traditional and new skills

The continued ‘disequilibrium’ in the supply and demand for manpower (particularly trades in this regard) has sky rocketed wages, increased skills mismatch and impeded proficiency in most trades; the implication of which has been heightened client dissatisfaction, unemployment and decline in productivity. Constructors and training providers (including industry stakeholders) should have a common strategy or framework to sustain available pools of labour. Such a strategy and/or framework underpinned the development of several demand led models discussed earlier. The models provide a realistic approach to the current
structure (supply and not demand) of manpower provision. That is, constructors make do with what skills they are supplied. By identifying the ‘redundancy’ in the skill supply, theoretically, an optimisation model therefore assumes a labour utilization strategy involving economic policy decisions and manpower proficiency. In line with the objective of imbibing and sustaining the equilibrium supply and demand for construction and building services skills, Figure 10.4 presents a conceptualized equilibrium-training model.

![Figure 10.4: An equilibrium training model](Source: adapted from Ejohwomu et al, 2007c)

Technological advancement in the field of computing and software engineering has been phenomenal, a field which is believed to have revolutionized human and industrial activities globally. The construction industry to day speaks of curtain walling, modular building / offsite construction, and partial / complete automation – an approach
Skills supply and demand strategies

which embraces ‘new’ skills. However, in order to ensure a sustainable supply of and demand for ‘Traditional’ and ‘New’ skills the Equilibrium Training Model (Figure 10.4) prescribes equilibrium investment in both ‘Traditional’ and ‘New’ skills i.e. the new training model introduces a framework which would accommodate the industry’s demand for new and traditional skills.
10.9. Summary

Discussed within this Chapter are paramount supply and demand side strategies in the context of industry and government initiatives to rebalance construction skills and demand. In particular, the Chapter has addressed the research objective – to suggest ways of imbibing and sustaining the equilibrium supply and demand for construction and building services skills.

Next is a conclusion of the research findings as well as recommendations of realistic but contemporary programmes to facilitate future planning directions in relation to the supply and demand for construction and building services skills.
CHAPTER 11

CONCLUSIONS, RECOMMENDATIONS AND FURTHER RESEARCH

11.1. Introduction

The Learning Skills Council (LSC) as a knowledge management organisation and a key benefactor of this research is rightly preoccupied with seeking information that would enable policy formulation at national, regional and sub regional levels. The LSC has fully engaged with the issue of skills crisis in the Construction and Building Services industry. Together with other construction stakeholders such as the Construction Industry Council (CIC) and the Construction Industry Training Board (CITB), the LSC continues to play a most significant role in addressing the issue of construction skills. This chapter is a conclusive summary of the research findings as well as recommendations of realistic but contemporary programmes to facilitate future manpower planning directions in relation to the supply and demand for construction and building service skills in the Black Country.

11.2. Conclusions
The main conclusion of the research is this; that the concept of multiskilling - a manpower utilization strategy – is a tentative redress for skills crisis in the UK construction and building services sector.

In satisfying the objectives of the research, the study conducted an extensive review of the literature on manpower planning and its impact on the supply and demand for UK construction and building services skills, and established a theoretical framework for optimising existing pools labour. The study also derived an exploratory procedure for gathering and evaluating manpower planning data.

In answering the research question on the link between skills crisis and a failure of manpower planning, the study has distinguished between manpower planning and modelling, developed and analysed a conceptual framework of manpower planning variable, discussed UK employment models and identified new and existing gaps of the CITB skills planning model as a backdrop for evaluating the phenomenon of construction and buildings services skills crisis.

Evidence suggests the UK skills crisis is a profound failure of construction specific manpower planning. In addition, existing redress strategies are mostly deficient in theory and ‘inward focused’ research amid forecasted increase in demand and decrease in entrant

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40 The objective of maximising existing pools of labour by identifying and/or eliminating redundancy; this is achieved whilst drawing on the concept of multiskilling.
trainees. This study has therefore embraced the argument of inward focussed research by maximising existing pools of labour whilst drawing on the concept of multiskilling. Attempts by construction researchers in other countries and non-construction inclined researchers have led to consensus interpretations of the benefits of imbibing the aforementioned research approach as a tentative redress for skills crisis and its attributes.

The research questions on a micro insight into construction trades and a macro insight into UK manpower variables were examined using both cross sectional\(^ {41}\) and longitudinal\(^ {42}\) data. Both of which revealed significant information on the influence of economic ‘booms’ and ‘burst’, technological and social changes and environmental changes on past and current supply and demand for construction manpower.

Overall, the supply side investigation revealed evidence of specialism and conflict of opinion between training providers and constructors, for example, with regards to current provision of skilled workers; adequacy of training provision; utilisation of training provision; and current skills provided and future demands. Whilst the demand findings purported: significant quality and quantity issues; the role of colleges were recognized but standardization is an issue; and on the issue of meeting future business challenges, respondents ranked

\(^ {41}\) Investigation through action research and semi structured interviews with supply and demand side target groups.
\(^ {42}\) Trend estimation analysis of aggregated and disaggregated forms dependent and independent variables.
multiskilling highest as against contract management, need for more training support for the industry as a whole, specialist trades and management courses.

In answering the research question on how to quantitatively assess the impact of multiskilling on UK construction skills crisis, a set of longitudinal data (secondary data) was harnessed from the 2003 edition of Construction Annual Statistics. This data was deseasonalised and disaggregated to allow for a robust trend analysis. The correlation matrix table of the dependent and twenty-two independent variables, which revealed traces of multicollinearity was managed using principal component regression (PCR). Eleven demand led exploratory models were developed. The ensuing optimisation model confirms the expected beneficial impact of implementing the concept of multiskilling (Burleson, 1997). In other words, the concept of multiskilling should be enshrined in UK construction manpower planning framework as tentative redress of skills crisis and sustainable construction. A finding that is complimentary of Leitch (2006) concluding argument, that except existing manpower supply paradigms revamped the UK construction sector, it will emerge as a ‘victim’ of its own ‘success’.

Following the validation of the optimisation model, while not yet perfect, it can be used as a tentative framework for bench marking ‘inward focused’ research in construction specific manpower planning. In further demonstration of the validity of the findings of the research,
contemporary skills supply and demand strategies were discussed; more importantly, a set of supply and demand side recommendations\textsuperscript{43} are outlined in Section 11.3 as a direct response to the research question on the efficiency of construction specific manpower planning in the Black Country and other UK sub region.

11.3. Recommendations

The central importance of equilibrium supply and demand for construction specific manpower to a peculiar sub region in the UK such as the Black Country has been the main catalyst for the investigation of this research. Based on the findings above, an ‘inward focussed’ supply driven and demand side recommendations are suggested with a view to improving and sustaining future manpower planning directions in relation to the equilibrium supply and demand for construction trades.

11.3.1. The demand-side recommendations

1. The cross sectional survey of Construction and Building Services companies in the sub-region reveal the expected dominance of SMEs. More significantly, however, is the presence of national and world-class construction companies e.g. Carillion, Alfred McAlpine, Interserve and many others. The sub-region is also home to the regional headquarters of a number of large to medium sized

\textsuperscript{43}It is pertinent to note that the Black Country LSC is currently implementing some of the recommendations outlined in Section 11.3.
construction and building services companies. This cluster, which is largely historical, need to be more recognised and the competitive edge maintained. Although not quantifiable at the moment, it is reasonable to suggest that the sub-region may be supporting the national construction infrastructure more than recognised; as such a cluster must surely be producing skill workers transferred elsewhere to work and even support the nation’s competitive edge in construction abroad. The LSC should work with the Advantages West Midlands (AWM) on this.

2. The SME construction and Building Services companies in the sub-region are non-specialist with most engaged in at least two areas of activity (a clear evidence of intuitive multiskilling) and they all spread these activities across all the boroughs of the sub-region fairly evenly. There is no significant difference in their ranking of the importance of each borough to their activities and it could safely be concluded that the contractors regard the sub-region holistically which should be recognised by the LSC and other stakeholders managing the supply and demand for construction and building services skill in the sub-region. Whatever activity is happening in one borough would most likely happen in the others be it housing regeneration or major developments. This wholeness of the sub-region needs to be engaged by the LSC.
3. Of most significance in construction and building services terms are the significant but fine balance between the 2012 Olympic and Regeneration projects by both the Public and Private sectors. Various PFI hospital projects are being concluded or proposed in the sub region, Housing Refurbishment Programmes, and Private sector led major development projects e.g. Brierly Hill, and numerous Housing Projects coupled with DIY would suggest the sub-region as one of the leading construction sites of the next five years. With politically sensitive and socially responsive local authorities, armed with the sustainable community agendas demanding that their communities be up-skilled by contractors through a section 106 and or other agreements, contractors cannot but take training seriously.

4. Black Country contractors are therefore very active and seriously engaged with, and concerned about, training local people for the emerging opportunities in the sub-region given the counter balance in demand for manpower. The cross sectional survey also reveals that 58 per cent of them have someone in charge of training at director level and that they consider the main challenges to their business to be how to get enough skilled operatives to do the job and engaging with training providers meaningfully to obtain these in sufficient quantities. The other challenges are coping with legislative changes and planning process difficulties. 19 per cent of Contractors in the sub-region are concerned that they might not be able to achieve their business aims because of skill shortages. Skill
shortage in the Black Country is real and will hamper this strong business cluster if not seriously addressed using the prescribed inward focused research approach.

5. Quantity not Quality of operatives seems the dominant issue in this skill crisis. Black Country contractors simply don’t have tradesmen in sufficient numbers but consider those trained by local colleges as OK or good enough for their jobs. The trades for which training is provided in the sub-region have been identified as Wood Trades, Trowel Trades, Heating and Ventilation respectively. There is little or no training for the following trades: Curtain Walling, Carpet, Hard and Soft Flooring including Tiling, Prefabrication and Cladding. Surely, there is a clear lack of training in these new and emerging trades in the sub-region and a new funding equilibrium model is prescribed in Section 10.8.

6. The construction and building services stakeholders seem to agree that the sub-region needs 20 per cent more operatives in the next five years (see Table 7.6 for a trade by trade prediction). This is contrary to the LSC employment model predictions of a falling requirement. The demand led prediction for total value of work done informs a better gaze at the future than the predictions of a roundly criticized employment prediction model.
7. Repairs and Maintenance, which is an encapsulation of BCDW, IFF and BCW rather than new build, is predicted for a more vigorous growth in the sub-region in the long-term. This will probably be driven by Social Housing Refurbishment and earlier discussed regeneration activities in the region; including the need for 70,000+ new houses over the next 20 years as identified by the Black Country study. More importantly, the skill-set required for a large scale programme of Repairs and Maintenance works across the sub-region is ‘multiskill’ – the research notes that the need to implement this concept of multiskilling remains a matter of some urgency in this era of heightened industrial and global competition. The dynamics of the repairs and maintenance labour market is now better understood and the LSC should now investigate and seek to purchase multiskilled training if it is to address any projected shortages.

11.3.2. The supply side recommendation

1. Available statistics confirm the Black Country as a peculiar sub-region with significant social and economic performance challenges. Academic performance at GCSE is below national and regional averages (ECOTEC, 2003; CITB, 2001 and 2003; Ejohwomu et al, 2006a). Progression to Further and Higher Education is also lower and unemployment level is higher than national averages. A concerted attempt is being made by various arms of Government to
Conclusion and recommendations

redress these issues but most important to this research is that social and economic performance invariably impact on construction skill supply more significantly than being acknowledged in the existing literature. This linkage needs to be recognised in devising strategies such as informed focused researches for effective construction skill supply and demand profile for the sub-region. The quality and quantity of trainees to the construction skill supply chain is directly affected by educational performance at primary and secondary school levels and the Black Country LSC cannot but be more vigorously engaged in primary and secondary school agendas than other sub-regions in the West Midlands. While the Black Country LSC is already engaged with the 14-19 agenda it should proactively steer the agenda to improve the supply of quality trainees to the Black Country Construction Industry. Needing immediate engagement are the proposed establishment of Construction Specialist Schools, Construction GCSE and Exemplar linkages between Schools and Construction Training Providers.

2. The review of existing literature and practice coupled with evidence from micro and macro analysis of construction trades suggest an unstructured and uncoordinated approach to the failure of construction manpower planning. The LSC buys training from training providers based on credit units without evaluating planning inventory, which is little informed by demand technological, social, economic and political changes. It would seem that the existing
funding mechanisms simply seek to maintain the status quo rather than being led by what the industry really needs to get its job done. Training providers can therefore be paid for units of training in a trade, which the industry no longer needs. A good example would be the number of training credits being expended on ‘plumbing’ far above the number required by the industry. Indications are that Black Country Colleges have not really done well with this funding model leading to pressures on limited resources in traditional trades. The Black Country LSC and other stakeholders should be ready to reflect on its current training procurement model, embrace a demand responsive model and the prescribed equilibrium funding model.

3. The aforementioned structural problems lead us to the question of developing a transparent framework for managing skill supply and demand data in the sub-region. Recognising that the LSC is bedding down its data management processes after inheriting somewhat chaotic processes from its predecessors, current Supply and Demand data are confusing and inconsistent or conflicting. A robust skill supply data management system need to be developed to inform funding decisions. Refer to section 10.2 for fuller details. An independent but contractor led construction data management unit for the Black Country is urgently required (may be part of the Black Country Observatory).
4. The Black Country LSC must necessarily make performance data underpin the training contract awarding process to the providers. With less than 37 per cent retention on construction skills nationally the study would suggest ‘retention’ as an essential performance measure. It would also suggest ‘employability’ and ‘achievement’ (i.e. pass rate) as some of the variables that should determine what training contract is awarded to any particular provider. A transparent performance league table (for each trade) could then be developed based on these performance measures and published annually in the Local and Regional Media as the LSC Black Country Construction League table. Transparency should lead to improved standards as the retention and employability problems become of concern to all.

5. A quantitative review of the supply-side skills market indicates some critical mass patterns in the training provision for construction, and building service trades in the Black Country. Most Black Country Colleges offer training in the main traditional construction and building service trades. With enrolment numbers the only indication of success, the study could have been able to recommend some form of specialisation by the colleges, however performance measures first need to be developed and communicated so that any future advice to providers to specialise is based on ability to deliver sufficient quantity and quality to meet sub-regional needs. The sub-region can be, and has a claim to being, a national champion for
construction and building services trades and should start now to lead the campaign for a multiskilled workforce.

6. With all colleges focussed on supplying traditional skills, and with a clear mismatch between supply and demand (Steering Committee stakeholders are quite concerned that what they need is not what is being provided - mismatch), and clear indications of demand for ‘new trades’ of Cladding etc, the Black Country LSC would need to start thinking seriously on the purchase of training for ‘new trades’ either from existing centres or set up a ‘new trades’ centre. ‘ New trades’ reflect advances in design and technology and with Egan’s ‘Rethinking Construction’ philosophy gaining ground there are likely to be further developments, which will require serious thoughts and strategic engagement. The location of such a centre may be tortuous but it is most important that the centre is in the Black Country to redress the serious region-wide perception of a preponderance of low-level skills in the sub-region. Concentrating ‘new and multiskilling trades’ in a single centre will have limited implications on existing training provision as they have little or no provision for them. A case for such a centre would tap into the concept of inward focussed research, re-thinking construction and prefabrication agendas of the ODPM and the Black Country must claim this ground quickly.
7. While training for ‘new trades’ must be provided, the Black Country LSC needs to do this with some caution as they are mostly for the new build sector of the construction market. Refurbishment and Maintenance would continue to be aligned with the traditional trades. If ‘new trades’ are to reflect ‘new build’ aspirations, cognisance must be taken of the cyclical demand dynamics. The LSC may have to support this ‘new trades’ platform for some time to ensure stability.

8. Skill supply to the rather buoyant Repair and Maintenance (R & M) sector is not structured. A skill needs survey to reinforce the concept of multiskilled trades for this sector of the industry is suggested. And the proposed standard of qualification required for the (R & M) sector needs to be hinged on the concept of multiskilling and speculatively provided for. Stakeholders must stop assuming that just anyone can refurbish and maintain the property stock. Given the growth of the repairs and maintenance market, which forms 47 per cent of total construction output in the West Midlands CITB (2003), it is time that a structured approach (effective manpower planning) to skill supply to the sector is determined and the Black Country LSC should lead this.

9. Research to date indicates variable quality and standards of achievement by training providers in the sub-region (see Chapter 6). On this basis participants were asked what in their opinion could be
Conclusion and recommendations

done in order to improve and standardise training offered by Colleges in the Black Country in the construction and building services sector, their suggestions being summarised into themes below:

a. a dedicated training college in the Black Country focused upon the construction industry;

b. better development of existing courses to meet needs of employers and employees;

c. greater emphasis upon C&G courses which are seen by a number as providing a more comprehensive system of learning than NVQ which is seen as varying from college to college;

d. more input from Government to specifically or directly support construction and building services courses in colleges;

e. a need for colleges to be more flexible towards construction industry particularly in relation to supporting block release of staff for training purposes;

f. colleges seen as needing to concentrate more on construction and engineering and less on ‘media type’ programmes;

g. courses seen as needing to appeal to young people (‘they need to have a job at the end of it’);

h. develop a league table of results for each provider to help achieve transparency in relation to quality and a guide for employees;

i. pre-apprenticeship courses possibly running alongside 6th form at school level;
j. financial help to fund (partly or wholly) apprenticeships and other forms of training (particularly for smaller firms); and

k. benchmarking quality across the entire region should be a serious consideration for the immediate future.

10. The Black Country LSC (or LSC nationally) may need to rethink Vocational Learning and Training. There are obvious tensions between demand and supply sides of the skill equation. Training centres often complain that they cannot place students, while contractors often complain that training providers are not responsive to their needs for modern skills set for advance design and technologies. The Black Country LSC must endeavour to bridge this divide with what this study would term a Partnership for Training Programme (PTP). The core of this is the separation of Vocational Learning from Vocational Training and the acceptance by the two sides that Learning and Training must be complimentary. In practice, the Colleges would concentrate on ‘Learning’ which the industry later complements with ‘Training’ leading to some trade specialisation with contractors as the ‘finishing school’. The study thinks a 2 + 2 years skill training for construction is possible. In Figure 11.1, the first two years would concentrate on vocational learning at college at the end of which the successful trainee is multi-skilled to, say, NVQ level 2 and the following two years the trainee specialises through a Work Based training in one of the trades to level 3. Such a streamlining of roles will form the
foundation of the PTP. The plethora of qualifications would need some streamlining and the PTP may be introduced through the Centre Of Vocational Excellence (COVE) in the first instance.
The Black Country LSC must recognise structural and staffing issues in Training Providing Institutions. At the root of the skill supply problem are staffing related issue. There is a dire shortage of trainers coupled with unattractive remuneration, a comparatively high work load for teaching staff, adoption of technology supported learning which does not necessarily translate to effective skill acquisition, variable qualification of trainers and variable qualifications and industrial exposure of trainers and an unclear staff development and retention policies. The study would recommend a research programme around ‘What Black Country Construction Trainers are really Like’ to fully understand this most important resource in skill supply. The Black Country LSC must recognise structural and staffing issues in Training Providing Institutions. At the root of the skill supply problem are staffing related issue. There is a dire shortage of trainers coupled with unattractive remuneration, a comparatively high work load for teaching staff, adoption of technology supported learning which does not necessarily translate to effective skill acquisition, variable qualification of trainers and variable qualifications and industrial exposure of trainers and an unclear staff development and retention policies. The study would recommend a research programme around ‘What Black Country Construction Trainers are really Like’ to fully understand this most important resource in skill supply. The Black Country LSC must recognise structural and staffing issues in Training Providing Institutions. At the root of the skill supply problem are staffing related issue. There is a dire shortage of trainers coupled with unattractive remuneration, a comparatively high work load for teaching staff, adoption of technology supported learning which does not necessarily translate to effective skill acquisition, variable qualification of trainers and variable qualifications and industrial exposure of trainers and an unclear staff development and retention policies. The study would recommend a research programme around ‘What Black Country Construction Trainers are really Like’ to fully understand this most important resource in skill supply. The Black Country LSC must recognise structural and staffing issues in Training Providing Institutions. At the root of the skill supply problem are staffing related issue. There is a dire shortage of trainers coupled with unattractive remuneration, a comparatively high work load for teaching staff, adoption of technology supported learning which does not necessarily translate to effective skill acquisition, variable qualification of trainers and variable qualifications and industrial exposure of trainers and an unclear staff development and retention policies. The study would recommend a research programme around ‘What Black Country Construction Trainers are really Like’ to fully understand this most important resource in skill supply. The Black Country LSC must recognise structural and staffing issues in Training Providing Institutions. At the root of the skill supply problem are staffing related issue. There is a dire shortage of trainers coupled with unattractive remuneration, a comparatively high work load for teaching staff, adoption of technology supported learning which does not necessarily translate to effective skill acquisition, variable qualification of trainers and variable qualifications and industrial exposure of trainers and an unclear staff development and retention policies. The study would recommend a research programme around ‘What Black Country Construction Trainers are really Like’ to fully understand this most important resource in skill supply. The Black Country LSC must recognise structural and staffing issues in Training Providing Institutions. At the root of the skill supply problem are staffing related issue. There is a dire shortage of trainers coupled with unattractive remuneration, a comparatively high work load for teaching staff, adoption of technology supported learning which does not necessarily translate to effective skill acquisition, variable qualification of trainers and variable qualifications and industrial exposure of trainers and an unclear staff development and retention policies. The study would recommend a research programme around ‘What Black Country Construction Trainers are really Like’ to fully understand this most important resource in skill supply.
Country LSC may need to seriously consider setting up a Motivation Package to support Construction Trainers and recognise their pivotal role in construction skill supply chain.

With 31 active stakeholders now in the Research Steering Committee representing both demand and supply sides, there is opportunity to build on this forum as the basis for identifying future directions i.e. a kind of ‘think tank’ for Construction Skills in the Black Country.

11.4. Further Research

The nature of the investigation (an ‘action research’ basis with enthusiastic engagement from members of the Steering Committee) reported in this research is such that it would not have been possible to delve into evaluating the concept of multiskilling as mitigating ingredient for skills crisis without first exploring the micro and macro status of UK construction and building services skills. The set objectives were achieved using this largely quantitative approach. Having adopted the concept of multiskilling in Chapter 4 the later part of the research (Chapter 9) evaluated the impact of combining manpower attributes on construction output in the sector. These variables can be studied in more details if the data were non-longitudinal and tied to disaggregated manpower activities of the immediate labour market. That is by analysing a cross-sectional data it is possible to better quantify demand for construction and building
services activities; and more importantly be able to inform training providers (supply side) on the quantified sustainability of current and emerging skills.

Another potential area of research from this work is the quantitative evaluation of the productive impact of adopting the concept of multiskilling. This will involve the virtual simulation of correlated variables using a virtual case study approach. Although this will involve harnessing the knowledge of experts in the area of virtual reality, a virtual system of this nature will either support or compliment quantified benefits of implementing the concept of multiskilling. Such a programme will significantly reduce the cost and time required for testing project-based impact of implementing the conceptual framework developed in Table 9.3. What is important, is that, stakeholders particularly constructors and training providers would be able to use such systems for mimicking and simulating construction and building services activities.

The development of a Smart Transparent Data Management System (STDMS) with a meta data architecture that links directly with UK manpower planning inventory is another fruitful area for further investigation. As its outcome, the STDMS will automatically trigger reports on skill training and demand deficiencies as well as flag redundant skills (if any).
REFERENCES


ALI, (2004). Adult Learning Inspectorate: Publication Scheme, available at:  
[www.ali.gov.uk/extra/Publication%20scheme.pdf](http://www.ali.gov.uk/extra/Publication%20scheme.pdf)


References


References


references


CITB - Construction Industry Training Board (2001) Bridging the Gap: An Analysis of Construction and Training Needs in the West Midlands. *Available at: www.citb.co.uk*

Construction Industry Training Board (2002). CITB Skills Foresight Report. King’s Lynn: CITB. *Available at: www.citb.co.uk*


*Available at:*  

[www.citb.co.uk](http://www.citb.co.uk)


CSCS (2003). Welcome to CSCS. Available at: [www.cscs.uk.com/](http://www.cscs.uk.com/)


References


References


References


Meen, G. (2002). Incorporating LFS data into the CITB employment model, [www.citb.co.uk](http://www.citb.co.uk)


Oshobayo, A.O. and Fellows, R.F. (1989). Investigation of leading indicators for the prediction of UK contractors’ workloads (total
new orders), Research Paper, Construction Study Unit, University of Bath.


APPENDIX 1

Name and address of Invitee

Date

Dear ..... 

Modelling the Supply and Demand for Construction and Building Services Skills in the Black Country

As part of an ongoing PhD research in the School of Engineering and the Built Environment, University of Wolverhampton, we are conducting a review of construction skills demand and supply in the Black Country and we really need your assistance in formulating the direction for this research.

As a first step we have organised a breakfast meeting of the main stakeholders in the Black Country to fully brainstorm the research parameters for Friday 25th of March at the Wolverhampton Science Park. Please see programme as attached. We would appreciate your attendance and would ask that you complete the tear-off slip below and return using the prepaid envelope provided or fax to us at 01902-322743.

We look forward to seeing you at what should prove to be a most defining event for construction in the Black Country.

Yours sincerely

Obuks Ejohwomu
Primary Investigator

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RESEARCH INSTITUTE OF ADVANCED TECHNOLOGY (RiATec)

Modelling the Supply and Demand for Construction and Building Services Skills in the Black Country

Name: 

Address: 

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Appendix

Telephone:
Controls

I will be attending the breakfast seminar  YES / NO
I would like to be in the Steering Committee for this project  YES / NO
Please return this slip in the prepaid envelope or fax to 01902-322743 for the attention of Obuks Ejohwomu.
## APPENDIX 2

List of Steering Committee Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
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</thead>
<tbody>
<tr>
<td>Cheryl Hall</td>
<td>LINFORD GROUP LIMITED</td>
</tr>
<tr>
<td>P.M. Wills</td>
<td>Director of Technology</td>
</tr>
<tr>
<td>Kevin Stevens</td>
<td>Dudley College of Technology</td>
</tr>
<tr>
<td>John Lapworth</td>
<td>Walsall College of Arts and Technology</td>
</tr>
<tr>
<td>Lucy Yorke</td>
<td>CITB - Construction Skills</td>
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<tr>
<td>Julie Boardman</td>
<td>Black Country Investment</td>
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<tr>
<td>Terence John Buxton</td>
<td>Mowlem Building</td>
</tr>
<tr>
<td>Patrick Hibbin</td>
<td>Rose Garth</td>
</tr>
<tr>
<td>Maxine Douglas</td>
<td>Rebuild</td>
</tr>
<tr>
<td>Alan Darby</td>
<td>Holbrow Brookes &amp; Partners</td>
</tr>
<tr>
<td>Peter Dobson</td>
<td>CHN Group</td>
</tr>
<tr>
<td>Scott Upton</td>
<td>Director of Corporate Development</td>
</tr>
<tr>
<td>Terry Reynolds</td>
<td>Managing Director</td>
</tr>
<tr>
<td>Heather Knight</td>
<td>Stourbridge College</td>
</tr>
<tr>
<td>Ian Martins</td>
<td>Black Country LSC</td>
</tr>
<tr>
<td>Sara Holyhead</td>
<td>Learning and Skills Council</td>
</tr>
<tr>
<td>Bozena Benton</td>
<td>Robinson Low Francis</td>
</tr>
<tr>
<td>Bill Munn</td>
<td>Best Practice Director</td>
</tr>
<tr>
<td>Neville Clements</td>
<td>Adonis Construction Limited</td>
</tr>
<tr>
<td>Karen Riley</td>
<td>City of Wolverhampton College</td>
</tr>
<tr>
<td>Paul Smith</td>
<td>Sandwell MBC</td>
</tr>
<tr>
<td>Kevin Dowd</td>
<td>Summitskills</td>
</tr>
<tr>
<td>Terry Cowley</td>
<td>Dudley Metropolitan Borough Council</td>
</tr>
<tr>
<td>Charles Parsons</td>
<td>Walsall Metropolitan Borough Council</td>
</tr>
<tr>
<td></td>
<td>Wolverhampton Metropolitan Borough Council</td>
</tr>
<tr>
<td>Peter Martin</td>
<td>Council</td>
</tr>
<tr>
<td>Graham Downs</td>
<td>Sandwell Metropolitan Borough Council</td>
</tr>
<tr>
<td>Amanda Sergeant</td>
<td>CITB - Construction Skills</td>
</tr>
<tr>
<td>Mark Lavender</td>
<td>Dudley Metropolitan Borough Council</td>
</tr>
<tr>
<td>Tony Robinson</td>
<td>Future Skills Sandwell (Sandwell MBC)</td>
</tr>
<tr>
<td>Dave King</td>
<td>Centre Manager</td>
</tr>
<tr>
<td>Ken Vinall</td>
<td>Walsall College of Arts and Technology</td>
</tr>
</tbody>
</table>
APPENDIX 3

Supply Side Questionnaire

This study is being undertaken by the School of Engineering and the Built Environment (SEBE) of the University of Wolverhampton on behalf of the Black Country Learning and Skills Council.

This questionnaire is intended to collect information from construction training providers on the Black Country’s current and future Supply for Construction and Building Services skills, the following questions having three chief objectives:

1. discover labour market needs for current and future construction projects;
2. outline a strategy for predicting demand for construction and building services in an ongoing basis;
3. highlight innovative ways for addressing the issues.

For the purpose of the research, the term Construction and Building Services Skills will encompass Foundation Modern Apprenticeships (FMAs), Advanced Modern Apprenticeships (AMAs), National Vocational Qualifications (NVQs), and Entry to Employment (e2e).

Everything you tell us will remain completely private and confidential.

Please tick a box wherever you see this sign ✔ or write in your answer wherever you see this sign ☐

SECTION 1: ABOUT YOUR INSTITUTION

Q1. What is the name of your construction training providing institution? ☐

Q2. How many workers does your construction / building services department employ? ☐

Q3. Please specify number of staff in your construction department. ☐

Q4. Please indicate in order of importance of the following boroughs/regions in relation to where your students / trainees come from. (6 being the most important and 1 being the least important to you):

Dudley ☐ Wolverhampton ☐
<table>
<thead>
<tr>
<th>Location</th>
<th>Region</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandwell</td>
<td>Rest of West Midlands</td>
<td>Rest of Great Britain</td>
</tr>
<tr>
<td>Walsall</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q5. With regards to your student population in the last academic year (2004/2005), please indicate enrolment level by construction trades in the tables below.

<table>
<thead>
<tr>
<th>Construction Trades</th>
<th>Level 1 / Entry</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male Female</td>
<td>Male Female</td>
<td>Male Female</td>
</tr>
<tr>
<td>Multi-skilling / General</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brickmasons, blockmasons, and stonemasons</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cement masons, concrete finishers, segmental pavers, and terrazzo skilled workers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground Engineering Works</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpet, floor, and tile installers and finishers</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Construction and equipment operators</td>
<td></td>
<td></td>
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<tr>
<td>Wood works, Joinery, and Carpentry</td>
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<tr>
<td>Painting and Decorating</td>
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<tr>
<td>Structural and reinforcing iron metal</td>
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<td>Curtain Walling</td>
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<tr>
<td>Prefabrication of Building Components Works</td>
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<tr>
<td>Heating and Ventilation</td>
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<tr>
<td>Mechanical Services and Plumbing</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Others (please specify)</td>
<td></td>
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</tr>
</tbody>
</table>
Appendix

Q5a. Please indicate the primary sources of funding for your trainees.

<table>
<thead>
<tr>
<th></th>
<th>Level 1 / Entry</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LSC</td>
<td>Non-LSC</td>
<td>LSC</td>
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<tr>
<td>Electrical</td>
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<tr>
<td>Wood</td>
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<tr>
<td>Trowel</td>
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<tr>
<td>Plumbing</td>
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<tr>
<td>Plastering</td>
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<tr>
<td>Painting and decoration</td>
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<tr>
<td>Gas</td>
<td></td>
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<td></td>
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<tr>
<td>General building</td>
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<tr>
<td>Others</td>
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</tbody>
</table>

Q6. Using the stipulated age profile, please indicate your trainees’ achievement rate by age for the last academic year.

<table>
<thead>
<tr>
<th>Years</th>
<th>% Pass / Completion</th>
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<tbody>
<tr>
<td>16 – 18</td>
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<tr>
<td>19 – 24</td>
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<tr>
<td>25 – 45</td>
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<tr>
<td>46 – 65</td>
<td></td>
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<tr>
<td>All ages</td>
<td></td>
</tr>
</tbody>
</table>
Q6a. Please state your trainee’s level of achievement for the following courses.

<table>
<thead>
<tr>
<th>Multi-skilling / General</th>
<th>% Pass Rate at Level 1</th>
<th>% Pass Rate at Level 2</th>
<th>% Pass Rate at Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brickmasons, blockmasons, and stonemasons</td>
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<td></td>
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<tr>
<td>Cement masons, concrete finishers, segmental pavers, and terrazzo skilled workers</td>
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<tr>
<td>Others (please specify)</td>
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</tbody>
</table>
Q7. Please specify the number of trainees you enrolled per mode of attendance for the last academic year.

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Full-time, full year</td>
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<tr>
<td>Full-time, part year</td>
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<tr>
<td>Part-time, other (including E-learning)</td>
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<tr>
<td>Part-time open</td>
<td></td>
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<tr>
<td>Part-time distance</td>
<td></td>
<td></td>
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<tr>
<td>Part-time evening</td>
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</tbody>
</table>

**SECTION 2: WORK BASED LEARNING (WBL)**

Q8. Please indicate the total number of WBL students you had in the following categories for the last academic year.

<table>
<thead>
<tr>
<th></th>
<th>Total No</th>
<th>% White</th>
<th>% Male</th>
<th>Dominant Age Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMA</td>
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<tr>
<td>FMA</td>
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<tr>
<td>NVQ</td>
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<tr>
<td>e2e</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
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</tbody>
</table>
Q9. Please indicate the destination of your trainees on completion of training programme.

<table>
<thead>
<tr>
<th>Multi-skilling / General</th>
<th>Total No Employed</th>
<th>Total No Unemployed</th>
<th>Total No Self Employed</th>
<th>Total No Learning</th>
<th>No Records</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brickmasons, blockmasons, and stonemasons</td>
<td></td>
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</tr>
<tr>
<td>Cement masons, concrete finishers, segmental pavers, and terrazzo skilled workers</td>
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<tr>
<td>Wood works, Joinery, and Carpentry</td>
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<td>Structural and reinforcing iron metal</td>
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<td>Curtain Walling</td>
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<tr>
<td>Mechanical Services and Plumbing</td>
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<tr>
<td>Others (please specify)</td>
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<td></td>
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</tr>
</tbody>
</table>
Q10. Listed below are factors that have had a negative impact / hindered effective training provision in construction and building services in general. Please indicate the extent to which you agree / disagree which each statement: 

<table>
<thead>
<tr>
<th>Factor</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Don’t Know</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of Government Incentive to training</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Workload / unpredictability</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>No time to train as you have too much pressure from work</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Government Policies</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Lack of support or slow response by Colleges</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Finishing rate – lack of good applicants to train</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Lack of interest in our type of work by the young</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Sub-contracting</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Work placement</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Assessors</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Others (please specify)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
SECTION 3: ASSESSMENT OF FACILITIES

Q11. How will you rate your training facilities (workshops, tools, etc) in relation to the following trades? ✓

<table>
<thead>
<tr>
<th>Trade</th>
<th>Excellent</th>
<th>OK</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-skilling /General</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brickmasons, blockmasons, and stonemasons</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cement masons, concrete finishers, segmental pavers, and terrazzo skilled works</td>
<td></td>
<td></td>
<td></td>
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<tr>
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<tr>
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</tr>
<tr>
<td>Wood works, Joinery, &amp; Carpentry</td>
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<tr>
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<tr>
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<tr>
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<tr>
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<tr>
<td>Heating &amp; Ventilation</td>
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<tr>
<td>Mechanical Services and Plumbing</td>
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<tr>
<td>Others (please specify)</td>
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</tbody>
</table>

Q12. What are the major obstacles to staff recruitment and retention for your construction and building services trades? 🔴
Q13. How will you rate your staff strength (in terms of quality and number) for the following trades?

<table>
<thead>
<tr>
<th>Trade</th>
<th>Excellent</th>
<th>OK</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-skilling /General</td>
<td></td>
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<td>Brickmasons, blockmasons, and stonemasons</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trade</th>
<th>Age</th>
<th>Gender</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td></td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>Wood</td>
<td></td>
<td>Male</td>
<td></td>
</tr>
<tr>
<td>Trowel</td>
<td></td>
<td>Male</td>
<td></td>
</tr>
<tr>
<td>Plumbing</td>
<td></td>
<td>Male</td>
<td></td>
</tr>
<tr>
<td>Plastering</td>
<td></td>
<td>Male</td>
<td></td>
</tr>
<tr>
<td>Painting and decoration</td>
<td></td>
<td>Male</td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td></td>
<td>Male</td>
<td></td>
</tr>
<tr>
<td>General building</td>
<td></td>
<td>Male</td>
<td></td>
</tr>
</tbody>
</table>

Appendix
Q15. Please comment on your staff developmental strategies in relation to demand for current and future skills. You could include comments on any particular issues you have about supply provision, what changes you would like to see made to the existing structure amongst others.

AND FINALLY....... 

What more do you think could be done to improve the supply of training for construction and building services skills in the Black Country:

THANK YOU FOR COMPLETING THE QUESTIONNAIRE, YOUR HELP IS GREATLY APPRECIATED
Please return it in the prepaid envelope
APPENDIX 4
Demand Side Questionnaire

Demand For Skills in Construction and Building Services in the Black Country
This study is being undertaken by the School of Engineering and the Built Environment (SEBE) of the University of Wolverhampton on behalf of the Black Country Learning and Skills Council.

This questionnaire is intended to collect information from employers on the Black Country’s current and future Demand for Construction and Building Services skills, the following questions having two chief objectives:

1. to identify demand for construction skills, education and training by constructors in the Black Country and;
2. to identify future and current needs of employers and explore innovative ways of addressing the issue.

For the purpose of the research, the term Construction and Building Services Skills will encompass Foundation Modern Apprenticeships (FMAs), Advanced Modern Apprenticeships (AMAs), National Vocational Qualifications (NVQs), and Entry to Employment (e2e).

Everything you tell us will remain completely private and confidential.

Please tick a box wherever you see this sign ✔ or write in your answer wherever you see this sign ✗

SECTION 1: ABOUT YOUR BUSINESS

Q1. What is the name of your company?  

Q2. What is your full postcode?  

Q3. How many workers does your organisation employ?  

Q4. Please rank in order (from most to least) how important each of the following boroughs/regions are for you in relation to your activities in terms of trade/services/the products you provide (6 being the most important and 1 being the least important to you):


Appendix

Q5. Which types of project have you been involved in during the past year from the list below?

- [ ] New Built Commercial
- [ ] Civil Engineering and Related Works
- [ ] New Built Housing
- [ ] Steel Fabrication and Installation
- [ ] Housing Refurbishment and Maintenance
- [ ] Others (please specify)
  1. 
  2. 
  3. 

Q6. How many employees have been working in each of the following project categories in the past year?

- [ ] New Built Commercial
- [ ] Civil Engineering and Related Works
- [ ] New Built Housing
- [ ] Steel Fabrication and Installation
- [ ] Housing Refurbishment and Maintenance
- [ ] Others (please specify)
  1. 
  2. 
  3. 

SECTION 2: WHAT IS THE KEY CHALLENGE(S) AFFECTING YOUR BUSINESS AT THE MOMENT?

Q7. Briefly describe the main challenge that is affecting your business at the moment.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

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Appendix

Q8. Do you think you have the necessary skills to successfully address this challenge?



Yes ☐ No ☐ Don’t Know ☐

Q9. If NO, what skills do you think you need?

Q10. If you have or wanted to obtain advice to help you solve this challenge, who would you contact?

SECTION 3: CHARACTERISTICS OF YOUR WORKFORCE

Q11. Please complete the box below with a number to show the characteristics which are relevant for your employees showing how many you have of each:

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Employed</th>
<th>Skilled</th>
<th>Ethnic Minority</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 and Below</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between 19 – 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between 26 – 35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between 36 – 45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between 46 – 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q12. How many of your workers have the following type of qualifications:
Q13. The Construction Skills Certificate Scheme (CSCS) was launched in the mid-1990’s in an attempt to provide formal recognition for people’s skills. How many of your employees hold this award?

________________________

Q14. If applicable, what are the difficulties you have experienced in securing CSCS for your workers

Q15. How many staff do you employ with disabilities? Please specify what they do.

________________________

Q16. How many staff do you employ from each of the following ethnic backgrounds?

<table>
<thead>
<tr>
<th>Black African</th>
<th>Indian</th>
<th>Chinese</th>
<th>White other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Caribbean</td>
<td>Pakistani</td>
<td>Mixed</td>
<td>Other</td>
</tr>
<tr>
<td>Black Other</td>
<td>Bangladeshi</td>
<td>White European</td>
<td></td>
</tr>
</tbody>
</table>
Q17. Please describe what strategies you use in promoting under-represented groups in your organisation:

SECTION 4: RECRUITMENT AND TRAINING

Q18. From the list below please tick which training providers you use or have used in the last 2 years.

- [ ] Wolverhampton City College
- [ ] Dudley College
- [ ] Sandwell College
- [ ] Stourbridge College
- [ ] Walsall College
- [ ] University of Wolverhampton
- [ ] CITB
- [ ] Voluntary Sector
- Other (please specify):

Q19. How many of your 16-25 year old employees are on an apprenticeship scheme?

___
Q20. Please describe the apprenticeship scheme and comment on its effectiveness in ensuring that your organisation has a skilled workforce. You could include comments on any particular issues you have about the apprenticeship scheme, what changes you would like to see made to the existing apprenticeship scheme and what incentives would make you take on more apprentices.
Q21. Listed below are different construction and building services trades. Of all those receiving training in your organisation in the past year, please indicate the number of staff trained in each trade and please tick the effectiveness of the training received.

<table>
<thead>
<tr>
<th>Number of your staff trained by your organisation</th>
<th>How effective was the training received</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very poor quality</td>
</tr>
<tr>
<td>OCN Construction</td>
<td></td>
</tr>
<tr>
<td>Trowel Trades, Plastering and Brickwork</td>
<td></td>
</tr>
<tr>
<td>Wool Trades, Carpentry and Joinery</td>
<td></td>
</tr>
<tr>
<td>Painting and Decorating</td>
<td></td>
</tr>
<tr>
<td>Mechanical Services and Plumbing</td>
<td></td>
</tr>
<tr>
<td>Ground Engineering</td>
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<tr>
<td>Heating and Ventilation</td>
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<tr>
<td>Curtain Walling</td>
<td></td>
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<tr>
<td>Carpet, Floor and Tile Installers</td>
<td></td>
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<tr>
<td>Construction and Equipment Operators</td>
<td></td>
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<tr>
<td>Structural and Reinforcing Iron Metal</td>
<td></td>
</tr>
<tr>
<td>Prefabrication and Building Components</td>
<td></td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
</tr>
</tbody>
</table>

Q22. Have you conducted a training needs assessment in your company in the last 2 years?  

Yes ☐  No ☐

Q23. How much did your business spend on training and development last year?  Please estimate if you do not know exactly.  

£______________
Q24. Does your company have any of the following:

a. A formal training and development plan that is linked to the business plan
b. Someone responsible for training and development **at** Director level
c. Someone responsible for training and development **below** Director level
d. A training and development budget
e. A regular review process for evaluating the effectiveness of training and development
f. A regular and formal appraisal system covering all staff

Q25. Please indicate how easy it is to recruit sufficiently skilled workers in the following trades.

<table>
<thead>
<tr>
<th>Trade</th>
<th>Very Difficult</th>
<th>Difficult</th>
<th>OK</th>
<th>Easy</th>
<th>Very Easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-skilling /General</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brickmasons, blockmasons, and stonemasons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cement masons, concrete finishers, segmental pavers, and terrazzo skilled works</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Ground Engineering Works</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Carpet, floor, and tile installers and finishers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction and equipment operators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood works, Joinery, &amp; Carpentry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Painting and Decorating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural and reinforcing iron metal</td>
<td></td>
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<tr>
<td>Curtain Walling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modular Building Works</td>
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<tr>
<td>Cladding System Works</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Prefabrication of Building Components Works</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Heating &amp; Ventilation</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Mechanical Services and Plumbing</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others (please specify)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Q26. Listed below are factors that have had a negative impact / hindered effective training for construction and building services. Please indicate the extent to which you agree / disagree which each statement:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Don’t Know</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of Government Incentive to training</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Workload / unpredictability</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>No time to train as you have too much pressure from work</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Government Policies</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Lack of support or slow response by Colleges</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Finishing rate – lack of good applicants to train</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Lack of interest in our type of work by the young</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Sub-contracting</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Work placement</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Assessors</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Others (please specify)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Others (please specify)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

SECTION 5: FUTURE CONSIDERATIONS

Q27. Please indicate in percentage terms whether in your view you think the number of employees in those trades listed below which you specialise in will increase (+) or decrease (-) in the next five (5) years:

PLEASE BE SPECULATIVE IN YOUR JUDGEMENT
Q28. From the table below choosing those areas that you specialise in please indicate in percentage terms by what margin you think the number of future projects you undertake will increase (+) or decrease (-) in the next five (5) years: 

**PLEASE BE SPECULATIVE IN YOUR JUDGEMENT**

<table>
<thead>
<tr>
<th>All Trades</th>
<th>+ - % Change In Employment</th>
<th>All Trades</th>
<th>+ - % Change In Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCN Construction</td>
<td></td>
<td>Trowel Trades, Plastering &amp; Brickwork</td>
<td></td>
</tr>
<tr>
<td>Ground Engineering</td>
<td></td>
<td>Wool Trades, Carpentry &amp; Joinery</td>
<td></td>
</tr>
<tr>
<td>Heating &amp; Ventilation</td>
<td></td>
<td>Painting &amp; Decorating</td>
<td></td>
</tr>
<tr>
<td>Curtain Walling</td>
<td></td>
<td>Mechanical services &amp; Plumbing</td>
<td></td>
</tr>
<tr>
<td>Carpet, Floor &amp; Tile Installers</td>
<td></td>
<td>Construction &amp; Equipment Operators</td>
<td></td>
</tr>
<tr>
<td>Structural and Reinforcing Iron Metal</td>
<td></td>
<td>Prefabrication &amp; Building Components</td>
<td></td>
</tr>
<tr>
<td>Others (please specify)</td>
<td></td>
<td>Others (please specify)</td>
<td></td>
</tr>
</tbody>
</table>

## Type of future project

<table>
<thead>
<tr>
<th>Type of future project</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>New built (housing)</td>
<td></td>
</tr>
<tr>
<td>New built (commercial)</td>
<td></td>
</tr>
<tr>
<td>Repairs &amp; Maintenance (DIY)</td>
<td></td>
</tr>
<tr>
<td>Brickmasons, blockmasons, and stonemasons</td>
<td></td>
</tr>
<tr>
<td>Cement masons, concrete finishers, segmental pavers, and terrazzo skilled works</td>
<td></td>
</tr>
<tr>
<td>Ground Engineering Works</td>
<td></td>
</tr>
<tr>
<td>Carpet, floor, and tile installers and finishers</td>
<td></td>
</tr>
<tr>
<td>Construction and equipment operators</td>
<td></td>
</tr>
<tr>
<td>Wood works, Joinery, &amp; Carpentry</td>
<td></td>
</tr>
<tr>
<td>Painting and Decorating</td>
<td></td>
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<tr>
<td>Structural and reinforcing iron metal</td>
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<tr>
<td>Curtain Walling</td>
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</tr>
<tr>
<td>Modular Building Works</td>
<td></td>
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<tr>
<td>Cladding System Works</td>
<td></td>
</tr>
<tr>
<td>Prefabrication of Building Components</td>
<td></td>
</tr>
<tr>
<td>Heating &amp; Ventilation</td>
<td></td>
</tr>
<tr>
<td>Mechanical Services and Plumbing</td>
<td></td>
</tr>
<tr>
<td>Others (please specify)</td>
<td></td>
</tr>
</tbody>
</table>
Q29. Please select those skills below which you think will be relevant to your organisation in order to undertake future projects over the next five (5) years and please tick a box ✓ to reflect how difficult it will be in your judgement in acquiring those skills:

<table>
<thead>
<tr>
<th>Skill</th>
<th>Very Difficult</th>
<th>Difficult</th>
<th>OK</th>
<th>Easy</th>
<th>Very Easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-skilling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brickmasons, blockmasons, and stonemasons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cement masons, concrete finishers, segmental pavers, and terrazzo skilled works</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground Engineering Works</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Carpet, floor, and tile installers and finishers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction and equipment operators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood works, Joinery, &amp; Carpentry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Painting and Decorating</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Structural and reinforcing iron metal</td>
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</tr>
<tr>
<td>Curtain Walling</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Modular Building Works</td>
<td></td>
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<tr>
<td>Cladding System Works</td>
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<tr>
<td>Prefabrication of Building Components Works</td>
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</tr>
<tr>
<td>Heating &amp; Ventilation</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Services and Plumbing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others (please specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Q30. For the skills identified above what qualification(s) would your organisation need?
Q31. Colleges in the Black Country provide training for most trades in the construction and building services sector. Standards in provision / facilities and cost in delivery of provision vary between colleges – some colleges may find it expensive to run similar types of training course offered by another college. Hence in the future some rationalization may be necessary. In your opinion what more could be done in order to improve and standardise training offered by Colleges in the Black Country in the construction and building services sector?

<table>
<thead>
<tr>
<th>Qualification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>OCN</td>
<td></td>
</tr>
<tr>
<td>ONC</td>
<td></td>
</tr>
<tr>
<td>Higher National Certificate (HNC)</td>
<td></td>
</tr>
<tr>
<td>Foundation Modern Apprenticeships (FMAs)</td>
<td></td>
</tr>
<tr>
<td>Advanced Modern Apprenticeships (AMAs)</td>
<td></td>
</tr>
<tr>
<td>National Vocational Qualifications (NVQs)</td>
<td></td>
</tr>
<tr>
<td>Entry to Employment (e2e)</td>
<td></td>
</tr>
<tr>
<td>Heating &amp; Ventilation</td>
<td></td>
</tr>
<tr>
<td>Others (please specify):</td>
<td></td>
</tr>
</tbody>
</table>

Q32. In the boxes below against each trade please tick to say how important it would be to provide additional training provision:
### AND FINALLY.......

**What more do you think could be done to improve skills in the construction and building services sector:**

- Multi-skilling
- Brickmasons, blockmasons, and stonemasons
- Cement masons, concrete finishers, segmental pavers, and terrazzo skilled works
- Ground Engineering Works
- Carpet, floor, and tile installers and finishers
- Construction and equipment operators
- Wood works, Joinery, & Carpentry
- Painting and Decorating
- Structural and reinforcing iron metal
- Curtain Walling
- Modular Building Works
- Cladding System Works
- Prefabrication of Building Components Works
- Heating & Ventilation
- Mechanical Services and Plumbing

Other - Please identify new skills that would be of direct benefit to your organisation and which you would be ready to employ in your organisation:

<table>
<thead>
<tr>
<th></th>
<th>Very Little Importance</th>
<th>Little Importance</th>
<th>Important</th>
<th>Very Important</th>
<th>Extremely Important</th>
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</thead>
<tbody>
<tr>
<td>Multi-skilling</td>
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</tr>
<tr>
<td>Brickmasons, blockmasons, and stonemasons</td>
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<tr>
<td>Cement masons, concrete finishers, segmental pavers, and terrazzo skilled works</td>
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<tr>
<td>Ground Engineering Works</td>
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<td></td>
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<tr>
<td>Carpet, floor, and tile installers and finishers</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Construction and equipment operators</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Wood works, Joinery, &amp; Carpentry</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Painting and Decorating</td>
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<tr>
<td>Structural and reinforcing iron metal</td>
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<tr>
<td>Curtain Walling</td>
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<tr>
<td>Modular Building Works</td>
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<tr>
<td>Cladding System Works</td>
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<tr>
<td>Prefabrication of Building Components Works</td>
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<tr>
<td>Heating &amp; Ventilation</td>
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<td></td>
<td></td>
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<tr>
<td>Mechanical Services and Plumbing</td>
<td></td>
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</table>
THANK YOU FOR COMPLETING THE QUESTIONNAIRE, YOUR HELP IS GREATLY APPRECIATED
Matrix scatter plot of traditional manpower variables

<table>
<thead>
<tr>
<th>Plumbers</th>
<th>Joiners and carpenters</th>
<th>Painting</th>
<th>Plasterers</th>
<th>Heating and ventilation</th>
<th>Electrical contractors</th>
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</thead>
</table>

Non-traditional manpower variables

<table>
<thead>
<tr>
<th>Asphalt and tarmac</th>
<th>Plant hire</th>
<th>Flooring contractors</th>
<th>Construction engineers</th>
<th>Insulating specialists</th>
<th>Suspended ceiling</th>
<th>Floor and wall finishes</th>
<th>Miscellaneous</th>
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</thead>
<tbody>
<tr>
<td>General builders</td>
<td>Building trades</td>
<td>Civil engineers</td>
<td>Roofers</td>
<td>Glaziers</td>
<td>Demolition contractors</td>
<td>Scaffolding specialists</td>
<td>Reinforced concrete</td>
</tr>
</tbody>
</table>
Appendix

APPENDIX 6
Examples of Secondary Data
Source: adapted from the 2003 edition of Construction Annual Statistics

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## Appendix

### Examples of Secondary Data

Source: adapted from the 2003 edition of Construction Annual Statistics

<table>
<thead>
<tr>
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<td>74.0</td>
<td>75.0</td>
<td>75.0</td>
<td>74.0</td>
<td>67.0</td>
<td>66.0</td>
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<td>150.0</td>
<td>162.0</td>
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<td>44.8</td>
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<td>44.8</td>
<td>44.8</td>
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<td>46.8</td>
<td>46.8</td>
<td>46.8</td>
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### By Trade of Firm

#### Total Main Trades

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<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>366.7</td>
<td>368.5</td>
<td>362.0</td>
<td>342.6</td>
<td>378.3</td>
<td>396.2</td>
<td>440.0</td>
<td>427.6</td>
<td>398.5</td>
<td>380.9</td>
<td>441.3</td>
</tr>
</tbody>
</table>

#### Constructional Engineers

| 12.7 | 12.7 | 11.4 | 9.3 | 9.0 | 8.2 | 8.1 | 9.8 | ... | ... | ... |

#### Demolition

| 3.5  | 3.2  | 3.0  | 3.0  | 3.8  | 4.4  | 4.6  | 6.0  | 6.2  | 11.1 | 11.2 |

#### Reinforced Concrete

| 2.9  | 2.3  | 2.1  | 1.7  | 1.7  | 1.8  | 4.5  | 2.1  | ... | ... | ... |

#### Test drilling and boring

| ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 0.7  | 0.7  | 1.1 |

#### Roofing

| 20.2 | 19.6 | 19.0 | 17.9 | 19.2 | 20.7 | 24.4 | 26.1 | 28.0 | 30.3 | 32.3 |

#### Asphalt and Tar Sprayers

| 7.7  | 8.7  | 8.5  | 7.8  | 8.7  | 7.9  | 9.0  | 8.0  | ... | ... | ... |

### Construction of highways

| ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  |

### Construction of water projects

| ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 4.7  | 3.9  | 4.0 |

#### Scaffolding

| 15.5 | 15.4 | 15.6 | 12.5 | 13.7 | 16.4 | 19.9 | 20.0 | 14.0 | 23.2 | 25.1 |

#### Installation of electrical wiring and lighting

| 82.6 | 82.4 | 81.8 | 80.4 | 94.3 | 98.0 | 118.7 | 100.8 | 122.3 | 135.3 | 151.5 |

#### Insulating activities

| 8.2  | 7.4  | 7.8  | 7.3  | 7.3  | 7.7  | 7.6  | 9.0  | 10.8 | 7.2  | 7.4 |

### Plumbing

| 26.6 | 26.8 | 26.8 | 26.0 | 30.3 | 32.8 | 30.5 | 49.3 | 77.7 | 67.1 | 101.5 |

### Heating and Ventilating

| 47.2 | 44.1 | 45.3 | 40.5 | 40.9 | 30.5 | 44.7 | 37.1 | ... | ... | ... |

#### Planting

| 8.7  | 8.2  | 8.4  | 7.1  | 8.0  | 8.5  | 10.5 | 9.9  | 10.8 | 13.2 | 13.0 |

#### Joinery installation

| 25.2 | 25.3 | 24.9 | 22.5 | 25.0 | 26.2 | 31.8 | 29.0 | 51.6 | 40.3 | 48.0 |

#### Flooring contractors

| 7.3  | 7.4  | 7.1  | 7.1  | 8.0  | 8.4  | 10.4 | 11.7 | ... | ... | ... |

### Floor and Wall Tiling Specialists

| 3.5  | 3.4  | 3.3  | 2.6  | 2.7  | 2.5  | 3.0  | 3.3  | ... | ... | ... |

#### Floor and wall covering

| ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  |

#### Suspended Ceiling Specialists

| 4.0  | 3.7  | 3.7  | 4.5  | 6.5  | 9.0  | 14.2 | 10.4 | ... | ... | ... |

### Painting

| 32.7 | 30.9 | 30.0 | 30.1 | 34.5 | 35.3 | 41.0 | 43.0 | 40.0 | 37.8 | 36.5 |

### Gilding

| 26.3 | 20.7 | 25.2 | 17.2 | 17.4 | 15.6 | 13.9 | 15.4 | 14.5 | 18.0 | 26.5 |

### Plant hire (with operators)

| 19.7 | 20.2 | 20.3 | 17.1 | 16.5 | 17.0 | 20.1 | 17.7 | 10.4 | 14.3 | 15.9 |

### Other construction work and building installation and completion

| 31.6 | 30.3 | 42.6 | 43.0 | 51.1 | 56.3 | 67.8 | 90.8 | 135.1r | 135.0 | 180.7 |

#### All Trades

| 753.2 | 753.3 | 750.9 | 707.1 | 778.3 | 813.6 | 902.8 | 945.9 | 972.6 | 989.9 | 1,142.8 |
### APPENDIX 7

<table>
<thead>
<tr>
<th>Publications</th>
<th>Status</th>
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</table>