# ECONOMIC FLUCTUATIONS AND PRODUCTIVITY IN THE MALAYSIAN CONSTRUCTION SECTOR

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# Abstract

Growth in productivity is the key determinant of the long-term health and prosperity of an economy. The construction industry being one of major strategic importance, its productivity performance has a significant effect on national economic growth. The relationship between construction output and economy has received intensive studies, but there is lack of empirical study on the relationship between construction productivity and economic fluctuations. Fluctuations in construction output are endemic in the industry. In part they are caused by the boom and slump of the economy as a whole and in part by the nature of the construction product. This research aims to uncover how the productivity of construction sector is influenced in the course of economic fluctuations in Malaysia.

Malaysia has adopted three economic policies – New Economic Policy (1971-1990), National Development Policy (1991-2000) and the National Vision Policy (2001-2010) since gaining independence in 1959. The Privatisation Master Plan was introduced in 1991. Operating within this historical context, the Malaysian construction sector has experienced four business cycles since 1960.

A mixed-method design approach is adopted in this study. Quantitative analysis was conducted on the published official statistics of the construction industry and the overall economy in Malaysia between 1970 and 2009. Qualitative study involved interviews with a purposive sample of 21 industrial participants.

This study identified a 32-year long building cycle appears in 1975-2006. It is superimposed with three shorter construction business cycles in 1975-1987, 1987-1999 and 1999-2006. The correlations of Construction labour productivity (CLP) and GDP per capita are statistically significant for the 1975-2006 building cycle, 1987-1999 and 1999-2006 construction business cycles. It was not significant in 1975-1987 construction business cycles.

The Construction Industry Surveys/Census over the period from 1996 to 2007 show that the average growth rate of total output per employee expanded but the added value per employee contracted which imply high cost of bought-in materials

and services and inefficient usage of purchases. The construction labour productivity is peaked at 2004 although there is contraction of construction sector in 2004.

The residential subsector performed relatively better than the other sub-sectors in most of the productivity indicators. Improvements are found in output per employee, value added per employee, labour competitiveness and capital investment but declines are recorded in value added content and capital productivity. The civil engineering construction is most productive in the labour productivity nevertheless relatively poorer in the capital productivity. The labour cost is more competitive in the larger size establishment. The added value per labour cost is higher in larger sized establishment attributed to efficient in utilization of capital.

The interview with the industrial participant reveals that the productivity of the construction sector is influenced by the economic environment, the construction methods, contract arrangement, payment chain and regulatory policies. The fluctuations of construction demand have caused companies switched to defensive strategy during the economic downturn and to ensure short-term survival than to make a profit for the long-term survival and growth. It leads the company to take drastic measures to curb expenses, downsizing, employ contract employment, diversification and venture overseas market.

There is no empirical evidence supports downsizing as a necessary step in a process of reviving productivity. The productivity does not correlate with size of firm. A relatively smaller and focused firm is more productive than the larger and diversified organisation. However diversified company experienced less fluctuation in both labour and capital productivity.

In order to improve the productivity of the construction sector, it is necessary to remove the negatives and flaws from past practices. The recommended measures include long-term strategic planning and coordinated approaches of government agencies in planning of infrastructure development and to provide regulatory environments which encourage competition and facilitate productivity improvement.

# Keywords

Construction Sector, Productivity, Economic Fluctuation, Malaysia

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# List of Abbreviations

| | |
|---|---|
| **AFAS** | ASEAN Framework Agreement on Services (AFAS) |
| **ALP** | Average Labour Productivity |
| **ANOVA** | Analysis of Variance |
| **ASEAN** | Association of Southeast Asian Nations |
| **BIM** | Building Information Modelling |
| **BNM** | Bank Negara Malaysia (Malaysian Central Bank) |
| **BOT** | Build Operate Transfer |
| **CCC** | Certificate of Completion and Compliance |
| **CFO** | Certificate of Fitness for Occupation |
| **CIDB** | Construction Industry Development Board |
| **CIPPA** | Construction Industry Payment and Adjudication Act |
| **CREAM** | Construction Research Institute of Malaysia |
| **CLP** | Construction Labour Productivity |
| **FTAs** | Free Trade Arrangements (FTAs) |
| **GDP** | Gross Domestic Product |
| **GFCF** | Gross Fixed Capital Formation |
| **GLC** | Government-Linked Companies |
| **GNI** | Gross National Income |
| **GNP** | Gross National Product |
| **HICOM** | Heavy Industries Corporation of Malaysia |
| **IBS** | Industrialised Building System |
| **KLSE** | Kuala Lumpur Stock Exchange |
| **MADA** | Muda Agricultural Development Authority |
| **MARDEC** | Malaysian Rubber Development Corporation |
| **MIDA** | Malaysian Industrial Development Authority |
| **MLP** | Marginal Labour Productivity |
| **MPC** | Malaysian Productivity Corporation |
| **NEAC** | National Economic Advisory Council |
| **NEM** | New Economic Model |
| **NEP** | New Economic Policy |

| | |
|---|---|
| **PETRONAS** | Petroleum National Bhd |
| **PPP** | Public Private Partnership |
| **PWD** | Public Work Department |
| **RBC** | Real Business Cycle |
| **RM** | Ringgit Malaysia (Malaysian Currency) |
| **R&D** | Research and Development |
| **TDC** | Tourist Development Corporation |
| **TFP** | Total Factor Productivity |
| **SEDCs** | State Economic Development Corporations |
| **SMEs** | Small and Medium Enterprises |
| **UDA** | Urban Development Authority |
| **WTO** | World Trade Organisation (WTO) |

# Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signature:

Date: 2nd November 2011

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# Chapter 1: Introduction

## 1.1 BACKGROUND

Growth in productivity is important to maintain or increase the international competitiveness and standards of living. It is the key determinant of long-run growth which will leads to higher prosperity. The construction industry is one of major strategic importance. Its level of productivity has a significant effect on national economic growth. Gains from the higher construction productivity will flow through across the economy, because all industries are reliant on construction to some extent as part of their business investment. The construction sector's productivity has been volatile in recent years.

This chapter outlines the background and context of the research. Section 1.2 outlines the role of construction sector in the Malaysian economic development and a brief account of productivity of the nation and the construction sector. Section 1.3 delineates the purpose of this study which states the research problem and research questions. Section 1.4 defines scope and delimitations of the study. Section 1.5 outlines the research methodology. Finally, Section 1.6 includes an outline of the remaining chapters of the thesis.

## 1.2 CONTEXT

Productivity is by far the most important determinant in the long-term health and prosperity of an economy (Baumohl 2005). Sustainable increases in living standards depend largely on the productivity performance of economy. It is the engine of economic growth both for a country and for an individual organization (Hope and Hope 1997). It is the most important objectives that businesses and their management try to improve all around the world because it is very closely connected to profitability (Lewis 2004).

Productivity varies due to differences in production technology, differences in the efficiency of the production process, and differences in the environment in which production occurs (Fried 1993). Pearce (2003) says,

> ‘The general requirement is that the stocks of all assets in the economy, expressed in per capita terms and, or, their productivity should be rising on a consistent basis over time. These stocks constitute the productive capacity of the economy…The forms of capital are manmade capital, human capital, natural capital and social capital. The productivity of these forms of capital depends on how they are combined and on technological change’ (Pearce 2003).

Baumol (1985) divided an economy into ‘stagnant’ sector and ‘progressive’ sector. He argues,

> ‘…relative costs and prices in the stagnant sector would tend to rise persistently and cumulatively, and that if the output proportions of the two sectors happened to remain fairly constant, the share of the economy’s inputs used by the stagnant sector and the share of consumer expenditure devoted to outputs of the stagnant sector must both rise toward 100 percent’ (Baumol, Blackman et al. 1985).

Abel and Bernanke (2005) comment that productivity slowdown can be an illusion, the result of measurement problems that have overstated the extent of the decline. The key issue in productivity measurement is whether the official output statistics adequately capture changes in quality; the capital and labour devoted to a cleaner environment and worker safety and health, etc. (Abel and Bernanke 2005).

GDP per capita is widely regarded as the best single measure of economic well-being. That measure is simply labour productivity multiplies by the proportion of the population that works. Productivity, however, varies enormously and explains virtually all of the differences in GDP per capita. Thus, to understand what makes countries rich or poor, Lewis (2006) suggests must understand what causes productivity to be higher or lower. This understanding is best achieved by evaluating the performance of individual industries, since a country’s productivity is the average of productivity in each industry, weighted by its size (Lewis 2006).

Construction plays a vital role in economic development. It promotes growth, accumulates capital formation, contributes source of employment, and provides critical backward and forward linkages to the rest of the economy (Wells 1985;

Kirmani 1988). Value-added, or the 'net' output of construction is only a small part of the total construction process; a large percentage of total construction output consists of intermediate inputs from other sectors of the economy, mainly the building materials and service industries. The construction of physical facilities is also an essential part of development of other productive activities, which in turn may contribute further to economic growth (Wells 1984). The relationship between construction output and economy has received intensive studies (Turin 1973; World Bank, 1984; Wells 1986; Ofori, 1990; Bon, 1992; Crosthwaite, 2000; Chan, 2001). There is lack of empirical study on the relationship between construction productivity and economic development.

Table 1-1
Comparative Growth Rates of Malaysian GDP (in 2005 constant prices) and Employment and Shares of Construction Sector

| Year | GDP (Million Ringgit) | | Growth Rate (%) | | Employment (Thousands) | | Share of Construction (%) | |
|---|---|---|---|---|---|---|---|---|
| | National | Construction | National | Construction | National | Construction | GDP | Employment |
| 1970-1979 | 78,913 | 3,410 | 9.83 | 11.81 | 4,009 | 160 | 4.34 | 3.99 |
| 1980-1989 | 150,382 | 6,994 | 5.77 | 3.63 | 5,531 | 365 | 4.77 | 6.61 |
| 1990-1999 | 307,351 | 13,716 | 7.25 | 9.03 | 7,860 | 644 | 4.37 | 8.19 |
| 2000-2009 | 511,147 | 16,012 | 4.76 | 1.79 | 10,549 | 763 | 3.11 | 7.23 |

Source: Computed for this research from Economic Reports, 1970/1971 to 2009/2010 issues.
Note: AU$1 is equivalent to RM$3.0797 as at Feb3, 2011

The average annual growth rate of the Malaysian construction activity has drastically contracted from 11.8% in 1970s to 1.8% in 2000s as shown in Table 1-1. Its contribution to the GDP fell from 4.3% in 1970s to 3.1% in 2000s. However, the labour resource consumed by the construction sector is rising from 4.0% in 1970s to 7.2% in 2000s. The increased in employment and decreased in contribution to GDP in the share of economy suggests that there is an overall decline in the productivity of the sector.

Figure 1.1 is graphical comparison of shares of value-added and employment of manufacturing and construction sectors in the Malaysian economy. For the manufacturing sector, its share of employment in the economy increased from 9.0% in 1970 to 27.6% in 2009, and there is corresponding increase in the share of value-added to the economy from 12.6% in 1970 to 25.3% in 2009. For the construction sector, its share of employment in the economy is marginally decreased from 2.7% in 1970 to 6.6% in 2009. However, the share of value-added to the economy is reduced from 3.9% in 1970 to 2.9% in 2009.

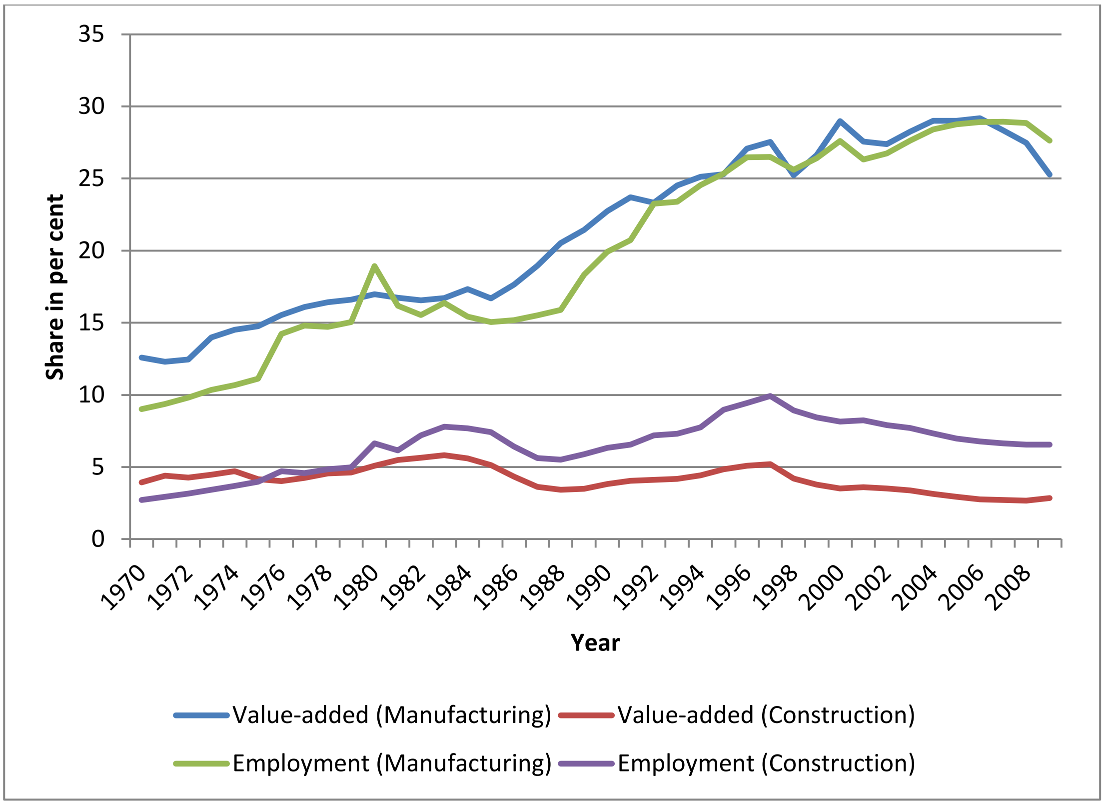


Figure 1.1. Comparisons of the contribution of construction and manufacturing sectors in value-added and employment (in 2005 constant prices)
Source: Computed for this research from Economic Reports, 1970/1971 to 2009/2010 issues.

The average annual growth rate of value-added per employment between 1970 and 2009 is 4.2% in the total economy and 3.5% in the manufacturing sector. The construction industry is lagged behind at 2.4%. Figure 1.2 depicts the time series of value-added per employment of total economy, manufacturing sector and construction sector between 1970 and 2009.

The productivity statistics published by the Malaysian Productivity Corporation (MPC) shows that annual growth of productivity in the construction sector between 1996-2009 is lagged behind the other economic sectors most of the times (Table 1-2 and Figure 1.3). Nevertheless, it recorded the highest growth of 5.0% in 2009.

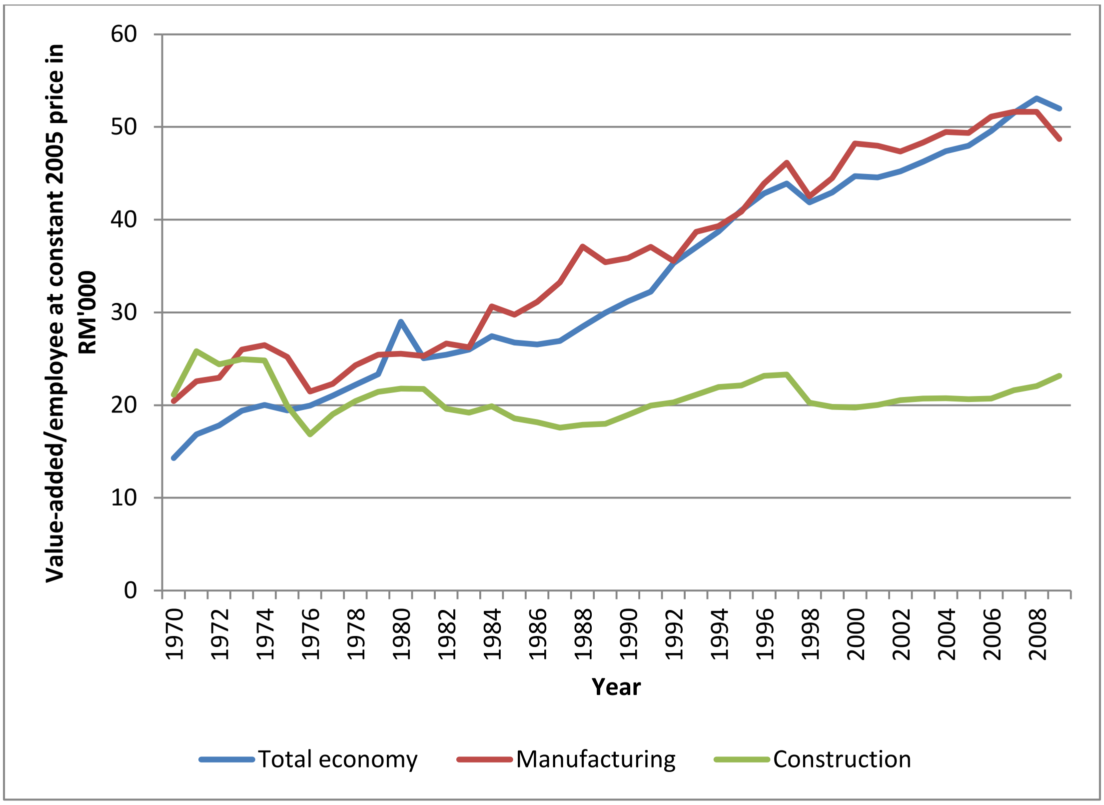


Figure 1.2. The Value-added/Employment of total economy, manufacturing and construction sector (in 2005 constant prices)
Source: Computed for this research from Economic Reports, 1970/1971 to 2009/2010 issues.

Table 1-2
Productivity Growth (1996-2009) of Selected Sectors in Malaysia

| Sectors | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Malaysia | 5.70 | 5.60 | -1.80 | 3.86 | 6.10 | 0.29 | 2.46 | 2.66 | 3.42 | 2.98 | 3.68 | 4.17 | 2.89 | -1.84 |
| Manufacturing | 5.83 | 5.73 | -7.01 | 9.11 | 11.05 | -3.42 | 3.32 | 5.31 | 6.10 | 3.76 | 4.42 | 2.65 | 2.01 | -8.59 |
| Construction | 2.05 | 1.88 | -12.71 | -4.91 | 2.33 | 0.39 | 2.51 | 2.55 | -0.30 | -0.74 | 0.47 | 1.51 | 1.52 | 4.96 |
| Agriculture | 4.68 | 4.57 | -0.66 | 4.01 | 0.52 | 2.29 | 1.11 | 1.92 | 2.50 | 2.58 | 3.41 | 2.80 | 3.01 | 0.36 |
| Trade | 5.34 | 1.84 | -0.24 | 1.17 | 2.37 | 1.54 | 1.14 | 3.24 | 2.36 | 2.67 | 2.15 | 5.54 | 4.34 | 0.83 |
| Transport | 8.27 | 8.42 | 0.97 | 3.21 | 3.76 | 2.12 | 1.35 | 2.15 | 3.21 | 4.03 | 4.07 | 5.66 | 4.51 | 1.28 |
| Finance | | | | -0.36 | 2.50 | 4.93 | 2.75 | 2.81 | 2.41 | 3.86 | 4.06 | 4.87 | 4.21 | 3.23 |

Source: Computed for this research from Productivity Reports (Issues 2000-2009), Malaysia Productivity Corporation

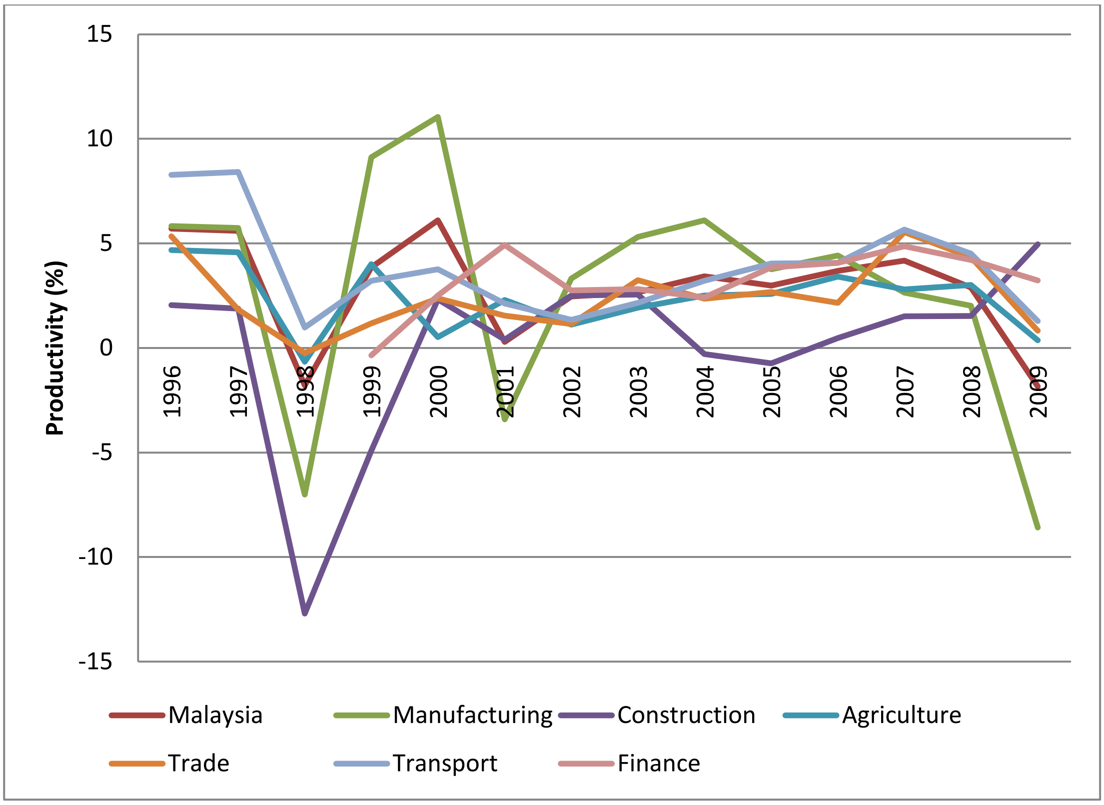


Figure 1.3. Productivity Growth (1996-2006) of Selected Sectors in Malaysia
Source: Computed for this research from *Productivity Report (Issues 2000-2009)*, Malaysia Productivity Corporation.

In view of the importance of the construction sector and productivity to an economy's development; it appears that there is a decline in construction productivity with the fact that construction sector has decline in its share of GDP but consuming higher labour resource and there is lack of study on the productivity of the construction sector and economic development, it is important to investigate: Is there any relationship between the construction productivity and economic fluctuations? What are the underlying factors of the fluctuation in the construction productivity?

## 1.3 PURPOSES

The aim of this research intent to uncover:

*How is the productivity of construction sector influenced in the course of economic fluctuations in Malaysia?*

At a more specific level, the objectives of this research are to investigate:

1. How the productivity of construction sector is affected by the macroeconomic fluctuations?
2. What are the key aspects and issues underlying productivity of construction sector?
3. What is the usual course of action taken by the industrial participants when they are encountered with macroeconomic fluctuations?
4. Why such course of action is chosen?
5. What are the impacts of such course of action?

## 1.4 SCOPE AND LIMITATION

This research was conducted in the Peninsular Malaysia (i.e. West Malaysia). The statistical data included in the analysis is from 1970 onwards. 1970 was chosen as a starting point for this study is because the first major economic policy, New Economic Policy (NEP), was introduced in the year. In addition, there are more comprehensive statistical data available from 1970 onwards.

The interview data were collected from Kuala Lumpur, Selangor, Penang and Johor which cover Northern, Central and Southern Malaysia. The share of construction activities in these regions is equal to 72% of total value of construction work done.

## 1.5 RESEARCH METHODOLOGY

A more thorough examination and description of the research procedures that addressed the issues relating to this study is made in Chapter 5. This section provides an overview of the research methodology chosen for the present research. The research approach chosen was a mixed-method design, which includes a quantitative secondary study of existing statistics of the construction industry and Malaysia economy and a qualitative method to follow up and refine the quantitative findings. The qualitative study involved interviews with a purposive sample wherein intentionally selected participants who are informed of, or have experience with, the central research question being investigated. The purpose of the quantitative study was to assess the productive performance of the construction sector from the published official statistics.

A flow chart of research process is shown in Figure 1.4.

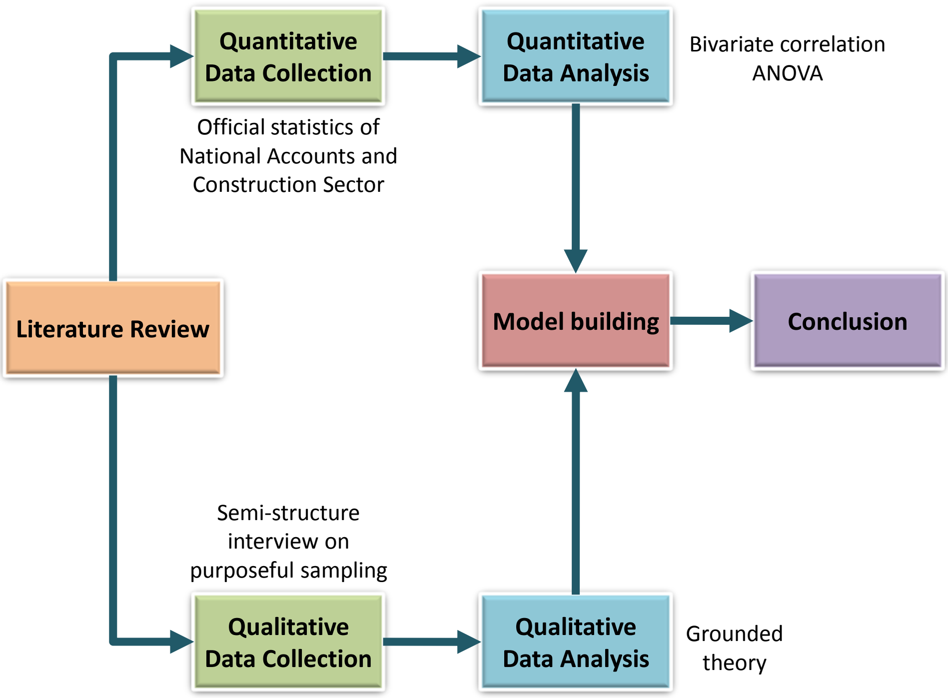


Figure 1.4.Flow chart of the research activities

## 1.6 THESIS OUTLINE

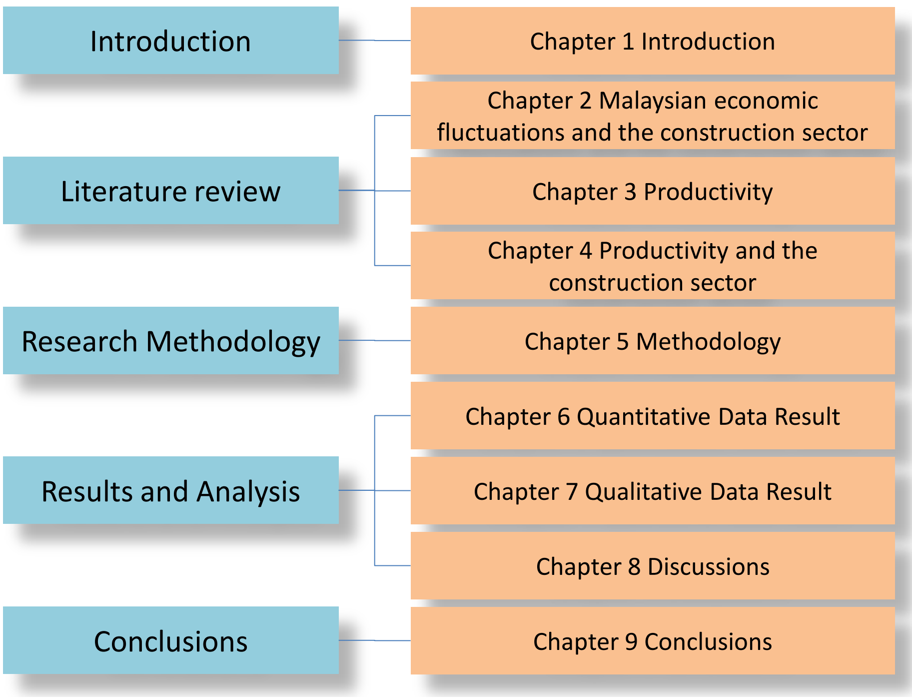


Figure 1.5 Thesis Structure

This thesis is divided into five parts as indicated in the Figure 1.5. Part 1 is the introduction of this study. It begins with the background of this study, outlines the construction sector which includes its contribution to the Malaysian economy and a brief account of productivity performance. The gap of the previous researches is identified. The research problems and research questions are defined. The scope and limitations of the study are delineated. The research methodology adopted and the thesis structure is outlined.

Part 2 review the related literatures. It consists of three chapters. Chapter 2 provides an overview of the economic development of Malaysia. It gives a brief account of the development process and Malaysia's economic performance including the changing structure of the economy, highlights the challenges and crisis encountered by the country and discusses the major policies adopted. It also examines the evolution of the Malaysian construction sector and reviews the role of the construction sector in development. Chapter 3 reviews the concept and definitions of productivity and compares the different productivity measures used. It also examines the objectives and problems of the productivity measures involved. Chapter 4 examines and reviews the determinants of construction productivity discussed in the literature. The factors studied by the earlier researchers are organized according to the nature of industry, nature of work and nature of environment.

Part 3 includes Chapter 5 only. It highlights the methodological issues involved and selection of research methods. This chapter explains the research design adopted, the stages by which the methodology will be implemented, the details the participants in the study; lists instruments used in the study and justifies their use; outlines the procedure to be used and the timeline for completion of each stage of the study; discusses how the data will be analysed; considers the ethical issues and its potential problems and limitations.

Part 4 reports the data collected and analyse of the results. Chapter 6 analyses the productivity performance of the construction sector in Malaysia. The first section discusses the economic development of the construction sector in Malaysia, the second section looks at construction productivity and economic development between 1970 and 2009, while the third section examines the various productivity indicators computed from the construction survey and census between 1996 and 2007. The fourth section analyses the productivity indicators at the sub-sector levels. Chapter 7 presents the findings of the interviews. This includes the background information concerning the interviews, themes on the key aspects and issues of economic development in Malaysia, the usual course of action taken by the industrial participants when they encounter macroeconomic fluctuations, the reason for the courses of action chosen and the impacts of such courses of action on the productivity of the construction industry. Chapter 8 triangulates the data from the two phases of the study to facilitate the interpretation and discussion of the quantitative results and qualitative findings, highlighting trends and patterns and commenting on their significance in the context of the literature reviewed.

Part 5 contains Chapter 9 which presents the conclusions drawn from the study in relation to the research questions. It also highlights the implications of the research which outline the contribution to the body of knowledge in construction economics and implications on the strategies choice and decision making of the practising manager, recommendation for policy and suggestion for the future research.

# Chapter 2: Malaysian economic development and the construction sector

## 2.1 INTRODUCTION

Since independence, Malaysia has experienced four economic downturns in 1970s, 1980s, 1990s and 2000s. She has adopted three major economic policies – New Economic Policy (1971-1990), National Development Policy (1991-2000) and the National Vision Policy (2001-2010) and eight number of 5-year plans. In addition, the Privatisation Master Plan was released in 1991. Operating within this historical context, the construction sector has gone through three construction business cycles.

This chapter provides a historical background of the economic development and the construction sector in Malaysia. Section 2.2 begins with a brief account of the development process and Malaysian economic performance. It includes reviews the structure of the economy; highlights the challenges and crisis encountered by the country and discusses the major policies adopted. Section 2.3 outlines the overall productivity and efficiency of the economy. Section 2.4 examines the evolution of the Malaysian construction sector. Section 2.5 reviews the role of the construction sector in the economic development. Section 2.6 summarises the chapter.

## 2.2 ECONOMIC DEVELOPMENT IN MALAYSIA

Malaysia is a small open economy, with a population of 26.1 million. At the time of gaining independence in 1957, the economy was fundamentally primary commodity-based with heavy dependence on rubber and tin which contributed about 70 per cent of total export earnings, 28 per cent of government revenue and 36 per cent of total employment (Economic Planning Unit 2010). As a result of the progress made in agriculture and manufacturing as well as in utilities, services and other sectors, Malaysia emerged at the end 1960s with a deeper, broader and stronger economic base. The share of exports of goods and services in the GNP decreased from 52.6 per cent in 1960 to 45.1 per cent in 1970, while the share of rubber and tin in total merchandise exports fell from 70 per cent to 53 per cent during the decade. As such by 1970 the first phase of the Malaysian economic transformation, namely agricultural diversification, was already in place where timber and palm oil had emerged as important export commodities. With the discovery of oil fields off Sarawak, the production of crude petroleum began to gain significance (Economic Planning Unit 2010).

Figure 2.1 shows the changes of contributions of major economic sectors in the total economy between 1970 and 2009. The contribution of agriculture has been reduced from 25.1 percent in 1970 to 7.9 percent in 2009. On the other hand the role of manufacturing sector is rising from 12.6 percent in 1970 to 25.3 percent in 2009. The contribution of construction sector is 3.9 percent in 1970, peaked at 5.8 percent in 1983 and subsequently declined to 2.9% in 2009.

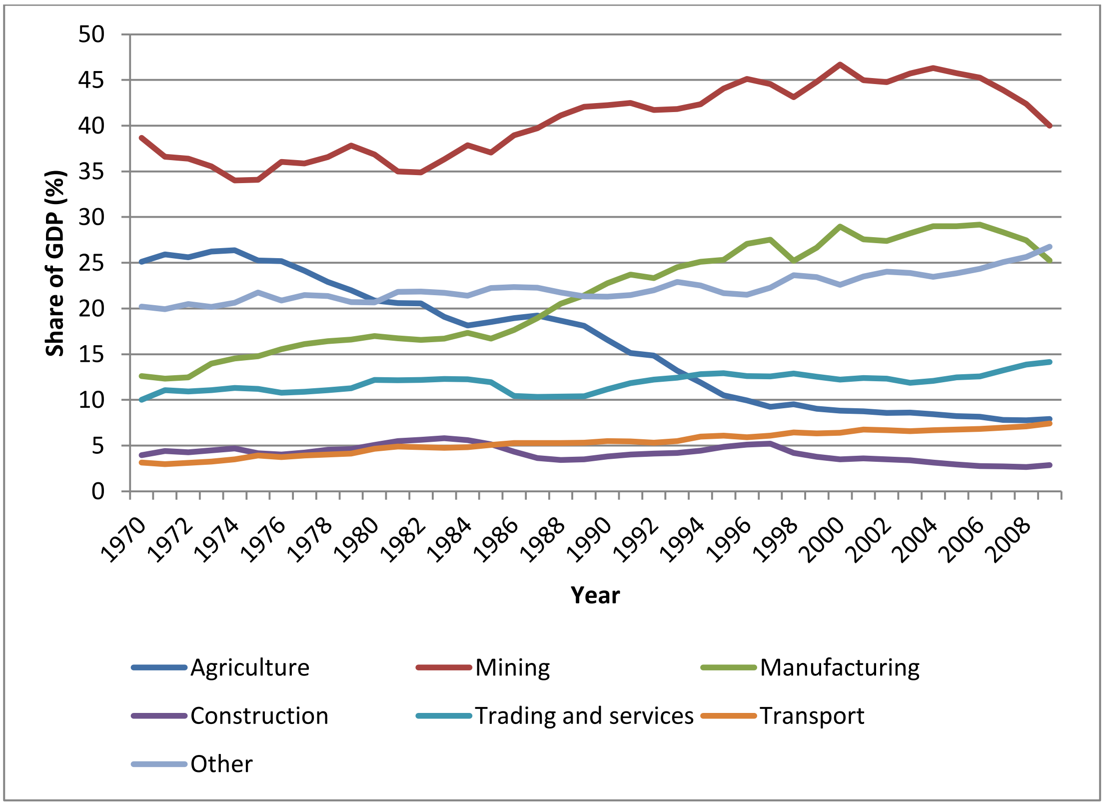


Figure 2.1. Share of Major Economic Sectors Contribution to the GDP (1970-2009)
Source: Computed for this research from *Economic Reports*, issues 1970/71 to 2009/10

### 2.2.1 THE ECONOMIC STATUS DURING 1960-1980

Following a brief period of racial unrest which erupted in May 1969, the New Economic Policy (NEP), promulgated in 1970 aimed to achieve national unity through poverty eradication irrespective of race and inter-ethnic economy parity by a 'restructuring' exercise. The government hoped to create a Malay business community and a 30 per cent *Bumiputera* (a Malay term widely used in Malaysia, embracing indigenous people of the Malay Archipelago) ownership of the corporate sector of the economy by 1990. The decade following the inception of the NEP witnessed the proliferation of public enterprises involved in activities that covered the entire range of the economy (Gomez 1994). In 1975, the Industrial Coordination Act (ICA) was introduced which allowed the government increased authority over manufacturing enterprises and which provided the bureaucracy with avenues to counter those who side-stepped the essence of NEP (Gomez 1994). The resulting outcome is soaring public development expenditure during the early 1970s. Under the First Malaysia Plan, 1966-1970, for example, the allocation was RM4.6 billion, which was doubled to RM10.3 billion under the Second Malaysia Plan, 1971-1975. With the Third Malaysia Plan, 1976-1980, the allocation for public development expenditure tripled to RM31.1 billion (Malaysian Meteorological Department 2009).

The decade following the inception of the NEP witnessed the proliferation of public enterprises involved in activities that covered the entire range of the economy. These public enterprises can be classified into three major categories. First, departmental enterprises, which are mainly those responsible for providing public services, such as water supply, telecommunication, civil aviation and refuse collection. Second, statutory bodies established by the law at federal and state levels, for example, the Malaysian Industrial Development Authority, the Tourist Development Corporation (TDC), The Urban Development Authority (UDA), Petroleum National Bhd (Petronas), the Muda Agricultural Development Authority (MADA), the Malaysian Rubber Development Corporation (MARDEC), and the various state economic development corporations (SEDCs). Third category are government-owned private or public limited companies established under the Company Act (1965), whose equity holdings are either fully or partially held by the government; among the more prominent public enterprises are the Heavy Industries Corporation of Malaysia (HICOM), property developer Peremba Bhd, and Food

Industries of Malaysia (FIMA). Many public enterprises in the latter two categories were developed to accelerate *Bumiputera* participation in commerce and industry (Malaysian Meteorological Department 2009). *Bumiputera* trust agencies such as Perbadanan National Bhd (Pernas) and Permodalan Nasional Bhd (PNB) were also established to acquire corporate assets on behalf of the community. Among the sectors that the public enterprises began penetrating earliest were construction and transportation, areas traditionally dominated by the Chinese (Gomez 1994).

As larger enterprises developed in size, they often became less answerable to external monitoring, let alone supervision. The NFPEs have proved particularly problematic, especially as they were not subject to normal federal and state budgetary constraints. Various reasons have been put forward to explain the generally poor performance of public enterprises. In many instances, state-owned enterprises have been hampered by unclear or contradictory objectives. Co-ordination problems have also been serious, especially with the different levels of government (federal, state, municipal, regional authorities, etc.) as well as inter-ministry and other intra-governmental rivalries (Jomo 1994).

### 2.2.2 THE ECONOMIC STATUS 1981-2000

Beginning from 1981, most commodity prices were on a declining trend. This spurred efforts to continue to diversify the sources of growth while improving productivity. The National Agriculture Policy was introduced in 1984 to modernize and revitalize the agriculture sector. At the same time, generous fiscal incentives were granted to attract foreign direct investment to spur growth in the manufacturing sector (BNM 1999).

The first half of the 1980s was a challenging period for Malaysia. Faced with the world recession of the early 1980s and persuaded by the appraisal that the recession was short-lived, Malaysia undertook anti-cyclical fiscal measure to sustain the growth momentum. When the world recession persisted, rapid expansion in Government spending led to problem of twin deficits, a budget deficit of the Federal Government equivalent to 17.5% of GNP in 1982 (Figure 2.2), and a current account deficit in the balance payments of 14.1% of GNP. The increased recourse by the nation to meet the rapidly growing resource gap caused Malaysia's medium and long-term external debt to more than double from US$4.5 billion or 19% of GNP in 1980 to US$13.6 billion or 48% of GNP in 1983. Recognising that this situation was unsustainable, Malaysia undertook a voluntary adjustment programme in mid-1982 (BNM 1999).

In the post-1982 period, concerted measures were taken to reduce the role of government and to encourage private sector as the engine of growth. Public sector operating and development expenditure was restrained, even during the 1985-86 recession. In 1983, the Malaysian Government adopted an active programme of rationalisation of operations of non-financial public enterprises or NFPEs (state-controlled companies) to promote their privatisation (BNM 1999). The new policy initiative appeared on the policy agenda as the government came under increasing pressure from multilateral and bilateral institutions to institute economic reforms. The shift towards more private sector-oriented development policies by major multilateral financial agencies, such as the World Bank, the Asian Development Bank, and the International Monetary Fund, which were heavily influenced by the conservative economic philosophy propagated by Ronald Reagan and Margaret Thatcher. It was meant as an economic reform aimed at expanding the capital market and trimming the size of the public sector. It indicated a major shift in state policy, from this time forth, primary responsibility for the country's future economic development was to be handed over to private management (Gomez 1994).The multilateral agencies argued against extensive government involvement in the economy. They were particularly strongly biased in favour of private enterprise, and advocated policies to deregulate economies, reduce government economic intervention and curb government spending (Malaysian Meteorological Department 2009).

Although the NEP officially expired in 1990 as originally envisaged, it continued as Malaysia's defining development framework in other guises – The National Development Policy until 2000 and the National Vision Policy until 2010. The twin objectives – the eradication of poverty irrespective of race and the restructuring of society to end the identification of race with economic function – were to be pursued (Lavender 1996).

a. ***Privatisation***

The announcement of privatisation in Malaysia was a radical move since it involved a reversal of NEP to create public enterprises to redistribute wealth and generate jobs. The Privatisation Master Plan released in 1991 voiced its hope to reduce the number of public sector personnel as well as financial and administrative burden by promoting competition, improve efficiency, stimulate private entrepreneurship and encourage investment (Malaysian Meteorological Department 2009). The privatization policy of the government signalled a new approach in national development to reduce the government's direct involvement in the economy and to allow market forces to govern economic activities. It was introduced as part of the structural adjustment package to improve public finances in the face of rising public sector budget deficits in the early 1980s and widespread dissatisfaction with the poor financial and operating performance of some of the public enterprises (BNM 1999). Nevertheless, the close connection between privatisation and affirmative action goals made Malaysian privatisation unique. Privatized ventures had to meet the NEP target of at least 30 per cent *bumiputra* equity and employment participation. Nearly 500 enterprises and services were injected with private capital or management over the next 22 years (Lavender 1996). There were 510 privatisation and PPP projects in the transportation, road, communications, health and energy sectors established since 1983 (Economic Planning Unit 2010).

The private sector, and not the public enterprises, was now being promoted as the main vehicle for economic development. By this time, a substantial segment of corporate stock had been captured and controlled by an elite few in the United Malays' National Organization (UMNO), the leading component party in the ruling coalition, the *Barisan Nasional* (National Front), either in their personal capacities or through proxies; this allowed them privileged and continued access to patronage, thereby reinforcing their position in the party. Soon after the privatization policy was put into effect, however, allegations of extensive political nepotism and patronage emerged (Gomez 1994).

The most controversial case, however, involved the multi-billion ringgit North-South Highway project contracted in 1987 to United Engineers (M) Bhd (UEM), then an ailing publicly-listed company with a dismal track record in the construction industry and no experience in highway building. UEM was, however, then majority-owned by Hatibudi, an UMNO holding company (Gomez 1994).

Regardless of the critics, the government argues,

> 'Privatization played an important role in accelerating economic growth through greater investments which led to corporate expansion. Growth was also generated through efficiency gains as more output was produced using lesser amount of resources. Multiplier effects generated to the economy resulting from privatization. The construction of highways for example, led to increased growth in manufacturing activities for construction-based industries and resulted in time-savings to motorists as well as reduced operating costs for vehicles. With privatization, more resources were also available for the government to spend on other sectors of the economy thus contributing to the growth of those sectors' (Economic Planning Unit 1996).

Table 2-1
Proceeds, savings and reduction in public sector employees

| Item | 1983-1995 | 1991-1995 | 1996-2000 | 2001-2005 |
|---|---|---|---|---|
| Proceeds (RM million) | | | | |
| Sale of assets | 19.13 | 11.81 | 2,083.5 | 21.7 |
| Sale of equity | 2.39 | 2.31 | 2,428.5 | 40.5 |
| Savings (RM million) | | | | |
| Capital expenditure | 72.76 | 51.59 | 49,252.2 | 28,603.9 |
| Operating expenditure | | | | 126.9 |
| Number of public sector employees transferred | 96,756 | 43,038 | 17,442 | 6,249 |

Source: Developed for this study from *Sixth Malaysian Plan (1991-1995), Seventh Malaysian Plan (1996-2000) and Eight Malaysian Plan (2001-2005)*

Table 2-2
Number and mode of privatized projects in the construction industry (1991-2005)

| Items | 1991-1995 | 1996-2000 | 2001-2005 |
|---|---|---|---|
| Sale of equity | 1 | 0 | 0 |
| Sale of asset | 23 | 0 | 0 |
| Build-operate-transfer | 13 | 0 | 3 |
| Build-own-operate | 2 | 25 | 0 |
| Corporatization | 0 | 1 | 0 |
| Management contract | 1 | 0 | 0 |
| Lease of asset | 1 | 0 | 0 |
| Management-buy-out | 0 | 1 | 0 |
| Build-transfer | 5 | 0 | 0 |
| Build-lease-transfer | 0 | 0 | 2 |
| Land development | 0 | 0 | 10 |
| Total | 46 | 27 | 15 |
| Number of total privatized projects | 204 | 98 | 35 |
| % of total privatized projects | 22.5 | 27.6 | 42.9 |

Source: Developed for this research from *Seventh Malaysian Plan* (1996-2000) and *Eighth Malaysian Plan* (2001-2005)

The Ninth Malaysian Plan reported that the total savings in capital expenditures from privatized projects amounted to RM153,960.8 billion and RM7.7 billion in operating expenditure. The privatization had contributed RM6.5 billion from the sale of assets and equity, over and above the revenue from corporate tax which otherwise would not have been collected by the Government. Recurrent income from privatization in the form of lease rentals further contributed to the Government's revenue. The programme reduced the administrative burden of the Government in terms of recruitment, promotion and training of personnel. Since 1983, 113,220 employees of total public sector workforce were transferred to the private sector (Economic Planning Unit 2006).

In addition, privatization contributed towards increased efficiency and productivity of the privatized entities through improvement of quality of service and management systems and privatization also led to faster implementation of projects, particularly highways and ports. In this regard, the construction of the Port of Tanjung Pelepas in Johor was completed six months ahead of schedule, while the construction of the Damansara-Puchong Highway was completed in 28 months instead of 36 months (Economic Planning Unit 2001). Privatization benefited employees who opted to join the entities concerned as most of these entities adopted the performance oriented remuneration scheme. The improved performance of the privatized entities benefited employees in terms of year-end bonuses and salary increases. Other benefits to the employees included the offerings of company shares to the employees under the Employee Share Option Scheme and Employee Loyalty Share Option Scheme. Privatization through MBO method provided opportunities for management to participate and hold significant equity in the privatized entities (Economic Planning Unit 1996). Ironically, World Bank doubt the sustainability of Malaysian privatization model, it comments,

> 'the Asian crisis notwithstanding, worldwide few countries have succeeded in using a stand-alone BOT model to deliver a large scale highway program on a privatized basis. This is due to the complex relationships between toll rates, user demand, and financing structures for the project, especially in the early stages of implementation' (Haddad 2000).

Comparing the experience of Malaysia and Chile in infrastructure privatization, World Bank identified there are three differences, namely, difference in motivation, difference in sectoral emphasis and difference in approach within sector, it remarks,

> '…Malaysia and Chile differ in their philosophical motivation for privatization. Whereas Chilean privatization is integrally linked to a competition policy, competition within the infrastructure sector is virtually absent in Malaysia. Instead, privatization in Malaysian has been, and continue to be, driven by the aim to fill a perceived financing gap, although other considerations including socio-economic factors are at play as well…In the electric power sector, power generators compete to supply to a power grid in Chile. In Malaysia, the five private power producers have long-term contracts with Tenaga giving them a virtually assured market for the power they produce irrespective of efficiency' (Haddad 2000).

World Bank also comments on the process of concession, contracting and divestiture have not been very transparent.

> 'Most of the privatization exercises in Malaysia – such as the issuance of telecom licenses, IPP concessions, BOT road projects, or divestiture of ports – have tended towards direct negotiations between the government and a pre-selected private firm. The Privatization Master Plan, while viewing competitive negotiations and sole-source negotiated deals as being among the ways to contract for private provision of infrastructure, failed to point out the downside effects of not awarding contracts by competitive bids. It also did not specify the circumstances under which direct negotiations or competitive negotiations may be preferred to competitive tenders' (Haddad 2000).

As most critics had brought to attention, however, it was questionable whether Malaysian were being well served when the government awarded contracts without competitive bidding or sold assets without seeking the best offer (Gomez 1994). In addition, the gains from privatization i.e. improved efficiency and competitiveness, and meeting of long term targets by privatized entities were generally 'patchy'. This was partly due to weak regulatory framework – which was imperative to ensure that incentives were in place to induce the owners to improve efficiency and invest – and ad hoc intervention by the government through various ministries. Moreover, these failures can be attributed to institutional failure that led to incorrect privatization choices, poor screening and selection, and weak regulation. Apart from the fact that such a manner of policy implementation by the government could have eliminated competition that may have benefited consumers and tax-payers, it was also leading the country perilously close to a situation where private monopolies were being created to gradually replace public ones (Gomez 1994).

The policies of shift from the public sector to the private sector as the engine of growth also created new risks. While there was no doubt that privatisation amassed new revenue from lease payments and corporate taxes, substantial debt was transferred to the private sector, improving efficiency and services and trimming the bureaucracy by more than 114,000 employees, privatisation itself remained extremely contentious. Public monopolies sometimes became private monopolies with a noticeable deterioration in performance and devastating hidden cost to tax payers. The government sometimes guaranteed a certain rate of return to recipients, stretching over decades, so that profits but not risks were privatised; details were not disclosed to the public and not reflected in the national budget (Lavender 1996). The political connected conglomerates formed around privatized projects and nurtured by government policies and patronage, which had found it easy to fund their often frenzied expansion by raising capital in the local stock market, or by borrowing abroad. They had evolved into politically protected market leaders, oozing wealth and power, but not distinguished by productivity or innovation and were completely untested in export markets (Lavender 1996).

b. ***1997-1998 Asian Financial Crisis***

In similar fashion to the 1985-1986 recessions, Malaysia went into 1997 with a prolonged current account deficit. The full effect of the regional financial crisis was felt in 1998. Real output declined by 7.5%. As the crisis deepened, the impact on the economy became more severe with the economy contracting by 3.1% in the first quarter of 1998 before worsening to -10.9% and -10.3% in the third and fourth quarters of 1998 respectively. The ringgit depreciated by 40% against the US dollar in the period 1 July 1997 – end-August 1998 following developments in Thailand. A track record of relative macroeconomic stability and progressive policy tightening was not sufficient to insulate Malaysia from the contagion effects of the developments in the region. The market perception of emerging risks in the Malaysia financial system and economic outlook resulted in the contagion effects on Malaysia being more severe, leading to a large liquidation of portfolio investment by the foreign investors and a significant downward adjustment of the currency. The prolonged and the severe Asian financial crisis continued to exert downward pressure on the ringgit during the first eight months of 1998. The ringgit breached a historical intra-day low of US$1=RM4.8800 on 7 January 1998. In addition to the continued uncertainty in the region, new risks emerged following the build-up of ringgit balances in regional offshore centres since April 1998. The consequent build-up of offshore ringgit increased the vulnerability of ringgit and threatened to further destabilize the economy. These developments led to the imposition of selective exchange controls on 1 September 1998 and the fixing of the ringgit at RM3.80 against the United States dollar on 2 September 1998 (BNM 1999).

As the crisis worsened, the Government reversed the initial expenditure cuts and injected an additional development expenditure of RM30.7 billion in the second half of the Seventh Malaysia Plan (1996-2000) period to stimulate economic activities and counter the sharp decline in private investment. Consequently, the share of public investment to total investment increased to 36.9 per cent during the Plan period compared with 33.1 per cent during the Sixth Malaysia Plan (1991-1995) (Economic Planning Unit 2001)

Within a relatively short period real GDP recovered to record a strong positive growth of 4.1% in the second quarter of 1999. For the first half of 1999, the economy expanded by 1.4%. Measures to restore financial market stability, significant progress made in the restructuring of the banking and corporate sectors, the accelerated implementation of the fiscal stimulus package and the favourable performance of the external sector have contributed positively to a significant revival in private consumption and export-related activities. The decline in private investment has moderated as lower stock levels and higher capacity utilization rates evident in several major industries (BNM 1999). Per capita income in current terms, which declined in 1998, rebounded to RM13,359 in 2000, surpassing the pre-crisis level.

Prior to the onset of the regional financial crisis in mid-1997, the Malaysian economy was fundamentally sound. The strength of the economy was demonstrated by a number of indicators. A high savings rate in an environment of stable price situation, low external debt, strong Government fiscal position following five consecutive years of surplus budgets since 1993 and a sound banking sector placed Malaysia in a relatively strong position from which to address the contagion effect of the regional financial crisis (BNM 1999) compared with the significant deficit equivalent to 16.6 per cent of GDP in 1982 (Figure 2.2). The fiscal deficit had been largely financed by external debt since 1980s, and the level of external debt servicing was already pushing towards the internationally acceptable norm of 20 per cent of exports. Again in contrast to 1985 when the government had to quickly cut back on its borrowings and spending, it could in 1998 afford to spend large sums of money to cushion any significant fall in domestic demand. In particular, since the foreign debt service level was less than 7 per cent of exports and exports had increased from 49 to 103 per cent of GDP, and ability of the economy to borrow externally was considerable (Barlow and Francis 2003).

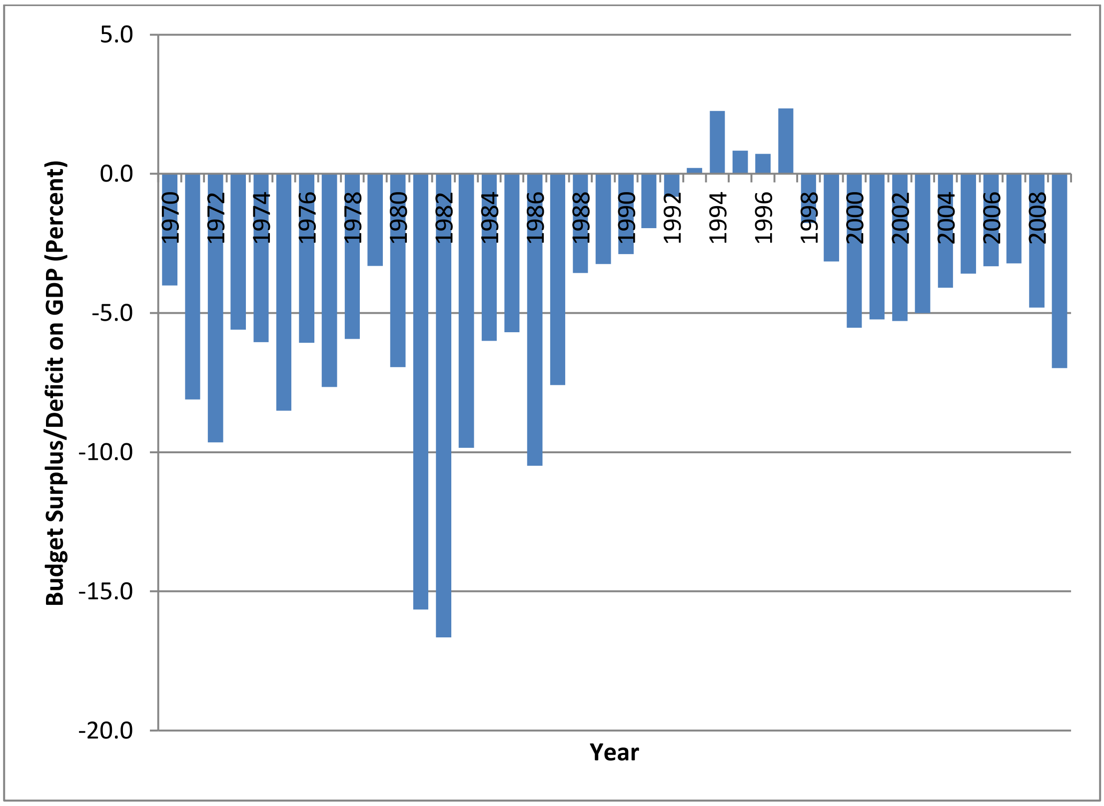


Figure 2.2. Fiscal Balance 1970-2009
Source: Developed for this research from *Economic Reports*, issues 1970/71 to 2009/10

Before the Asian financial crisis engulfed Malaysia in 1997-1998, the spending spree was private sector driven and encouraged by government policies. Much of this private spending was funded by debt, with part of this being in foreign currency borrowings. There was as in 1984 a substantial bubble in the property and stock markets building up in the domestic economy. The then economic adviser to the Prime Minister, Tun Daim, warned investors several times that Kuala Lumpur Stock Exchange (KLSE) Composite Index was rising fast and was already too high. The Bank Negara also recognised this trend, and tried to control it by setting a credit ceiling on lending to the broad property sector (Barlow and Francis 2003).

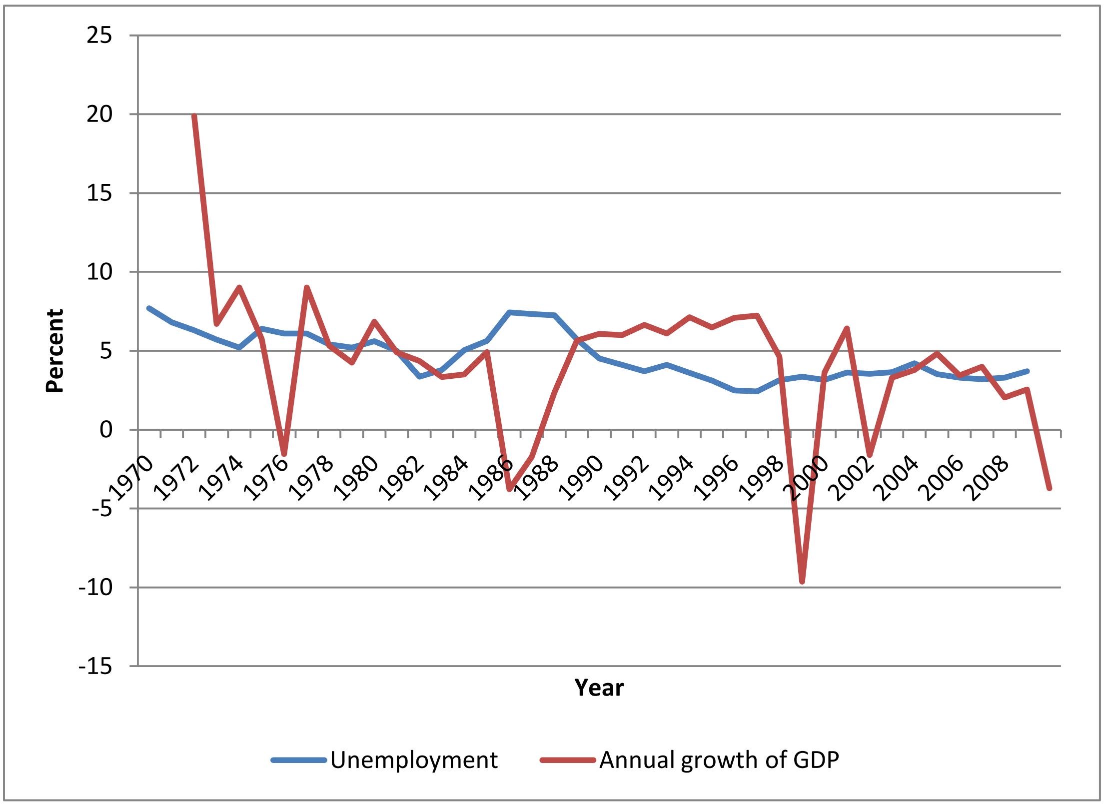


Figure 2.3. GDP growth and unemployment rate 1970-2009
Source Developed for this research from *Economic Reports*, issues 1970/71 to 2009/10

Unfortunately, that effort was aborted under intense business lobbying and political pressure. It thus seems that if there had been a well-managed publicity campaign backed up by specific actions to build domestic and international confidence, there should have been no massive erosion of confidence. Unfortunately, severe disagreements within the government on how to handle the crisis led to inadequate, if not wrong, policy responses. In particular, the initial drive to emulate International Monetary Fund policies, and especially the two-pronged attack to cut expenditure and force an immediate contraction of loans, greatly worsened the crisis (Barlow and Francis 2003).

On the other hand, and contrasting with the 1985-1986 recession, the economy was characterized by full employment and a sound government fiscal position. Not only was unemployment merely 2.4 per cent (1985: 6.9%), but more importantly there were 1.5 million foreign labourers in the country (Figure 2.3). Unofficial estimates even put the total legal and illegal foreign labour force as high as two million persons. There was thus no likelihood in 1997 of massive retrenchment of Malaysian labour, even if GDP declined sharply for a couple of years. Domestic consumer confidence should hence not have been depressed by fear of retrenchment (Barlow and Francis 2003).

Consequently, the political connected conglomerates were too indebted and lack of managerial competencies. The government either bailed them out or effectively privatised re-nationalized them, converting private debt into public burden, with no one held responsible for the losses. In the five years, the government spent RM11 billion rescuing seven privatised enterprises, including RM7.73 billion for two light rail systems in the capital (Lavender 1996).

#### 2.2.3 THE ECONOMIC STATUS 2000-2010

The Malaysian economy registered 2.74% average annual growth during the Eighth Malaysia Plan period (2001-2005) despite uncertainties in the global environment arising from the September 11 incident in 2001, wars in Afghanistan and Iraq, the dotcom crash in 2000-2002, the severe acute respiratory syndrome (SARS) in 2003 and crude oil price upsurge in 2004-2005. The expansion was broad-based with all sectors registering positive growth. The economic fundamentals remained strong. Inflation and unemployment rates were low. The current account of the balance of payments strengthened and national savings remained high (Economic Planning Unit 2006).

Over the last decade, the average annual growth is 2.5% between 2000 and 2009; Malaysia’s momentum of growth has noticeably slowed, while the growth rates of several countries in the region have improved. The slowing momentum of growth is largely attributable to the lacklustre performance of private investments, which has fallen from an average of close to 25% of GDP through the 1990s to an average of about 10% of GDP over the past decade. The moderation in private investment was partially offset by higher public investment which is average at 6.2% per annum, giving a positive growth in fixed capital formation during the Ninth Plan period. The higher public investment resulted from the two stimulus packages in 2009 and 2010 amounting to RM67 billion, as well as the implementation of the Ninth Malaysia Plan (2006-2009) projects in infrastructure, education and training and health facilities. The global expansion has enabled Malaysian companies to tap into new and larger markets, especially in the Asian, African and Middle East regions. The scope of investment has also broadened from the oil and gas sector and plantations to the construction and services sectors, particularly financial services, telecommunications, utilities and business services. This augurs well for Malaysian firms to leverage on regional growth opportunities to drive domestic economic growth through greater regional integration (Economic Planning Unit 2010).

Under the Ninth Plan, 22 projects with an estimated value of RM12 billion were undertaken via privatisation and PPP. A new wave of privatisation will be implemented under the Tenth Plan (2011-2015). Privatisation and PPP will be substantially intensified under the Plan period with 52 projects estimated at value of RM62.7 billion already under consideration. Projects under consideration include seven toll highways, five Universiti Teknologi MARA branch campuses, the Integrated Transport Terminal in Gombak, privatisation of Penang Port, and redevelopment of Angkasapuri Complex, Kuala Lumpur as Media City (Economic Planning Unit 2010).

## 2.3 PRODUCTIVITY AND EFFICIENCY

The annual average change of Malaysian's productivity has declined from 5.5% pre-crisis (i.e. 1987-1997) to 2.9% post-crisis (1998-2007) (Economic Planning Unit 2010). In 2008, the economy registered a productivity growth of 2.9% amid the challenging economic environment experienced by major trading partners such as the USA, Japan, Singapore, China, Thailand and Korea. The productivity level improved to RM49,526 from RM48,135 in 2007 (MPC 2009). In 2009, productivity of Malaysian economy contracted by 1.8% to RM48,614 lowering the capacity utilisation from 88% in 2008 to 69% (MPC 2010).

Total factor productivity (TFP) is a critical component for economic and industrial growth. The annual average change of TFP has marginally declined from 1.7% pre-crisis (1987-1997) to 1.6% post-crisis (1998-2007) (Economic Planning Unit 2010). TFP contribution to GDP increased to 29.0% during 2001-2006 period compared with 24.0% achieved during 1996-2000 period. The contribution of labour to GDP was higher at 33.2% while contribution of capital to GDP at 37.8% was lower than the 45.2% during 1996-2000 period, indicating a shift towards productivity-driven growth. The lower incremental capital output ratio (ICOR) at 6.2 during the 2001-2006 period compared with 8.6 in 1996-2000 period indicated enhanced efficiency in the utilization of capital (Economic Planning Unit 2006).

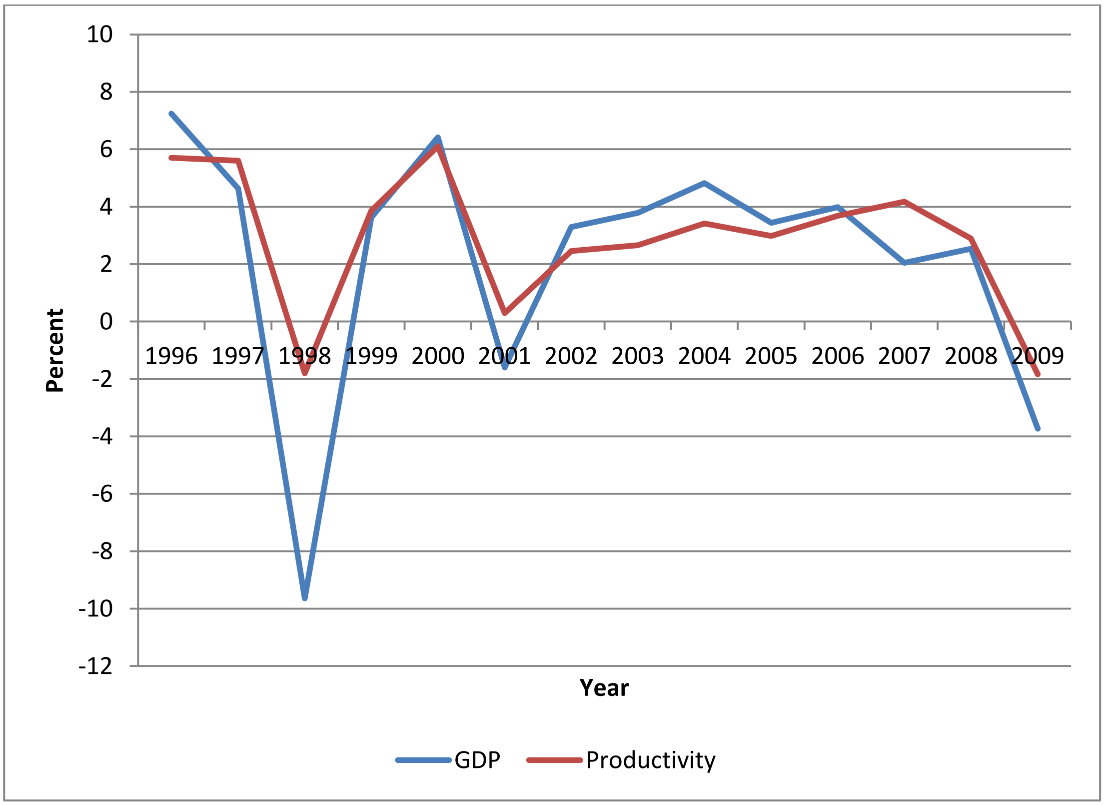


Figure 2.4. Productivity and GDP growth (1996-2009)
Source: Developed from *Productivity Reports*, issues 1999 to 2009

The policy to shift from an input-driven strategy to a productivity-driven strategy during the Seventh Plan period was affected by the economic crisis. The contribution of TFP during the Plan period was 24.0 per cent of GDP growth, while the contribution of labour was 30.8 per cent and that of capital was 50.2 per cent as shown in Table 2-3. This indicated that growth continued to be input-driven, particularly from capital. During the 1998-2000 period, additional measures were adopted to increase productivity, which included the allocation of more resources for research and development (R&D), expansion of education and training, and technology improvements(Economic Planning Unit 2001).

As the economy progressed towards becoming more knowledge-based, productivity and efficiency further improved. The total factor productivity (TFP) contribution to GDP increased to 29.0 per cent during the Eighth Plan compared with 24.0 per cent achieved during the Seventh Plan period, as shown in Table 2-3. The contribution of labour to GDP was also higher at 33.2 per cent. However, the contribution of capital to GDP at 7.8 per cent was lower than the 45.2 percent achieved during the Seventh Plan period, indicating the economy was gradually shifting towards productive-driven growth. The lower incremental capital output ratio (ICOR) at 6.2 during the Eighth Plan period compared with 8.6 in the seventh Plan period indicated an improvement towards efficient utilisation of capital (Economic Planning Unit 2006).

Table 2-3
GDP, labour productivity, capital productivity and TFP

| Years | Growth | | | | % of GDP | | |
|---|---|---|---|---|---|---|---|
| | GDP | Labour | Capital | TFP | Labour | Capital | TFP |
| 1991-1995 (6MP) | 9.5 | 2.3 | 4.7 | 2.5 | 23.9 | 50.2 | 25.9 |
| 1996-2000 (7MP) | 4.8 | 1.5 | 2.2 | 1.1 | 30.8 | 45.2 | 24.0 |
| 2001-2005 (8MP) | 4.7 | 1.5 | 1.8 | 1.4 | 33.2 | 37.8 | 29.0 |
| 2006-2010 (9MP) | 4.2 | 1.3 | 1.4 | 1.5 | 30.8 | 34.5 | 34.7 |
| 2011-2015 (10MP) | *6.0* | *1.4* | *2.3* | *2.3* | *24.0* | *37.5* | *38.5* |

Sources: Developed from *Productivity Reports*, issues 1999 to 2009

Table 2-4.
Components of TFP Growth

| Components of TFP | 1991-1999 | 1992-2000 | 1993-2002 | 1994-2003 | 1995-2004 | 1996-2005 | 1997-2006 | 1998-2007 | 1999-2008 | 2000-2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Education and training | 15.9 | 14.8 | 37.8 | 36.4 | 38.1 | 31 | 35.6 | 38.8 | 31.4 | 35.9 |
| Capital structure | 11.8 | 5.2 | 15.3 | 11.4 | 12.5 | 17 | 19.3 | 15.2 | 14.0 | 23.7 |
| Demand intensity | 2.8 | 15.1 | 35.6 | 26.4 | 27.6 | 30 | 23.8 | 19.2 | 39.7 | 16.2 |
| Economic restructuring | 2.9 | 2.3 | 1.3 | 13.1 | 13.2 | 12 | 12.4 | 18.0 | 10.0 | 10.1 |
| Technical progress | 7.8 | 6.2 | 10.0 | 12.6 | 8.6 | 10 | 8.9 | 8.9 | 5.0 | 14.0 |

Sources: Developed from *Productivity Reports*, issues 1999 to 2009

Tenth Malaysia Plan targets significant increases in productivity which will be achieved through higher levels of inputs from human capital adoption of new technologies and development of entrepreneurship to drive innovation and creativity.

The contribution of TFP to GDP is projected to increase to 38.5%, while that of capital and labour is estimated to decline to 37.5% and 24.%% respectively (Economic Planning Unit 2010).

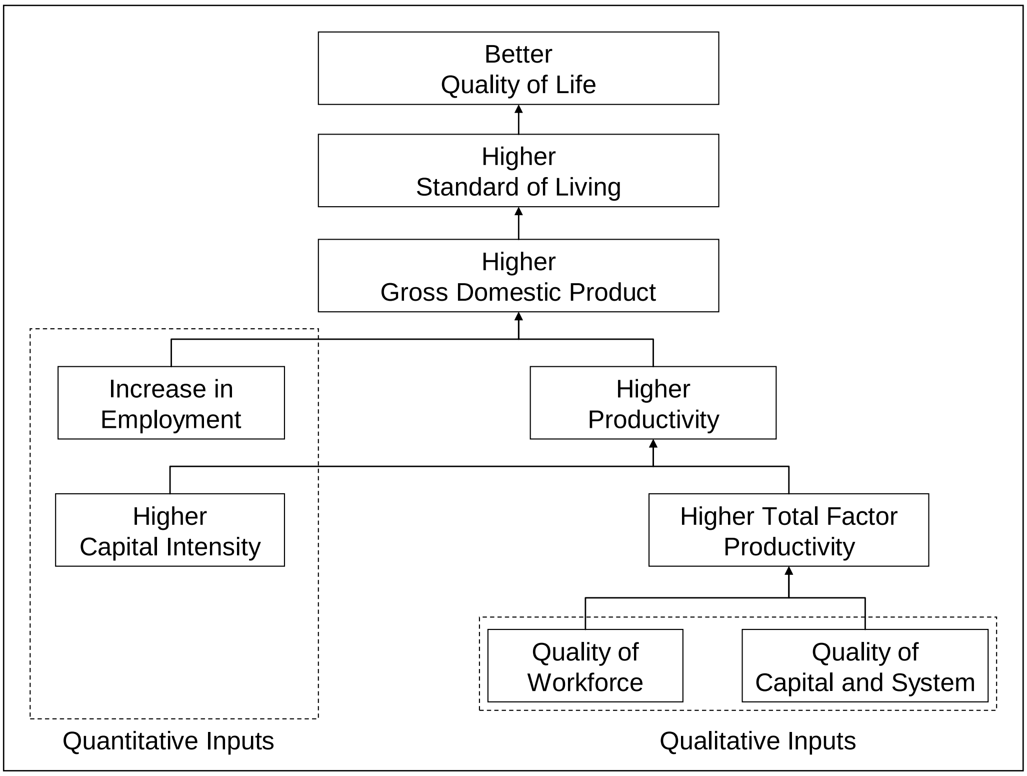


Figure 2.5. Productivity Framework
Source: NPC (2005) *Productivity Report 2004*, National Productivity Corporation Malaysia.

The growth in TFP is driven by human capital, demand intensity, technical progress, economic restructuring and capital structure. Human capital is the key thrust to ensure the country sustains its competitive edge to face the challenges of globalised economy. Investment in human capital produces skilled workers that are capable in producing better quality products and services. Investment in skills enhancement, creativity, design and innovation will improve TFP growth. For the period 2000-2009, human capital contributed 35.9% to TFP growth. Demand intensity grew by 0.2% and contributed 16.2% to TFP growth of 1.5%. The smaller contribution in the latter period was attributed to significant contraction in exports of manufactured goods. Demand intensity affects the productive capacity of the economy. A slowdown in demand will result in lower capacity utilisation of existing productive capacity. Capital structure refers to proportion of investment in productive capital. It yields immediate output as compared with investment on infrastructure, land and buildings. For the period 2000-2009, capital structure contributed 23.7% to TFP growth (Table 2.5)(MPC 2010).

Malaysia has maintained an exception record over the last quarter century. There is broad agreement that this was largely driven by the growth in physical capital stock. Although the TFP levels have been respectable, its relative contribution to growth has been modest. The World Bank reports,

> One lesson that we can draw from the Malaysian experience is that policies that encourage inflow of FDI and improve access to imported capital goods contribute to productivity growth. However, there are other policies that may have slowed down improvements in productivity growth. Rapid growth in bank lending relative to GDP is one such factor. While Malaysia managed to mobilize savings (both domestic and foreign) and the rapid growth in bank lending contributed to capital accumulation, it did not help raise productivity growth. Financial restraints, introduced in the form of negative directed lending, speed limits, and ceilings on lending to risky sectors, were not effective. More detailed industry level studies are needed on how financial system influence TFP growth (Ghani and Suri 1999).

## 2.4 MALAYSIAN CONSTRUCTION SECTOR

Historically construction activities in Malaysia could be traced back to the British Administration (1786-1957), British engineers and workers were seconded from the colonial Government of India and Ceylon (Sri Lanka) to construct the meter gauge railway track in 1882. Labourers from China and India were also brought in to work in tin mines, rubber and cocoa plantations. These labourers were housed around the mines and plantations from where town and cities began to grow. There were few general or main contractor of the kind responsible for construction today. The 'contractor' was made up of individuals of small groups of 3 to 5 people offering services and working under the direction of an architect or engineer, employed by the client (Tan 2004; Sundaraj 2006).

In the early days after independence, the construction of houses, buildings and infrastructure was slow. Contractors or construction companies tended to be family dominated and practiced the apprenticeship system. Conventional methods were used for construction, which were highly labour intensive and slow. Subcontractors are hired and organized by main contractors who bid for and obtain projects to subsequently sublet part of the contracts in packages had been grew from such early days. It is still predominant today (Tan 2004; Sundaraj 2006).

During post independence, the public sector has been the engine of growth for Malaysia. Public Works Department (PWD) has played a leading role in building social infrastructures, such as quarters, roads, railway, and government buildings, throughout Malaysia. As Malaysian was moving from an agriculture driven nation into an industrial driven nation, the private sector had been given the responsibility to accelerate her economic growth (Sundaraj 2006).

1981 was the start of the nation's development and the foundation of rapid growth. During this time, the government embarked on an aggressive foreign and industrialization policy, and implemented the Look East Policy. This policy encouraged open competition between local and foreign contractors, while providing adequate protection to the local players. The Malaysian government desired to learn from Japan and Korea and join in the ranks of the advanced countries of Asia. One of the most notable legacies of the policy was the Dayabumi building (Tan 2004).

The Dayabumi building was introduced to the Malaysian people through the Japanese technologies and management style. This building with two underground floors and 36 floors above ground, was originally planned with reinforced concrete structure and it needed 44 months to complete, but the contractor, Takenaka, proposed an alternative design of steel-frame structure and it was completed in 26 months and was opened on May 5, 1984 right on schedule. With the launch of the construction of the Dayabumi building as the impetus, Malaysia saw the beginning of great building boom (Takaneka 2000; Tan 2004).

Conversely, the RM313 million contract awarded by the government to Japanese contractor to build Dayabumi was RM71 million more expensive than the local company's bidding. Mahathir defended that Japanese would introduce new management skills and modern building techniques. However, the bumiputra engineering company that the Japanese were required to work with subsequently complained that its Japanese partners were using it merely to maintain good relations with the government, and said that no technology transfer was taking place (Lavender 1996).

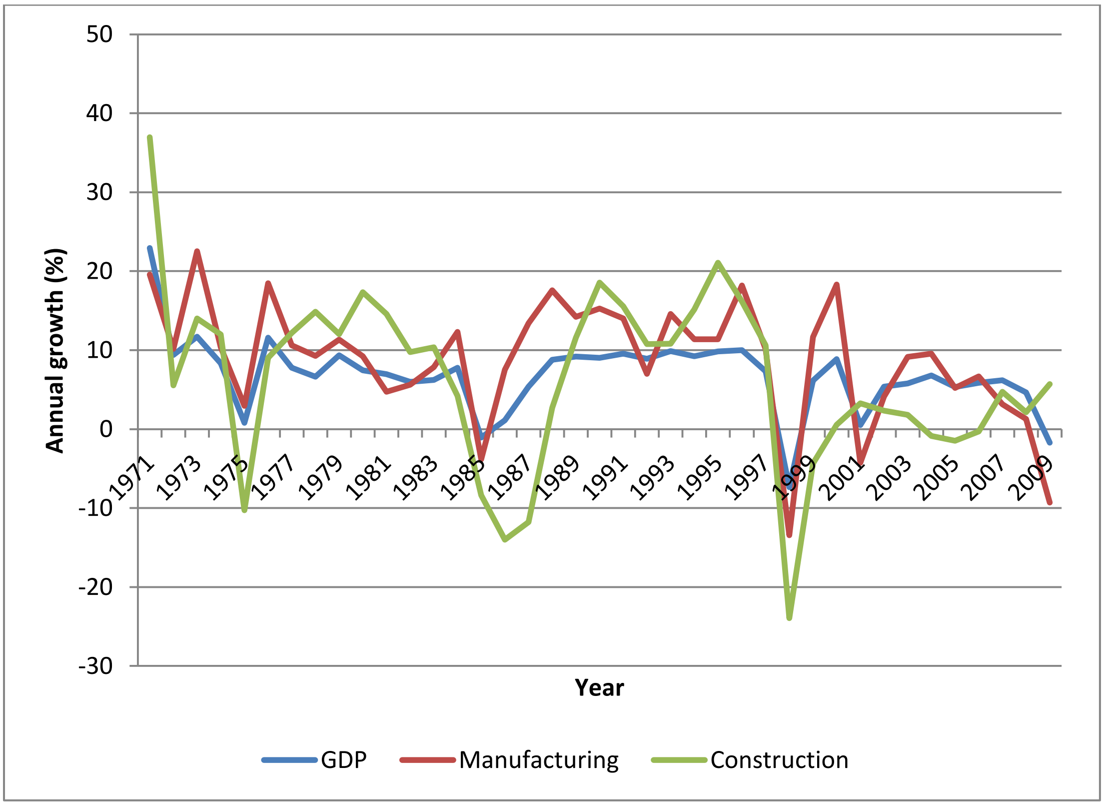


Figure 2.6 Annual growth rates of GDP and construction and manufacturing sectors
Source: Developed for this research from *Economic Reports*, issues 1970/71 to 2009/10

The period after 1981 has also seen more construction companies becoming corporatised in Malaysia. Over the years, more companies are being listed on the stock exchange to tap on the capital market for expansion (Tan 2004). Similar to many other industries, the construction industry is subject to the boom and bust cycles of the economy. The construction sector has experienced four cycles since 1960. In 1980, the Malaysian construction industry registered a double digit growth of 17.3%. However, by mid-1980's Malaysia's economic growth slumped and demand for the construction industry also weakened. Conditions worsened as global oil priced plummeted, aggravating the cost of goods, services and imports. Following the global recession in 1985, the construction underwent a correction with an average negative growth rate of 11.4% per annum for three consecutive years in 1985-87. By the end of the 1980's, the construction industry emerged from the doldrums and expanded by an average rate of growth of 13.3% during the period 1988-1997 and a peak of 21.1% in 1995 (Figure 2.6). The tremendous growth was powered by the implementation of several mega building and infrastructures expand projects towards the realization of Vision 2020 and development works carried in preparation for the 1998 Commonwealth Games. The abundance of construction projects created shortage of building materials and human resource which was lead to increasing employment of foreign workers subsequently. Nevertheless, its relative share of GDP remained relatively small at 5.1% in 1997 (1987: 3.7%) (CIDB 2004).

Growth of the construction sector was broad-based, covering the civil engineering, residential and non-residential sub-sectors. The civil engineering sub-sector expanded by 12.8%, benefiting from the government's privatized projects and the accelerated implementation of large infrastructure and civil engineering projects such as roads, highways, power transmission, telecommunication, rail transport and ports. Increased activity in the residential sub-sector, on the other hand, was supported by buoyant demand in response to higher disposable incomes. The aggressive promotion of the tourism industry also contributed to the development of non-residential sector, in particular, hotels, resorts and golf courses (BNM 1999).

During the latter part of the decade, growth in demand for residential and non-residential property was also fuelled by speculative demand following the wealth effect from a booming stock market and rising income. As a result, property transactions rose significantly, and property prices escalated, especially in major towns. During the period 1994-97, property transaction increased by an average of 8.3% in volume terms and 22.5% in value terms. The strong demand was also reflected in the significant increase in rental rates and high take-up of more than 90% for retail space in shopping complexes. Purpose built office space in the Klang Valley was seen more than double during the period 1990-97. Consequently, measures were taken as early as 1995 to address the issue of overheating and prevent the formation of an asset bubble (BNM 1999).

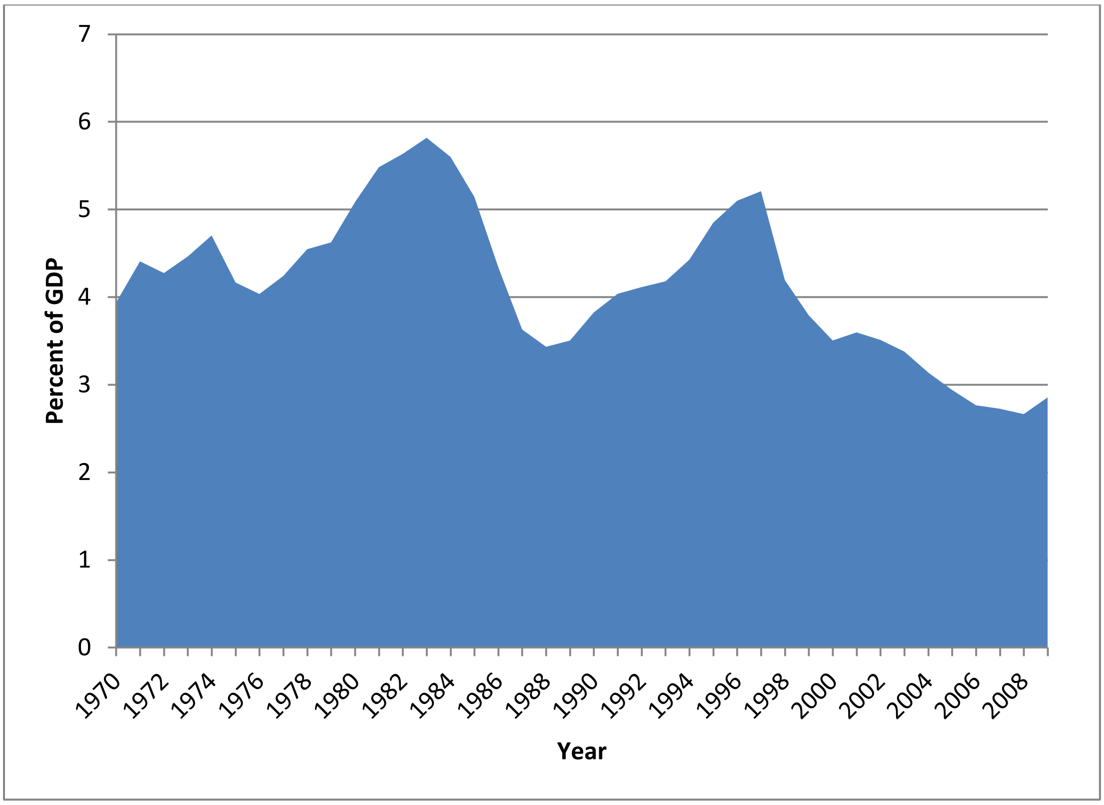


Figure 2.7 Construction industry contributions to Malaysia's GDP (1970-2009)
Source: Developed for this research from *Economic Reports*, issues 1970/71 to 2009/10

The Asian Financial Crisis in the second half of 1997 caused the Ringgit to lose more than half of its value. This led to diminished purchasing power, an escalation of debt cost that eroded wealth and income. A wave of non-performing loans and retrenchment exercises stirred political anxiety. Foreign capital took flight as investors lost confidence in the region. Concurrently, the devaluation of the Ringgit took a direct toll on contractors as supplies import, debt servicing costs and escalating foreign loan became exorbitant. Following the adverse impact of the regional crisis, the construction sector contracted 24% in 1998. Between 1998 and 1999, bad debts in the construction sector was estimated at RM8 billion. Retrenchments of workers were rampant, and in 1999 the number settled to 37,357. According to the reports received by CIDB, 115 projects worth RM2,457.47 million were either suspended or abandoned in 1998. Despite better economic climate of the country, the number rose to 149 projects in 1999, worth RM2,307.37 million. This is a 6.2% increase in terms of value and 29.6% in terms of number (BNM 1999; CIDB 2004).

To help the construction industry recover from the impact of the crisis, the Government formulated remedial solution to the overhang problem in the property market. Measures taken included:

- Exemption on stamp duties for purchase of residential properties;
- Reduction of interest rates;
- Simplified housing loan guidelines for easier purchases of houses;
- Regulations relaxation for foreign ownerships; and revival of several public projects and those in the pipeline expedited (CIDB 2004).

Just as the recovery set in, the global economy dwindled under the pressure of the meltdown of technology industries in developed nations. The construction industry's performance moved in tandem with the growth of the economy. Malaysia being a country practicing an open economy was very much affected by the trading partners' economies of those from ASEAN countries, US, Japan and the EU. Recovery measures initiated by our country left little headway as developed countries faced weakening economies that were worsened by the Afghanistan crisis, rising global terrorism issues and the heightened unfavourable geopolitical climate in the Middle East. Malaysian economy which recorded significant improvements in 1999 from the crisis was once again affected by this downturn in major economies. Malaysia's economy grew by 9.2% in year 2000 and the construction industry finally reversed its two year slowdown to record a 0.6% growth (CIDB 2004).

Despite the decrease in GDP to 1.2% in 2001, the construction industry was saved from further decline by the government's stimulus package of RM3.0 billion in March 2001. This was topped by a further RM4.3 billion at the end of 2001, post September 11$^{th}$ incident. The civil engineering sub-sector was the significant benefactor from the Federal Government's development expenditure on projects related to construction, especially in areas of transportation, education and health sectors. Construction projects implemented through the stimulus package included small construction projects, construction of rural roads, upgrading and maintenance work and privatization projects in the construction of Kajang Ring Road, the Ipoh-Lumut Highway, the Guthire Corridor Highway, the Butterworth External Ring Road and an Independent Power Plant in Perlis. As a result the construction industry grew from 0.6% in 2000 to 2.1% in 2001, against a GDP growth of 9.2% and 1.2% respectively (CIDB 2004).

The two stimulus packages in 2001 sustained economic growth; and further evidence of the Government fund injection can be seen by the value of construction work contracts awarded by the Government sector in 2001 and 2002 which were RM26 billion or 51.9% and RM23.4 billion 56.5% respectively. Among the big projects awarded by the Government in 2002 were the Tanjung Pelepas Phase 2 Harbour costing RM1.0 billion, the Kuala Lumpur Convention Centre costing an estimated RM550 million and the UNIMAS Development project costing RM750 million (CIDB 2004).

By 2003, funds under the stimulus package were exhausted, GDP strengthen at 5.4% and the growth for the construction sector was reduced to 1.5% at the end of the first half of 2003 due to lack of implementation of big projects. Major projects in Putrajaya which contributed to the growth in the construction industry has been completed and with no new leads, the construction industry could not expand further (CIDB 2004).

In 2004 and 2005, the construction sector contracted by 1.5% and 1.6% respectively. Overall activities in the residential and non-residential sub-sectors continue to expand during the years. Demand for residential properties was supported by rising disposable income and attractive financing packages, while the non-residential sub-sector benefited from the buoyant business and retail activities. On the other hand, following the completion of many privatized projects in recent years as well as lower Government spending on new large infrastructure, the civil engineering sub-sector remained weak. The excess capacity in this sub-sector encouraged many construction companies to venture abroad. Among the successfully secured contracts were in road building, housing, power generation and airport project in the regional and Middle Eastern nations. In particular, India continued to be the major destination for Malaysian contractors given its huge spending on infrastructure development (BNM 2005; BNM 2006).

Malaysian government have launched Amnesty Programme on 29 October 2004 to reduce the number of illegal foreign workers; close to 400,000 illegal workers left Malaysia between 2004 and 2005. Although the Amnesty Programme was designed to allow the speedy return of the now-legitimised foreign workers to Malaysia, delays emerged due to some administrative bottlenecks in the major source country, Indonesia. In March, 2005 the slow return of legal foreign workers created a temporary shortfall in labour in the manufacturing, construction and plantation sectors. Subsequently, Malaysian Government lifted the two-month freeze on hiring of new foreign workers in April, and allowed foreign workers from a number of different countries such as Vietnam, Pakistan, India, Nepal and Myanmar to work in Malaysia (BNM 2006).

Table 2-5
Number and Value of Construction Projects Awarded for 2000-2006

| Year | No. of Projects | Project Value (RM million) | Change in Value (Percentage) |
|---|---|---|---|
| 1996 | 3,182 | 26,747.68 | |
| 1997 | 6,136 | 57,848.03 | 116.27 |
| 1998 | 3,341 | 29,210.93 | -49.50 |
| 1999 | 5,123 | 49,497.14 | 69.45 |
| 2000 | 4,411 | 50,296.84 | 1.62 |
| 2001 | 5,155 | 51,800.67 | 2.99 |
| 2002 | 5,392 | 48,248.59 | -6.92 |
| 2003 | 4,519 | 49,015.71 | 1.59 |
| 2004 | 4,881 | 52,694.36 | 7.51 |
| 2005 | 5,493 | 53,514.05 | 1.56 |
| 2006 | 5,314 | 55,098.86 | 2.97 |
| 2007 | 7,388 | 94,416.83 | 71.36 |
| 2008 | 6,382 | 82,080.30 | -13.07 |
| 2009 | 6,145 | 65,154.79 | -20.62 |

Source: Developed for this study from *Construction Quarterly Statistical Bulletin* (Issues 2006Q3 to 2009Q3)

In 2006, the Government announced several crucial policy decisions that would influence construction activity, such as the higher Federal Government spending on infrastructure projects under the Ninth Malaysia Plan (9MP). The 17.6% increase in spending is mainly for the construction of highways, bridges, schools and water-related projects. The developmental projects outside the Klang Valley were also being emphasis. These projects included the Second Penang Bridge and the Penang Monorail, as well as the establishment of the Iskandar Development Region (IDR) to support economic growth in southern Johor. During the year, the Government undertook a number of important measures to facilitate the growth of the residential sub-sector. The Strata Title Act and related bills were amended in December 2006, to enable a faster and more transparent approval process of strata titles, as well as to provide a clearer oversight of property mangers on the management of funds collected and disbursed. Amendments were also made to the Housing Development Act, whereby the Certificate of Fitness for Occupation (CFO), previously given by the local; authorities, will be replaced with the Certificate of Completion and Compliance (CCC). The CCC will be issued by private architects and engineers, thus facilitating early occupation of buildings. The Government also liberalized rulings on foreign ownership of residential properties. Foreigner no longer need to obtain prior approval from the Foreign Investment Committee to purchase houses above RM250,000. Through these initiatives, the contraction of construction industry narrow to 0.5% in 2006 (BNM 2007).

During the boom times corporations were built up. The core business of the conglomerates tends to be centred on construction-related businesses, such as property development and manufacturing of building materials. This puts the entire corporation at risk during the recession, when the recession occurred, many of these companies were not able to survive since all of the related businesses would be affected (Tan 2004). It was a survival test for many contractors caught unaware in this slowdown as developers and clients put more projects on hold or made cancellations on construction plans. Foreign workers had to be deported as economic recession set in (CIDB 2004).

## 2.5 CONSTRUCTION SECTOR AND ECONOMIC DEVELOPMENT

Figures 2.8 show the trends of construction's share in GDP and per capital GNI and construction's share in GDP over times follow an inverted U-shaped relationship. Bon advocates that the inverted U-shaped relationship holds for any one country over time, as well. The economic development as generally unidirectional, that is, that each country must go through the three 'stages' of economic development i.e. less developed, newly industrializing and advanced industrialized status (Bon and Crosthwaite 2000).

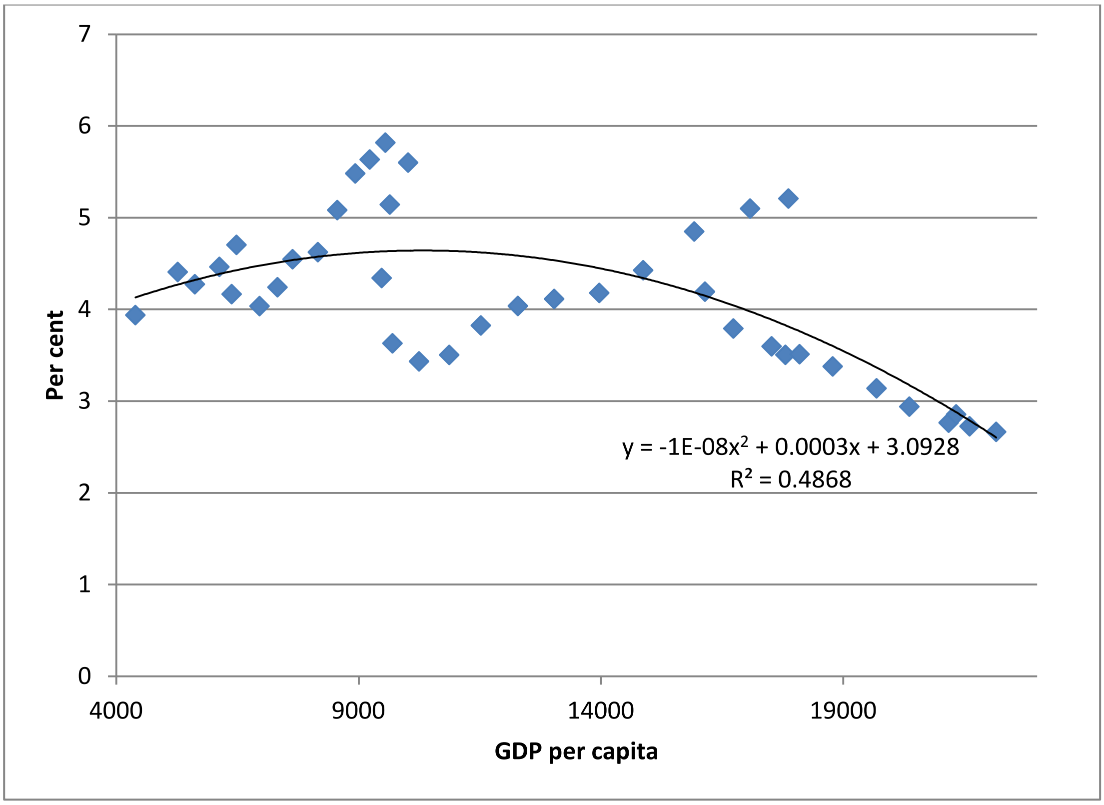


Figure 2.8 Share of construction output and per capita GNI (1970-2009)
Source: Developed for this research from *Economic Reports*, issues 1970/71 to 2009/10

Lewis study found that construction has been responsible for 6 per cent of GDP of selection of developed countries over the 36 years examined. In Malaysia, the share of construction in GDP has slowed down from 4.3% in 1970s to 3.1% in 2009. It suggests that the industry is declining in its importance to the economy. This characteristic was predicted by a number of earlier studies, such as the 'inverted U model' of Wells (1986) and Bon (1992), that share of construction would grow as a country begins development, but then, after a certain level is reached, begin to decline again (Lewis 2009).

Historically, construction accounted for around 50 per cent of a country's fixed capital formation (GFCF). Figures from the UN statistical service suggest that this is rather high and that nowadays, for the developed countries the figure is nearer to 26 per cent, however, for developing countries it is around 23 per cent. The changes over time of the proportion of construction in GFCF for the developed countries over a period of some 36 years appears to be converging at a little below 20 per cent with a range of 10 percentage points from 12.4 to 22.4 per cent (Lewis 2009).

Lewis's study found that developing countries appears a tendency to diverge so that the share of fixed capital formation in GDP has tended to become less and less similar across countries over time. One obvious reason for this is that government expenditure is normally responsible for much of the fixed capital in the form of infrastructure works and public buildings. These expenditures are first to be cut back in times of economic difficulty, such as during international recession early 1980s (Lewis 2009). As can be seen from Figure 2.9, the average share of GFCF in GDP was 17.8% in 1970s, it was continuously expanding to 23.0% and 30.4% in 1980s and 1990s respectively. Subsequently, it declined to 21.4% in 2000s. Figure 2.9 illustrates the annual change of the proportion of construction in GFCF between 1970 and 2009. The average share of construction to gross fixed capital formation are 24.5%, 20.6%, 14.8% and 14.9% in 1970s, 1980s, 1990s and 2000s respectively.

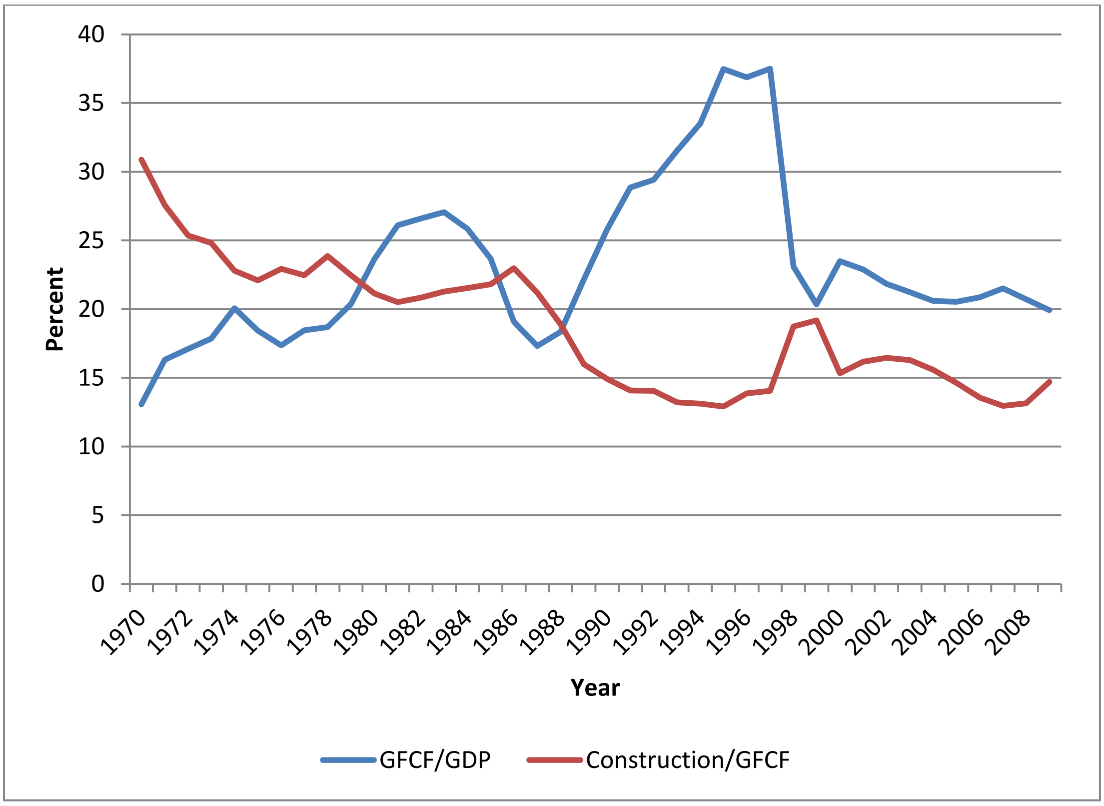


Figure 2.9 Construction as percentage of Gross Fixed Capital Formation and GFCF as percentage of GDP of Malaysia for 1970-2009 (constant 2005 RM value)
Source: Developed for this research from *Economic Reports*, issues 1970/71 to 2009/10

## 2.6 SUMMARY

This chapter begins with a historical background of economic development in Malaysia. It gives a contextual account of the political and economic environment of

Malaysian construction sector. When the nation attained its dependence in 1957 the Malaysian economy was fundamentally based predominantly on the primary sector, consisting of agriculture and mining which were major contributors to GDP as well as employment. It was heavily dependent on manufacturing in the 1960s-1980s. The financial crisis in 1998 dominated the economic features of the 1990s. Malaysian economy experienced sluggish growth in 2001, but rebounded strongly in 2002. The global financial crisis that began in 2008 have plummeted Malaysia into a severe recession again.

Since independence, Malaysia has adopted three economic policies – New Economic Policy (1971-1990), National Development Policy (1991-2000) and the National Vision Policy (2001-2010). In addition, the Privatisation Master Plan released in 1991 was introduced as part of the structural adjustment package to improve public finance in the face of rising public sector budget deficits. The close connection between privatization and affirmative action goals made Malaysian privatization unique. Soon after the privatization policy was put into effect, allegation of extensive political nepotism and patronage emerged.

The annual average change of Malaysian's productivity has declined to 2.9% post-crisis (1998-2007) from 5.5% pre-crisis (1987-1997). Similarly, the annual average change of TFP has also marginally declined to 1.6% post-crisis (1998-2007) from 1.7% pre-crisis (1987-1997).

Similar to many other industries, the construction industry is subjected to the boom and bust cycles of the economy. The Malaysian construction sector has experienced four cycles since 1960. The external shocks of the energy crisis of the 1970s, the 1980-1982 global recession and the 1997-1998 Asian financial crisis have plunged Malaysia construction sector into a more severe contraction spike than the one before. The annual growth of construction sector contracted 10.3%, 14.0%, 24% and 1.5% in 1975, 1986, 1998 and 2005 respectively.

The relationship of share of construction to the GDP is in inverted-U shape. The share of construction to GDP is 4.3% in 1970s, continue expanded to 4.8% in 1980s and subsequently declined to 4.4% and 3.1% in 1990s and 2000s respectively.

The share of construction to the Gross Fixed Capital Formation had declined from 24.5% in 1970s to 14.9% in 2000s.

This chapter has reviewed the historical economic events happened and development of the construction sector in Malaysia. The productivity of the Malaysian construction sector will be reviewed specifically in Chapter 5. Before that, the following Chapter 4 will examine the concepts of productivity and its measurement in general perspectives.

# Chapter 3: Productivity

## 3.1 INTRODUCTION

It has been highlighted in the Chapter 1 that productivity is by far the most important determinant in the long-term health and prosperity of an economy and it is the key determinant of long-run growth both for a country and for an individual organization. Despite the existence of well-developed frameworks about productivity, there is not always a common understanding of how to define and measure productivity. Confusion about productivity is caused by the many ways to define it. Therefore, it is necessary to have a precise and clear understanding of what is meant by productivity.

This chapter is focusing the literatures of 'productivity' in general; the productivity of the construction sector will be discussed in the Chapter 4. The concept and definitions of productivity are reviewed in Section 3.2. Section 3.3 compares the different productivity measures including Farrell's measurement of productivity efficiency. Section 3.4 analyse the difference in gross output and value-added productivity measures. Section 3.5 outlines the objectives of productivity measurement. Section 3.6 examines the problems of productivity measures. Finally Section 3.7 summarises this chapter.

## 3.2 CONCEPT AND DEFINITIONS

### 3.2.1 PRODUCTIVITY

Productivity is a measure of how well an individual, firm, industry or entire economy transforms its resources into goods and services and generates income. At its simplest, the level of productivity is measured as the ratio of output to one or more input. More precisely, productivity is a measure of the rate at which outputs (of goods and services) are produced from a given amounts of inputs (Productivity Commission 2004).

Input involves not only quantity but also quality which embrace raw materials, capital, land, machinery, and wages together with management, organization, skills, effort, ingenuity, creativity and attitudes. Output is not only limited to physical outputs, it include ‘invisible services’. Examples of improved services are better delivery, better quality, better output and better benefits to customer. It also embrace social concerns, such as job creation and security, poverty alleviation, resource conservation, and environmental protection (Olomolaiye, Jayawardane et al. 1998; APO 2005; Abdel-Razek, M et al. 2007).

The output of a firm can be measured in terms of the physical units produced. However, this becomes rather meaningless in construction where each building or project is unique. Therefore the money value of output is used instead because it is necessary to find a common measure in order to find the total output in a given period of time or to make comparisons (Ive and Grunberg 2000). The method of using monetary value of output to measure productivity had been criticized by Farrell (1957),

> ‘Comparisons of costs must clearly be limited to situations where all the firms compared face the same factor prices, but in such cases they constitute a much better criterion than "productivity" and are equivalent to the best "efficiency index". That they have drawbacks even in such cases can be seen from the fact that a firm's costs are proportional to its over-all efficiency, so that cost comparisons are open to the same objections as price efficiency-principally, objections arising from the possible divergence of past or future factor price ratios from their present values’(Farrell 1957).

In a nutshell, productivity is associated with efficient use of various factors of production. It is basically concerned with how efficiently a specific output of goods or services is produced and value created by the production process (Runeson 2000).

#### 3.2.2 EFFICIENCY

Efficiency has two rather distinct meanings, one of it is concerning with reducing unit cost (i.e. productive efficiency) and the other one involved dealing with scarcity of resources (i.e. allocative efficiency) (Lowe 1987).

a. ***Productive efficiency***

Productive efficiency is the production of any particular mix of goods and services in the least costly way (McConnell and Brue 2005). It is concerned with the quality and cost of inputs with the aim of minimizing the unit cost of production. From the point of view of productive efficiency under conditions of scarcity, an enterprise will have to combine the various inputs in the correct combination for optimal results to either minimize costs for a given level of production or to maximize production from available resources. It may be used for comparison of a firm, sector, or an industry over time (Lowe 1987).

b. ***Allocative efficiency***

Allocative efficiency is the least-cost production of that particular mix of goods and services most wanted by society (McConnell and Brue 2005). It is concerned with the distribution of scarce resource to a range of productive units within the economy. It aims to approach as near as possible to Pareto optimality – that is the situation when it is impossible to make anyone better off without making someone else worse off by reallocating resources (Lowe 1987). From the standpoint of allocative efficiency, the owners of the different factors of production may seek to maximize their return from those factors. These factors will receive the highest price when in their most productive uses and as a result should signify optimal productive efficiency (Lowe 1987).

The concepts of efficiency assume ability to identify change in the productivity ratios. Productive efficiency will follow if the factors being substituted – capital or material are cheaper than the factor being replaced, i.e. site labour. Allocative efficiency would follow if the factor being replaced could contribute more to the total welfare of the economy by being employed elsewhere (Lowe 1987).

Traditional labour measures productivity by comparing standard hours to productive hours give good examples of efficiency measures. However, such measures show organizations are ‘doing things right’, but they give no indication of whether an organization is ‘doing the right thing’(Grimes 2007).

There are possible conflicts of interest between the stakeholders of the industry concerning effective use of resources to achieve desired outcome. Efficiency for the contractor may mean giving priority to another job, but for the client means getting this contract completed. Efficiency in using resources must recognize their opportunity costs. Mechanization will raise output per man but is not always efficient. In developing countries, capital is scarce, equipment has to be imported and that makes it expensive, but there is a large pool of labour which cost little to employ. Manual work may mean lower output per man-hour, but it is cost-efficient (Manser 2002).

### 3.2.3 EFFECTIVENESS

Tangen (2002) advocates a single focus on efficiency does not seem to be a fruitful way to increase productivity. It is the combination of high values of both efficiency and effectiveness in the transformation process that leads to high productivity. Thus, it is possible for an effective system to be inefficient; it is also possible for an efficient system to be ineffective (Tangen 2002).

Effectiveness is a vital dimension in improving performance and productivity. Failure to take it into account can produce a false assessment of true performance. Effectiveness concerns whether set objectives have been met. Another aspect of effectiveness concerns whether the cost of compliance can be reduced, while still addressing identified market imperfections and achieving given objectives. Effectiveness will also depend on having sufficient resources and applying them well to ensure compliance with the regulation (Productivity Commission 2004).

Some components of productivity are easier to measure than others; labour cost and bought-in materials and services are more easily quantified than the level of customer satisfaction and quality of the product. The normal systems of productivity and efficiency do not normally take account of the factors relating to the way people work. It keeps out many of less quantifiable yet nevertheless essential ingredients of a successful enterprise, such as the ways people work, the initiative they use, flexibility, cooperation and adaptability (Grimes 2007). The end of this approach has led to the maximization of efficiency as a value. Given that effectiveness is taken into consideration, qualitative dimension should be taken into account.

### 3.2.4 THE TRIPLE-P MODEL

Tangen developed the Triple-P Model (Figure 3.1) to give a schematic view of how the different terms are suggested to be used. The model include five terms; productivity, profitability, performance, effectiveness and efficiency and explains how they are related to each other. Productivity is the central part of the Triple P-model and has a rather straightforward operational definition of productivity as a ratio of output quantity divided by input quantity. Profitability is also seen as the relation between output and input, but includes influences from price-factors. Performance is the umbrella term of manufacturing excellence and includes profitability as well as non-cost factors such as quality, speed, delivery and flexibility. Effectiveness is a term to be used when the output of the transformation process is focused, while efficiency represents how well the input of the transformation process is utilised (Tangen 2002).

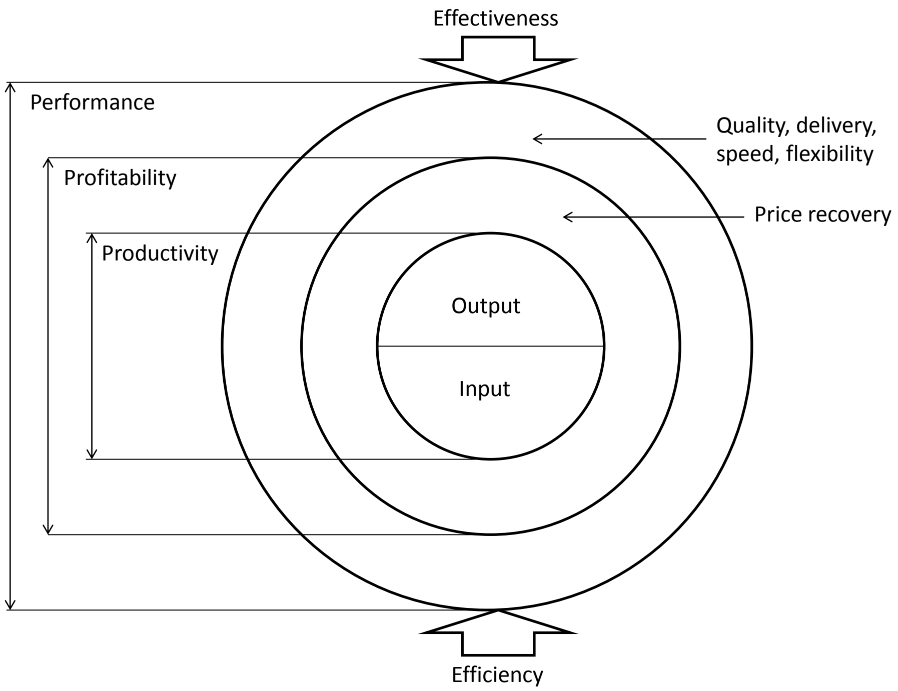


Figure 3.1 The Triple P-Model
Source: Tangen (2002)

## 3.3 PRODUCTIVITY MEASURES

Peter Drucker (1989) says 'a productivity measurement is the only yardstick that can actually gauge the competence of management and allow comparison between management of different units within the enterprise, and of different enterprises'(Drucker 1989). A survey by the Institute of Industrial Engineers also reveals that the top three responses of major obstacle to productivity are:

- Failure of management to apply proper measurement programs to evaluate productivity improvement.
- Failure of management to understand how productivity can be improved.
- Failure of management to authorize sufficient manpower to direct productivity improvements (Rao and Miller 2004).

There are many different measures of productivity. The choice between them depends on the purpose of productivity measurement and the availability of data. Broadly, productivity measures can be classified as single factor productivity measures or multi-factor productivity measures. Another distinction, of particular relevance at the industry or firm level, is between productivity measures that relate some measure of gross output to one or several inputs and those which use a value-added concept to capture movement of output (OECD 2001).

Of the three traditional factors of production, land is usually assumed as a fixed resource and consequently is not considered for the purpose of productivity measurement. This stems from the separation of the role of developer from that of contractor in the non-speculative sector of construction. Land remains the prerogative of the client or developer while labour and capital are the responsibility of the contractor. This leaves us with labour and capital as the inputs against which productivity is normally assessed (Lowe 1987).

Figure 3.2 uses these criteria to enumerate the main productivity measures. The list is incomplete insofar as single productivity measures can also be defined over intermediate inputs and labour-capita multi-factor productivity can, in principle, be evaluated on the basis of gross output (OECD 2001).

A *single factor productivity measures* or *partial productivity* relating a measures of output to a single measure of input e.g. time, labour, capital or energy (OECD 2001; Productivity Commission 2004; Flanagan, Jewell et al. 2005). Labour productivity and capital productivity are the two most common examples of single factor productivity measures.

*Labour productivity* refers to the output-to-labour ratio. This is typically measured as output per person employed or per hour worked (Royal commission into the building and construction industry 2002).

*Capital productivity* is measured as output per unit of capital (Royal commission into the building and construction industry 2002).

A *multifactor productivity* (MFP) or *total productivity measures* measure of output to a bundle of inputs. The most frequently used productivity measures are labour and capital productivity, and multifactor productivity (MFP), either in the form of capital-labour MFP or in the form of capital-labour-energy-materials MFP (KLEMS) (OECD 2001; Royal commission into the building and construction industry 2002; Productivity Commission 2004; Flanagan, Jewell et al. 2005).

| Type of output measure | Types of Input measure | | | |
|---|---|---|---|---|
| | Labour | Capital | Capital and Labour | Capital, labour and intermediate inputs (energy, materials, services) |
| Gross output | Labour productivity (based on gross output) | Capital productivity (based on gross output) | Capital-labour MFP (based on gross output) | KLEMS multifactor productivity |
| Value-added | Labour productivity (based on value-added) | Capital productivity (based on value-added) | Capital-labour MFP (based on value-added) | |
| | *Single factor productivity measures* | | *Multifactor productivity (MFP) measures* | |

Figure 3.2 Overview of main productivity measures
Sources: OECD (2001) Measuring Productivity OECD Manual: Measurement of Aggregate and Industry level Productivity Growth.

*Total factor productivity* (TFP) measures the synergy and efficiency of the utilization of both capital and human resources. It is also regarded as the degree of technological advancement associated with economic growth. Higher TFP growth is an indication of efficient utilization and management of resources, materials and inputs necessary for the production of goods and services (NPC 2005).

### 3.3.1 SINGLE–FACTOR PRODUCTIVITY MEASURES

Single-factor productive measures have the advantage of simplicity. They are easy to feed and actually measure the reality. In addition, they are easy for the workforce to understand and the reason behind any improvements can more easily be tracked (Lowe 1987; Flanagan, Jewell et al. 2005).

As single-factor productivity measures, they suffer from a weakness in that neither includes the total productive process and they do not adequately deal with the impact of technological change and factor substitution (Lowe 1987). The most used partial measure is labour productivity, often measured as output per man-hour or per employee (Flanagan, Jewell et al. 2005).

a. ***Labour productivity***

The calculation of labour productivity involves some measure of output (gross value-added and sometimes gross output) by labour input (numbers of workers, or hours).

One common measure of is average labour productivity (ALP) – a ratio of output per employee.

Average labour productivity (ALP) = Y/L

where Y = output

L = labour employed

Labour productivity, no matter how it is defined, cannot reflect inefficiency in the use of other resource inputs. A relatively high ALP could be achieved at the expense of total efficiency because ALP increases automatically as capital is substituted for labour (Crawford and Vogi 2006). Hence, if there is wasteful use of plant and equipment or material this will actually result in an increase in labour productivity in that it would increase the 'output' of the firm or industry. This substitution may or may not result in a better use of resources and cheaper unit costs of production. ALP cannot cope with changing technology or factor substitution over time. For example, if cost of labour increased relative to the cost of capital then substitution of the latter for the former would be expected. This would increase the ALP ratio to reflect the higher wage level but would not necessarily result in cheaper or more efficient production (Lowe 1987). Equally, using off-site fabricated components, which involves substituting off-site labour for on-site labour will also improve average labour productivity (Lowe 1987). A problem which applies particularly to contracting is that, given the extent to which subcontracting is employed by many construction firms, the number of directly employed operatives may be very small or even zero. This can produce ALP figures which may tend towards infinity even if the output statistics are in valued added form (Lowe 1987).

From this point of view, if ALP has any relevance, then it must be suitable proxy for operational efficiency (Lowe 1987). In the case of inter-temporal comparisons ALP will be valid provided that the other factor inputs remain the same. ALP will be of dubious accuracy in inter-enterprise comparisons (i.e. in the case of comparing one firm with another) because of the possibilities for subcontracting. It has one weakness for international comparisons (i.e. in the case of comparing domestic with foreign opposition) in that, unlike the other approaches which use pure financial ratios, it will be affected by the rate of exchange for currency. This will make such comparisons less valid during periods of instability in world currency markets (Lowe 1987).

Nevertheless, ALP measures have two advantages. First, there is an obvious welfare interpretation, e.g. income for hours worked, or output for a given labour input. Governments have obvious incentives to maximize the gross domestic product (GDP) per capita, which can be expressed as the employment rate, times GDP per worker (the national average labour productivity). ALP is distributed as wages and profits, and governments have an interest in measuring both. In other words, ALP is a measurement of a key government objective as much as it is a measure of productivity in a technical sense. Second, it is easy to calculate and often feasible where the estimation of a production function is not due to data limitations (Crawford and Vogi 2006).

ALP is indeed a measure of labour intensity of the production process and does not necessarily imply anything about the efficiency of use of resources. Labour productivity should provide a reasonable global measure of productive efficiency under certain circumstances although not suitable for inter-firm comparisons.

Measures based purely on the productivity of labour produces a very mechanistic approach to performance evaluation. The approach has resulted in narrow focus of operation, which is part of the criticism of the scientific approach to management - study after study from Mayo (1949) onwards, shows examples of cases where performance potential remains undisclosed (Grimes 2007).

An alternative measure is that of marginal labour productivity (MLP). MLP defines the increase in output that will stem the application of an additional unit of labour (Lowe 1987).

Marginal labour productivity (MLP) = $\delta Q/\delta L$

Statistically tables of output frequently use current prices, which are based on the prices actually charged. These current prices therefore increase with inflation from year to year. Consequently, values of output at constant prices that are based on the prices in one particular year are a more accurate measure of annual changes in production. It is possible to calculate real changes in construction output, using a construction price index to estimate the rise in construction prices from one period to the next. Different constant price deflators can be chosen either to eliminate the effect of general inflation occurring in the economy, or targeted more specifically to remove all price effects within construction so as to estimate changes in the physical volume of output. Eliminating the general effects of inflation is relevant for the study of firms' revenues, costs and profitability, since these are best measured relative to the rest of the economy. Removing construction price effects, taking account of specific price changes is relevant for the study of industry capacity utilization and physical productivity (Ive and Grunberg 2000).

b. ***Capital productivity***

Capital productivity, calculated on an 'internal rate of return' basis, should provide a good estimate for the marginal revenue product of capital and is not as dependent on assumption of perfect competition as ALP. Most private firms will seek to ensure an adequate return on capital invested to their shareholders – thus a high return on capital invested is far more relevant than high output per operative (Lowe 1987).

Capital productivity is usually defined in terms of a percentage return on capital invested.

Average capital productivity = $\pi K$,

where $\pi$= profit

$K$ = capital invested.

Capital productivity is a far more useful criterion than labour productivity for judging the performance of an enterprise operating within a market economy. It will provide a better assessment of its efficiency in use of resources. Wasteful use of labour and materials will reflect in profit margins and hence return on capital invested (Lowe 1987).

While capital productivity should provide a fair estimate of the overall financial management of a construction company, it will not be a good guide as to the efficiency of the contracting operations. It suffers from similar weaknesses as labour productivity on the issue of technical change and factor substitution (Lowe 1987). In addition, there are significant problems involved in determining the amount of capital (plant and equipment, buildings and structures) in use at any point of time because investment is creating new assets and wear and tear are depreciating existing assets (Royal commission into the building and construction industry 2002).

A practical feature of the construction industry is that since much of the fixed capital such as plant and equipment are hired, the industry itself being site based and no factory accommodation is required; hence fixed capital costs are low and can be treated as a variable factor in the short run. For this reason, a feasible way of increasing short-term output might be to hold the labour inputs fixed and apply more capital. Due to the very low capital requirements for contracting, the return on capital invested may be very high indeed and may tend towards infinity. In practice, most contractors will invest their surplus profits in other areas such as plant hire or property development thus increasing the shareholders' capital invested in the company. Thus it can be argued that for contracting companies the return on capital invested is more a measure of efficiency of the firm in non-contracting activities (Lowe 1987).

Nevertheless, there would be a fair degree of correspondence between the overall efficiency of use of capital and return on capital invested and the capital productivity should provide a reasonable measure of productive and allocative efficiency where appropriate (Lowe 1987).

Problems remain whichever single-factor definition of productivity is employed in that improved labour (or capital) productivity may not necessarily lead to more efficient and cheaper production (Lowe 1987). Grimes sum up the problems of partial productivity measures to: other factors in the production process ignored, unintended effect on results, mechanistic approach to measurement and performance indicators. By emphasizing selected aspects of the work, usually those most easily measured, productivity measurement forces attention and employee effort to those aspects of the work at the expense of others that may be more important (Grimes 2007).

The major objection to partial productivity measures is that they miss out on interrelationships between factors, perhaps most importantly relationship between capital investment and labour productivity. In this case, heavy investment in equipment and logistics might have been omitted or forgotten if labour productivity is used as the single measure. Hence, partial productivity measures may be very misleading if used on their own (Flanagan, Jewell et al. 2005).

### 3.3.2 MULTI–FACTOR PRODUCTIVITY MEASURES

Multifactor productivity (MFP) on the other hand is a more comprehensive productivity measure because it identifies the contribution of both capital and labour to output. MFP measures is an important tool for reviewing the past economic growth patterns as well as assessing the potential for future economic growth, in addition, for unweaving the direct growth contributions of labour, capital, intermediate inputs and technology (Liu and Song 2005). Economists tend to prefer estimating multi-factor production functions for more in-depth productivity analysis where there is a need to identify separately the contribution of all determinants to growth (including intangible inputs such as management, skills and technological progress, as well as measurable physical inputs such as labour and capital). However, the data and measurement requirements for such an approach are considerably more demanding, and as it is still an evolving methodology; therefore it cannot guarantee exact results (Crawford and Vogi 2006).

Unlike the partial measures; MFP is estimated in a way which takes changes in the mix of capital and labour overtime into account. Mathematically, MFP is defined as:

$$MFP_t = \frac{Q_t}{l_t}$$

where MFP in period *t* is the ratio of output in period *t* ($O_t$) and combined index ($l_t$) of the inputs labour (*L*) and capital (*K*) used in period t to produce the output.

The construction industry produces several different outputs and uses a range of capital inputs. Due to the different types of outputs and inputs cannot be simply added (for example, it is not meaningful to add the number of hours worked by employees to the amount of capital services consumed), therefore index number theory is used to overcome this problem.

Index of labour and capital $l_t$ is computed using a Tornqvist index. It is calculated recursively from the geometric mean of the growth rates of the labour input ($L_t$) and the capital input ($K_t$) as follows:

$$\frac{l_t}{l_{t-1}} = \left[\frac{K_t}{K_{t-1}}\right]^{W_t^k} \left[\frac{L_t}{L_{t-1}}\right]^{W_t^l}$$

where $W_t^k$ and $W_t^l$ are the average cost shares of capital ($S_k$) and labour ($S_l$) in period *t* and *t-1*. That is:

$W_t^k = \frac{(S_t^k + S_{t-1}^k)}{2}$ and $W_t^l = \frac{(S_t^l + S_{t-1}^l)}{2}$

(Tasman Economics Pty Ltd 2002)

Although multi-factor productivity measures are more comprehensive measure of productivity than single factor measures, the two methodologies share some important limitations. Both methodologies rely on highly aggregated data and numerous assumptions must be made in the process of collecting the necessary data. For example, capital estimation requires assumptions on the expected life of assets, the rate of decline in an asset's efficiency and discount rates. Taking account of changes in the quality of inputs and outputs over time as well as converting values to indexes can be problematic. The imperative limitation of the two productivity measures is they exclude the contribution of intermediate inputs to changes in productivity outcomes (Tasman Economics Pty Ltd 2002).

### 3.3.3 TOTAL-FACTOR PRODUCTIVITY

Total factor productivity (TFP) is a more holistic measure than MFP. This is because TFP measures the contribution of all inputs – labour, capital and intermediate inputs. The total-factor productivity index provides the best indication of the efficiency of the productive process employed (Lowe 1987). It is best illustrated by using the concept of a production function:

$$Y = Af(K, L, M)$$

which shows a relationship between output $Y$, inputs $K$, $L$ and $M$ (capital, labour and materials, respectively), a 'shift factor' $A$, where $f(\quad)$ is a function that gives the output for specific inputs.

*'A'* represents technological progress in the production of outputs for a given set of inputs. These include quality of management, knowledge and techniques, and best practice in various production activities. *'A'* is assumed to be 'neutral' in that it acts by shifting the production function $f(\quad)$, not by augmenting a particular input. Figure 3.3 shows a shift in a single input production function $Y = Af(L)$. For a given labour input $L$, the shift results in an increase in output of $Y_2$-$Y_1$. This increase in output is entirely due to an increase in productivity. Because the shift factor $A$ affects the productivity of all inputs, it is called total-factor productivity (TFP).

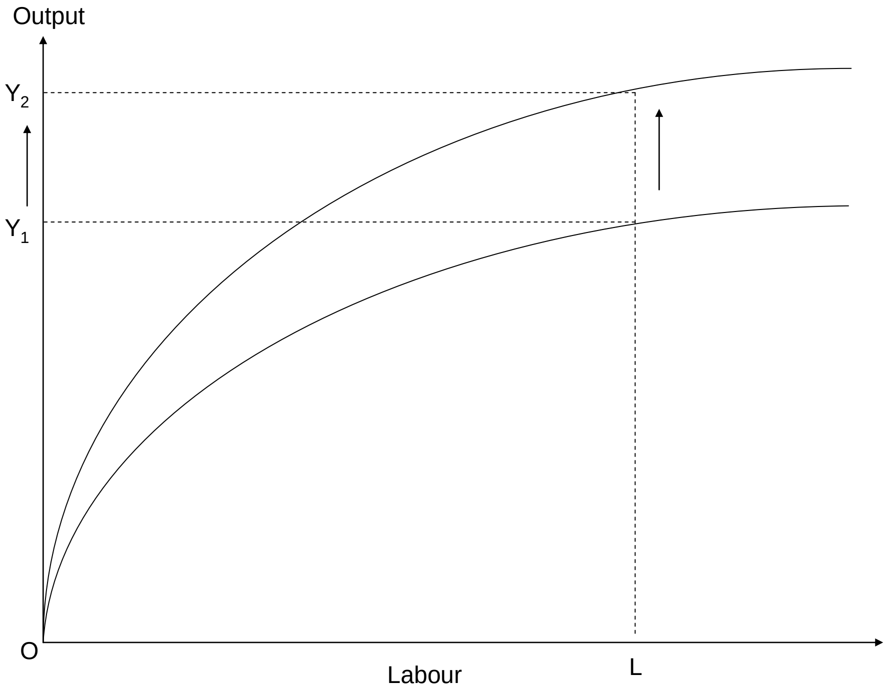


Figure 3.3. Total factor productivity

$Y = AK^{\propto_K}L^{\propto_L}M^{\propto_M}$ is a common specific form for $f(\quad)$, the Cobb-Douglas production function. The exponential $\propto_i$ on a given input parameterizes the rate at which an increase in the factor affects output. The multiplicative form of the Cobb-Douglas production function allows one to re-express it in an additive logarithmic form:

$y = \propto_k k + \propto_l l + \propto_m m + \propto$, where $\propto$ is the measure of *tfp*, that part of output not explained by the contribution of measurable inputs.

Although productivity is generally achieved through greater use of capital (capital deepening or higher capital intensity), TFP refers to the additional output generated through enhancement in efficiency arising from advancements in worker education, skills and expertise, acquisition of efficient management techniques and know-how, improvements in the organization, gains from specialization, introduction of new technology and innovation, enhancement and greater use of IT as well as the shift towards higher added value processes and industries (Abdullah and Goh 2001).

If all input and output measures were perfect, TFP would only measure technological progress. However, since this is not the case, the TFP measure will capture the impact of mis-measured and unmeasured inputs. It might also include the impact of business cycle, the market power of producers, innovation to improve products and deviations from constant returns to scale, depending on the extent to which these were captured in the specification of the estimation equation (Crawford and Vogi 2006).

TFP is likely to provide a valid measure of allocative efficiency. If the market structure is near to perfect competition, it may be assumed that the optimal allocation of resources will be ensured by the price paid for the factors of production – labour shortages being reflected by high wages – thus productive efficiency ought to ensure allocative efficiency (Lowe 1987).

The goal of productivity research is to explain TFP as much as possible by improving measurement and equation specification. The point of this is not so much to derive the most accurate estimate of technological progress, but to improve the accuracy of the estimation of the contribution of measured inputs to productivity performance, which are more natural objects of policy (Crawford and Vogi 2006).

### 3.3.4 RELATIVE PRODUCTIVE EFFICIENCY

If the theoretical arguments as to the relative efficiency of different productive units are to be subjected to empirical testing, it is essential to be able to make some actual measurement of efficiency. A number of attempts have been made to solve this problem, but, although they usually produced careful measurement of some or all of the inputs and outputs of the industry, they failed to combine these measurements into any satisfactory measure of efficiency. Productive efficiency takes account of all inputs. Productive efficiency refers to a comparison of the volume of output to that of the resources (input) used to produce the output. The productive efficiency of a construction firm is an important indicator of its competitiveness in the market. Chau, Poon et. al. (2005) investigates the factors that affect the productive efficiency of construction firms in Hong Kong. They found that: (1) economies of scale exist at the firm level; (2) firms that subcontract out more of their work have lower productive efficiency; and (3) more capital intensive firms tend to have lower productive efficiency, although these firms also have higher growth rates in productive efficiency over time (Chau, Poon et al. 2005).

Chau, Poon et. al. (2005) measure the relative productive efficiency of construction firm, a method originates from Farrell's (1957) seminal paper and was later further developed and generalized by other researchers. Suppose the efficient production function is known; that is, the output that a perfectly efficient firm could obtain from any given combination of inputs. The assumption of constant returns permits all the relevant information to be presented in a simple 'isoquant' diagram (Farrell 1957).

Input and output data of a production were used to estimate the most efficient frontier. The relative efficiency of each production unit was then evaluated in relation to this most efficient frontier.

Consider a construction firm employing two factors of production capital (K) and labour (L) to produce a single product (Q), under condition of constant return to scale. The relationship between inputs and outputs of these production units can be on a two-dimensional plane with the L/Q and K/Q as the X-axis and Y-axis respectively. L/Q and K/Q indicates the proportion of labour cost to output and capital to output respectively. A high ratio indicates high labour or capital cost. In figure 3.3, the point P represents the inputs of the two factors, per unit of output, that the firm is observed to use. Each point on the isoquant SS' represents the quantity and mix of inputs used by a production unit to produce one unit of output. Technological progress over time is represented by the movement of the SS' towards the origin. Since there is no prior knowledge, SS' is estimated by joining the observed best practices (or the most efficient Plus) by regression curve. To complete the production frontier, two curve segments are projected from the observations that use the minimum amount of each input to infinity, i.e. two extra hypothetical observations represented by $(0, \infty)$ and $(\infty, 0)$ that lie at the two end-points. The curve SS', then, will be taken as the estimate of the efficient isoquant.

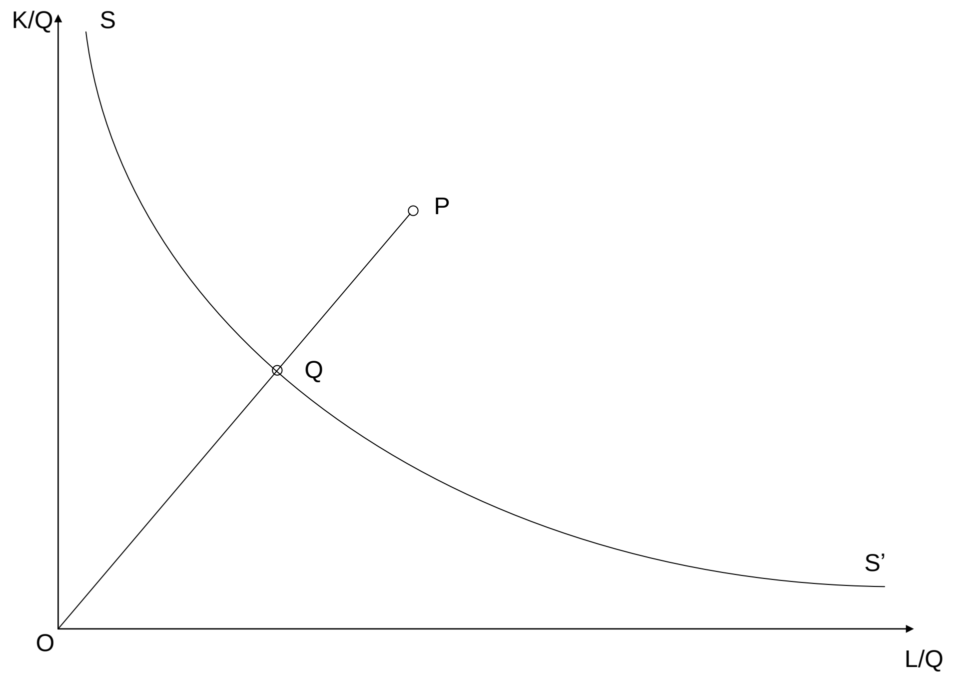


Figure 3.4 Relative productive efficiency

With these assumptions, the relative efficiency of any observation P can be evaluated by comparing the distance of P from the origin (OP) to a hypothetical observation Q on SS' that use the same input mix as P (OQ) (Chau, Poon et al. 2005).

Now the point Q represents an efficient firm using the two factors in the same ratio as P. It can be seen that it produces the same output as P using a fraction OQ/OP as much of each factor. It could also be thought of as producing OP/OQ times as much output from the same inputs. It thus seems as natural to define OQ/OP as the technical efficiency of the firm P. This ratio has the properties that a measure of efficiency obviously needs. It takes the value 100 per cent for a perfectly efficient firm, and will become indefinitely small if the amount of input per unit output becomes indefinitely large. Moreover, so long as SS' has a negative slope, an increase in the input per unit of one factor will, *ceteris paribus*, imply lower technical efficiency (Farrell 1957).

## 3.4 GROSS OUTPUT OR VALUE-ADDED PRODUCTIVITY MEASURES?

Another distinction, of particular relevance at the industry or firm level, is between productivity measures that relate some measure of gross output to one or several inputs and those which use a value-added concept to capture movement of output (Schreyer 2001). Gross output measure includes intermediate inputs (materials, energy and services used up in the process of production). Value-added measure excludes intermediate inputs.

### 3.4.1 GROSS OUTPUT

Every productivity measure, implicitly or explicitly, relates to a specific producer unit: an establishment, a firm, an industry, a sector or an entire economy. The goods and services that are produced within a producer unit and that become available for use outside the unit are called (gross) output. Output is produced using primary inputs (labour and capital) and intermediate inputs. The advantage of gross output-based estimates of productivity growth is that they acknowledge and allow for intermediate inputs as a source of industry growth. In this sense, they provide a more complete picture of the production process. The gross output-based productivity measure reflects a variety of influences including changes in efficiency, economies of scale, variations in capacity utilization and measurement error as well as disembodied technological change i.e. of advances in technology that are not embodied in new machinery and equipment. Disembodied technological change can be the result of research and development that leads to improved production processes or it can be the consequences of learning-by-doing. Gross output-based multi-factor productivity growth is positive when the rate of volume gross output rises faster than the rate of combined inputs (Schreyer 2001).

The gross output-based productivity measures are less sensitive to situations of outsourcing, i.e., to changes in the degree of vertical integration between industries. Outsourcing leaves gross output little affected, but reduces input. Increasing or decreasing labour productivity estimates based on gross output may not reflect a change in technology or efficiency but, rather, substitution between labour and intermediate inputs. For example, outsourcing activities previously conducted in-house will cause gross output per unit of labour input to increase even though the amount of labour used to produce the output may not have changed, or changed a little. In such a case, direct labour input is reduced and replaced by intermediate purchases and gross output may not necessarily increase, yet the substitution of inputs will result in an increase in measured labour productivity. Because of the peculiarities of the SIC, with the most process changes – where capital is substituted for labour and which represents a substantial source of the reduction in labour required on-site are not considered productivity improvements in building industry, but are classified as part of the manufacturing industries instead (Runeson 2000).

The other extreme is to assume that the nominal price of output is representative of increases in real output (Parker and Sieper 1991). It is difficult to establish a rate of conversion between labour and capital in order to compare them on equal terms. The solution has been using the price of outputs and inputs, and establishing the rate of change. This method works well where the value of outputs can be measure independently from the value of different inputs. However, in the building industry, there is no obvious way of measuring the output independently of the input. Rather the actual value of output has a close relationship to the cost of input. Hence, in the building industry, productivity goes up when times are good and profit is up, and goes down when times are bad and profit low. In the long run, there are very small changes (Runeson 2000).

Inclusion of intra-industry flows of intermediate products would involve double counting on both the input and output side of an industry production function. The input measure would include both the intra-industry transactions and the inputs required to produce them and output measure would include the intra-industry transactions and the goods made from them. This is best explained by way of an example: suppose that there are two firms; firm A (a subcontractor specializes in foundation) only serves firm B (a main contactor). Firm B itself produces only final output. Now assume that a productivity measure for aggregate construction and foundation industry should be formed. Simple addition of the flows of outputs and inputs implies is still possible but not the right procedure to obtain measures of output and input of the construction and foundation industry as a whole. There is double counting of outputs and inputs because of the intermediate flows between the main contractor and the foundation contractor and these flows have to be netted out. The double counting as output and intermediate inputs tends to obscure the extent of technological change or changes in efficiency taking place in the industry/sector as a whole. The extent of productivity change is artificially reduced by including intra sector transactions and this is compounded by basing industry/sector aggregates on increasingly smaller and smaller statistical units so that outputs and inputs are made larger and larger (Schreyer 2001).

Another problem is that changes in integration would introduce a bias into productivity growth trends. For example, if an establishment is divided into two with all output of one consumed by the other, the measure of output and material input would increase compared with the previous year. The addition of equal quantities to both output and input would result in a tendency toward zero in the rate of change of the materials/output ratio and in the growth of MFP. This can imply there is no technical progress in the industry (Schreyer 2001).

In summary, gross output-based measures of MFP are clearly preferable in principle in terms of estimating sectoral contributions to aggregates productivity estimates. It is potentially a better indicator of the full extent of disembodied technological change. However, it does not provide a reliable indication of the relative importance of industry productivity performance for aggregate MFP trends.

#### 3.4.2 VALUE-ADDED

The value-added measure is more meaningful in the presence of outsourcing and is generally favoured for estimating labour productivity. Value-added (*VA*), which takes the role of the output measure, is gross output corrected for purchases of intermediate inputs (Schreyer 2001). This is in effect a total measure of productivity, converted into a partial measure, by deducting the value of raw materials and bought-out goods and services from both the numerator and the denominator to give a measure of value-added during the production process (Grimes 2007). It is defined as the difference between separately deflated gross output (*Y*) and intermediate inputs (*M*), the use of value-added as a measure of output in productivity studies assumes that the underlying production function is additive-separable of the form $Y=VA+M$.

The model does not allow for substitution possibilities between the elements of the value-added function (capital and labour) and intermediate inputs. It assumes that price changes in the intermediate inputs do not influence the relative use of capital and labour; the prices of output and intermediate input always rise at the same rate and the technological change only affect the usage of capital and labour so that intermediate inputs cannot be the source of improvement in productivity. By excluding intermediate inputs, value-added based estimates of productivity growth deny improvements in productivity growth can arise from increases in efficiency in the use of intermediate inputs.

Construction sector relies inputs from manufacturing sector, which has adopted many management improvement techniques such as just-in-time production, computer-aided design and manufacturing, and other developments in reducing error rates and cut-down on sub-standard rejected production. Such improved efficiencies may be able to increase the quality of its output without changing the inputs used in the production process. On a building site, for instances, increasing the use of bought in off-site manufactured components would not necessarily change the gross output but it would cause the value-added on site to decline (Ive and Grunberg 2000). Prefabricated components bought in could increase the gross value of output per worker on site, while in fact the net value-added by the onsite labour declined (Ive and Grunberg 2000).

In addition, productivity growth as measured by the value-added method will systematically exceed the measure based on gross output by a factor equal to the ratio of gross output to value-added. Productivity in the gross output formulation is $\frac{Y}{(I+L+K)}$ where $Y$ is gross output, $I$ is intermediate input use, $L$ is labour input and $K$ is capital input. With a productivity improvement $\Delta Y$ with all inputs remaining constant, the gross output productivity growth rate is $\frac{Y+\Delta Y}{I+L+K} \div \frac{Y}{I+L+K} = \frac{Y+\Delta Y}{Y} = 1+\frac{\Delta Y}{Y}$

Productivity in the real value-added formulation is $\frac{Y-I}{(L+K)}$. With a productivity improvement $\Delta Y$ with all inputs remaining constant, the gross output productivity growth rate is $\frac{Y+\Delta Y-I}{L+K} \div \frac{Y-I}{L+K} = \frac{Y+\Delta Y-I}{Y-I} = 1+\frac{\Delta Y}{Y-I}$.

Thus, the smaller denominator in the real value-added productivity measure translates into larger productivity growth measures.

To sum up, value-added measure provides an index of the productivity of the total system. It is more meaningful in the presence of outsourcing and is generally favoured for estimating labour productivity. Under the value-added approach, improvements in the efficiency of use of intermediate inputs are overlooked. The value-added measure of productivity growth is clearly not a measure of technological change in an industry or a measure of overall improvements in efficiency.

Overall, it would appear that gross output and value-added based productivity measures are useful complements. When technical progress affects all factors of production proportionally, the former is a better measure of technical change. Value-added-based productivity measures vary with the degree of outsourcing and provide an indication of the importance of the productivity improvement in an industry for the economy as a whole. They indicate how much extra delivery to final demand per unit of primary inputs an industry generates. When it comes to labour productivity, value-added based measures are less sensitive to change in the degree of vertical integration than gross output-based measures (Schreyer 2001).

The distinction between gross output and net output in the building industry is important in understanding the contribution made by firms and labour on site to the value of the final building price. Productivity based on the gross output per worker on site has increased greatly in recent years due to the increase in prefabrication and the consequent decline in the number of workers needed on site. At the same time, the value-added to inputs by firms on site has declined as a proportion of gross output (Ive and Grunberg 2000). Nevertheless, the net productivity of site labour has continued on balance to rise, partly because of new techniques of construction, improved site management, and partly because of the introduction of improved plant and equipment (Ive and Grunberg 2000).

## 3.5 OBJECTIVES OF PRODUCTIVITY MEASUREMENT

We are taught to measure things until an attitude develops that suggests that if something cannot be quantitatively measured, it cannot be improved. With this attitude efficiency ceases to mean the greatest benefit for cost, but instead, the greatest 'measurable' benefit for the 'measurable' cost (Grimes 2007).

There is neither a unique purpose for, nor a single measure of productivity. The objectives of productivity measurement identify by OECD include tracing technology growth, identifying changes in efficiency, identifying real cost saving in production, benchmarking production processes and assessing standards of living.

The usefulness of any productivity measurement framework for policy-makers and industry practitioners alike depends crucially on the extent to which it enables the identification of the underlying drivers of productivity (Crawford and Vogi 2006).

Knowing that output per man is worth, by itself, is little use. It is only in comparison with a previous year, or another industry, that it becomes helpful. Productivity figures can be used within a company to compare progress on different sites. Comparisons over time indicate the rate of progress within a firm or an industry. Comparisons between industries monitor shifts in the structure of the whole economy. International productivity figures help to assess the competitiveness in world market (Manser 2002).

## 3.6 PROBLEMS OF PRODUCTIVITY MEASURES

Differences between market prices and true economic values of inputs and outputs may occur for a number of reasons, including lack of competitive markets, regulation that preclude market processes functioning properly, fixities that limit short-run adjustment, and market power that causes a 'wedge' between the private and social valuations. These deviations are difficult to measure using observed data by definition, since markets do not reflect appropriate economic or shadow valuations in these cases (Morrison 1998).

Quantifying constraints such as regulatory restrictions, in order to include them as arguments of the function, may also be difficult to accomplish. In many cases, however, either dummy variables representing the initiation of such regulation, or proxies for the results of such regulation may be used (Morrison 1998).

Similarly, Hope and Hope (1997) critique that approach to measuring productivity derives directly from the economic model which is reinforced by accounting system that record people as cost rather than as assets. They went on commenting that under such approach the costs of hiring, training, and developing people are written off as an expense of the period in which they happen to occur and, as a result, managers will look to minimize the costs of education, training, and development, thus causing damage to the very processes that ultimately define their competitiveness (Hope and Hope 1997). Again, Barber and Strack (2005) make the similar comment that company's operational performance will be driven mainly by the things it has in common with seemingly dissimilar people-orientated businesses. However, today's business performance measures and management practices do not reflect particular economics of people-driven business. Companies mistakenly focus on capital productivity rather than employee productivity and rely on capital orientated metrics, such as return on assets and return on equity, as these tend to mask weak performance or indicate volatility where it does not exist (Barber and Strack 2005).

It needs to consider resources rather than labour, but managers, even apt to be overly concerned with labour's use of the 'hardware' in a business, whereas labour should be viewed more of a resource in its own right, the 'software' of the organization.

Problems arises when each individual uses different types of measures for different purposes and each user, whether viewing the company internally or externally, has his or her own perspective. Often measures are used because of tradition, or because they are operationally the most practical, not necessarily the best or the most appropriate. Productivity viewed from the position of a first-line supervisor would include a much more limited range of inputs and outputs as the supervisor has no need to consider the total system. At the level of the direct worker, the measurement of performance may well be limited to a very simple ratio, and feedback will often be immediate, especially if payment is dependent upon performance. Methods of assessing performance therefore will not only depend on position, but also on the level of managerial responsibility (Grimes 2007).

The incentive schemes based on direct work measurement can actually serve to hold down productivity, as when employees did not disclose ‘loose’ rates and by working at lower performances than those at which ‘right’ rates made bonus payments marginal. Where it is tied to a bonus payment, the amount of activity increased is weighted more than the amount of useful work done. Financial benefits do not always equate with cost savings. Individual employees worked out for themselves their own satisfactions from the job, regardless of the objectives of management. By emphasizing those aspects of work, which are readily measured, and by rewarding improvements in those aspects, the importance of other aspects of work, such as discretion, initiative and flexibility, will diminish (Grimes 2007).

Productivity measures, other than companywide ones, almost always allow compensation for disruption beyond the control of the individual or group, and there is a large discretionary element in these allowances which allow the workforce, supervision, and management to adjust the figures in such a way as to produce the answer they think is correct (Grimes 2007).

There has been great emphasis and effort on achieving measures of efficiency by the use of techniques such as work measurement, rather than promoting efficiency by concentrating on methods and procedures. A concentration of effort, spent on reduction the ineffective time within the control of the direct worker and ignoring the usually greater potential for savings from management where the measures of performance are more difficult to obtain and evaluate. The use of the technique of work measurement, not simply to provide the essential data for other essential management functions, such as costing, planning, production control, personnel, forecasting and sales, but often as a means of providing data to justifying staffing reductions, thereby leading employees to believe work measurement is purely a device for controlling earnings and employment opportunities (Grimes 2007).

Minzberg (1982) sees three consequences of this approach:

- That some costs can be more easily measured than others
- That it will lead to adverse-social conditions

- Because it is costs rather than benefits that are often measured, the economy is reduced (Grimes 2007).

This requirement necessitates an approach that involves formally describing the production process and explaining as much as possible of construction output in terms of the quantity and quality of inputs that are used to generate it (Crawford and Vogi 2006).

## 3.7 SUMMARY

This chapter looks at the productivity in general; it has reviewed the concepts of productivity, efficiency and effectiveness. Tangen's Triple-P model gives a schematic view of how the different terms are suggested to be used. The three types of productivity measures, namely, single-factor productivity, multi-factor productivity and total-factor productivity has been examined. The literatures on relative productive efficiency measures are reviewed. The cons and pros of gross output and value-added measures on productivity are discussed. It has also uncovered the several problems of productivity measurement such as the difference between market prices and true economic values of inputs and outputs; quantifying constraints such as regulatory restrictions, record people as cost rather than as assets, etc. The productivity improvements can be due to technological or sociological factors and have an effect which is short term or long term. The long-term improvements have a more significant effect, which are leading to higher productivity and sustainable growth. The concepts on productivity, types of productivity measures, considerations on output and value-added measures, the long-term and short-term productivity improvement strategies have provided an essential background to study the issues of productivity encounter in the construction sector of the following chapters.

The next chapter will focus on the specific issues of productivity in the construction sector.

# Chapter 4: Productivity of the construction sector

## 4.1 INTRODUCTION

Construction productivity will affect the outcomes of national effort to build or renew infrastructure systems. Enhancement in productivity and quality is vital to build a sustainable local construction industry that is poised to compete with global players.  A wide array of organizational issues, policies, and practices that result in inefficiencies and loss of productivity of the construction industry have documented by previous researchers.

This chapter focus on the issues of the productivity of the construction sector which forms the second part of the research title. Section 4.2 looks at the determinants of construction productivity discussed in the published reports. Section 4.3 explores the nature of industry which consists of the construction process and market structure of the construction sector. Section 4.4 examines the nature of construction work. It will cover the labour and capital as factors of production, the technological progress and occupational safety and health of the constructions sector. Section 4.5 appraises the environmental nature of construction sector; it includes the business cycle, government regulations and weather. The theoretical framework is summarised at Section 4.8.

## 4.2 DETERMINANTS OF CONSTRUCTION PRODUCTIVITY

There are large number determinants of construction productivity. The determinants of construction productivity can be very complex; These factors vary from country to country, from project to project, and even on the same project anything influencing them can subsequently affect productivity (Olomolaiye, Jayawardane et al. 1998). The following sections will grouped the issues according to the nature of industry, nature of work and nature of environment.

## 4.3 NATURE OF THE INDUSTRY

### 4.3.1 THE STRUCTURE OF THE INDUSTRY

The construction industry is not homogenous; it involved a diverse set of fragmented set of stakeholders, which include owners, users, designers, general contractors, subcontractors, skilled and manual labourer, suppliers, manufacturers, regulators, financing institutions, legal representatives, insurance and bonding companies and others (NESTA 2007). Each of these groups come to a project from a different discipline and has its own objectives as it participates in the project. The statistical data from Department of Statistic divide the construction sector into four sub-sectors: residential construction, non-residential construction, civil engineering and special trade construction.

Table 4-1
Grades, tendering capacity & net worth of contractors registered with CIDB

| Grade | Tendering capacity | Paid up capacity/ Net worth | Size* |
|---|---|---|---|
| G1 | Not exceeding 100,000 | 5,000 | Micro |
| G2 | Not exceeding 500,000 | 25,000 | Small |
| G3 | Not exceeding 1,000,000 | 50,000 | Small |
| G4 | Not exceeding 3,000,000 | 150,000 | Medium |
| G5 | Not exceeding 5,000,000 | 250,000 | Medium |
| G6 | Not exceeding 10,000,000 | 500,000 | Large |
| G7 | no limit | 750,000 | Large |

*Note: Definition of SME is explained in Appendix 3.
Source: Developed for this research from CIDB and BNM *SME Annual Report 2007*

Contractors operate in Malaysia need to register with Construction Industry Development Board (CIDB). The registration will fall within seven grades (G1 to G7) which are graded based on three main criteria; tendering capacity, financial capacity, and human resources (Table 4-1). The distribution of contraction firms registered with CIDB according to the grades for years 1996-2010 are shown in Table 4-2. There are 64,593 contractors registered with CIDB as at 2010, out of which approximately 51% are in the category of G1 (Table 4-2). The construction industry in Malaysia, as in many other countries, is characterised by a mass of small enterprises. The shape of the industry structure is that of a flattened pyramid, with 6,049 large contractors at the top, and 52,497 micro and small contractors forming the broad base. There are 8.9% of large construction firms and 80.4% micro and small size firms in Malaysia in year 2009 (Table 4-2).

In recent years, with the completion of ‘mega-projects’ and subsequent economic prudence, local projects were insufficient to sustain the 64,000 odd contractors. Thus, many of the lower ranking contractors have left the industry; the number of G1 contractors has reduced from 39,191 in 2005 to 32,987 in 2010, however, the number of G7 contractors has increased from 3,476 in 2005 to 4,533 in 2010 (CIDB 2011).

Table 4-2
Percentage and grades of contractors registered with CIDB (1996-2010)

| Grade | G1 | G2 | G3 | G4 | G5 | G6 | G7 | Foreign | Total |
|---|---|---|---|---|---|---|---|---|---|
| 1996 | 53.6 | 20.2 | 16.0 | 4.0 | 3.0 | 1.5 | 1.7 | 0.0 | 100 |
| 1997 | 63.3 | 18.0 | 10.9 | 3.3 | 2.3 | 0.9 | 1.2 | 0.0 | 100 |
| 1998 | 61.5 | 15.7 | 12.3 | 3.1 | 3.0 | 1.2 | 3.1 | 0.0 | 100 |
| 1999 | 54.9 | 15.9 | 15.0 | 3.4 | 4,0 | 1.5 | 5.3 | 0.0 | 100 |
| 2000 | 52.8 | 15.6 | 16.0 | 3.6 | 4.3 | 1.6 | 6.0 | 0.1 | 100 |
| 2001 | 51.2 | 14.5 | 17.1 | 3.8 | 5.1 | 1.8 | 6.2 | 0.2 | 100 |
| 2002 | 53.3 | 12.1 | 16.6 | 3.5 | 4.8 | 1.8 | 7.7 | 0.3 | 100 |
| 2003 | 57.1 | 10.9 | 15.6 | 3.2 | 4.7 | 1.7 | 6.5 | 0.2 | 100 |
| 2004 | 58.3 | 11.1 | 15.1 | 3.2 | 4.5 | 1.7 | 5.8 | 0.3 | 100 |
| 2005 | 61.7 | 9.0 | 14.7 | 3.1 | 4.4 | 1.5 | 5.5 | 0.2 | 100 |
| 2006 | 60.7 | 9.0 | 15.3 | 3.2 | 4.3 | 1.5 | 5.7 | 0.3 | 100 |
| 2007 | 54.8 | 11.6 | 16.7 | 3.7 | 4.9 | 1.7 | 6.6 | 0.0 | 100 |
| 2008 | 53.4 | 11.8 | 17.2 | 3.8 | 5.3 | 1.9 | 6.7 | 0.0 | 100 |
| 2009 | 51.9 | 12.5 | 17.0 | 4.0 | 5.7 | 2.2 | 6.7 | 0.0 | 100 |
| 2010 | 51.1 | 12.5 | 16.9 | 4.2 | 6.1 | 2.3 | 6.9 | 0.0 | 100 |

Source: Developed for this research from CIDB. Construction Quarterly Statistical Bulletin. (Issues 2006Q3 to 2010Q4).

Table 4-3
Grades, number and percent distribution of contractors registered with CIDB and project value in year 2010

| Grade | Registered contractors | | Value of project awarded | |
|---|---|---|---|---|
| | Number | Percentage | RM Million | Percentage |
| G1 | 32,987 | 56.0 | 98 | 0.2 |
| G2 | 8,077 | 13.4 | 133 | 0.2 |
| G3 | 10,761 | 15.5 | 1,186 | 2.2 |
| G4 | 2,766 | 3.5 | 1,255 | 2.3 |
| G5 | 3,962 | 4.4 | 2,816 | 5.1 |
| G6 | 1,507 | 1.7 | 2,711 | 4.9 |
| G7 | 4,533 | 5.4 | 46,807 | 85.1 |
| **Total** | **64,593** | **100.0** | **55,005** | **100.0** |

Source: Developed for this research from CIDB. Construction Quarterly Statistical Bulletin. (Issue 2010Q4).

Table 4-3 indicates that 85% of the project values are undertaken by the 6.4% of G7 grade contractors and 2.6% of the project values are undertaken by the 85% of the micro and small firms i.e. G1-G3 grade.

The scale of small organisation activity in the construction industry is considerable. The entire construction labour market is on widespread self employment. The large contracts require specialist work and the specialist contractors are predominantly self-employed and, where necessary, employ a few additional hands (The National Academy of Sciences 2009).

#### 4.3.2 CONSTRUCTION PROCESS

The processes and relationships within the construction industry can have a significant impact on the incentives for parties to strive to improve productivity and performance. Activity in the construction industry is managed on a project by project basis. Each project draws together a wide range of skills and the project manager needs to integrate, coordinate and sequence the work so that people with the right skills are available when they are needed (Productivity Commission 2004). The three common characteristics of construction project which determine the work arrangement are:

1. each project is managed on individual basis;
2. each project draws together a wide range of skills; and
3. the specific skills needed vary during the life of the project.

Managing the workforce is therefore a complex exercise as there are many workers with different employers who are needed on the project at different points in the construction process. There is a need for a high level of coordination of work arrangements on each project so that output is not affected by inconsistencies in the work arrangements adopted by the various employers on site (Productivity Commission 2004).

Given any project from the conception stage towards completion, the whole development involves complex processes, materials, technologies, regulations coupled with years taken before completion. Within this period, operating conditions and stakeholders may change as the project progresses. It limits the opportunities for the sharing of expertise across disciplines because inefficiencies in labour, time, and knowledge management are created as each phase starts and stops and as project responsibilities and information are handed from one group to the next (The National Academy of Sciences 2009).

a. ***Procurement practice***

The Building and Construction Productivity Taskforce of New Zealand (2009) found that while the failings of cost-driven models have been recognised, clients are surprisingly reluctant to move away from this model, citing ‘cost certainty’ or ‘best market price’ as the main reason. The linear procurement method is not cost effective which can lead to perverse outcomes on user needs being neglected, loss of innovation, additional cost due to changes made after the project has commenced, poor quality and performance and disputes leading to litigation. The focus on price at the expense of other measures of value means that the industry is driven by cost rather than the amount of value derived (Productivity Taskforce 2009).

Table 4-4
Number and value of projects awarded by type of contract in Malaysia (2005-2010)

| Year | Conventional | | Design and Build | | Turnkey | | Built, Operate & Transfer (BOT) | | Engineering, Procurement, Construction and Commissioning (EPCC) | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | Value | No. | Value | No. | Value | No. | Value | No. | Value | No. | Value |
| 2003 | 4173 | 37919 | 257 | 9253 | 55 | 1832 | 3 | 11 | 53 | 545 | 4541 | 49560 |
| | *91.9* | *76.5* | *5.7* | *18.7* | *1.2* | *3.7* | *0.1* | *0.0* | *1.2* | *1.1* | *100.0* | *100.0* |
| 2004 | 4571 | 39793 | 172 | 5527 | 79 | 4863 | 6 | 32.6 | 53 | 2479 | 4881 | 52694 |
| | *93.7* | *75.5* | *3.5* | *10.5* | *1.6* | *9.2* | *0.1* | *0.1* | *1.1* | *4.7* | *100.0* | *100.0* |
| 2005 | 5065 | 41340 | 200 | 8818 | 70 | 1227 | 10 | 205 | 20 | 671 | 5365 | 52261 |
| | *94.4* | *79.1* | *3.7* | *16.9* | *1.3* | *2.4* | *0.2* | *0.4* | *0.4* | *1.3* | *100.0* | *100.0* |
| 2006 | 5521 | 51760 | 219 | 6966 | 51 | 1448 | 10 | 111 | 53 | 642 | 5854 | 60927 |
| | *94.3* | *85.0* | *3.4* | *11.4* | *0.9* | *2.4* | *0.2* | *0.2* | *0.9* | *1.1* | *100.0* | *100.0* |
| 2007 | 6630 | 72234 | 331 | 14435 | 51 | 2647 | 9 | 490 | 48 | 652 | 7069 | 90458 |
| | *93.8* | *79.9* | *4.7* | *16.0* | *0.7* | *2.9* | *0.1* | *0.5* | *0.7* | *0.7* | *100.0* | *100.0* |
| 2008 | 6102 | 67720 | 286 | 14082 | 87 | 2058 | 4 | 12 | 19 | 1777 | 6498 | 85649 |
| | *93.9* | *79.1* | *4.4* | *16.4* | *1.3* | *2.4* | *0.1* | *0.0* | *0.3* | *2.1* | *100.0* | *100.0* |
| 2009 | 6425 | 64683 | 191 | 4811 | 92 | 3346 | 6 | 12 | 4 | 10 | 6718 | 72863 |
| | *95.64* | *88.8* | *2.8* | *6.6* | *1.4* | *4.6* | *0.1* | *0.0* | *0.1* | *0.0* | *100.0* | *100.0* |
| 2010 | 3458 | 33959 | 94 | 3507 | 44 | 552 | 6 | 39 | | | 3602 | 38058 |
| | *96.0* | *89.2* | *2.6* | *9.2* | *1.2* | *1.5* | *0.2* | *0.10* | *0.00* | *0.00* | *100.0* | *100.0* |

Sources: CIDB Construction Quarterly Statistical Bulletin (2006Q3-2010Q4)

The number and value of projects awarded by conventional contract is the most common kind of procurement routes as shown in Table 4-4. The lowest price tender form of procurement is inadequate in dealing with the complexities of substantial developments, and delivered less optimal results compared to a more collaborative model where more time and effort is invested upfront with representatives of the design and construction team and in relationships. The issues of buildability were not considered sufficiently at the design stage of transaction-focused, cost-driven models. Non-productive work throughout the supply chain in pursuing and defending contractual claims for additional payments and extensions of time, and the non-productive work throughout the supply chain arising from preparing unsuccessful tenders.

b. ***Fragmentation***

The fragmentation of the construction industry resulted from the heterogeneity nature of the industry which had been discussed in the previous paragraph was illustrated by Ganesan in a simplified form (Figure 4.1). He divides the whole industry into five levels. The national economy is at the highest level '0'. Construction industry (level 1) is assumed to consist of a number of sub-sectors (highways, nuclear power plant, commercial buildings, etc.). Each sub-sector (level 2) is consisting of numerous projects (level 3), and each project involves different stages of activities from conception of a project to its completion. The organizations and individuals (level 4) that act as inputs of the activities are output of various end-products from the sub-sectors (level 2) of the industry. The model illustrates the extensive interaction taking place between subsystems, at single level interdependence as well as multilevel interdependence and also underlines from the national economy, which supplies vital resources to construction. The character of construction products and the framework of their assembly present major impediments to efforts to improve productivity (Ganesan 1984).

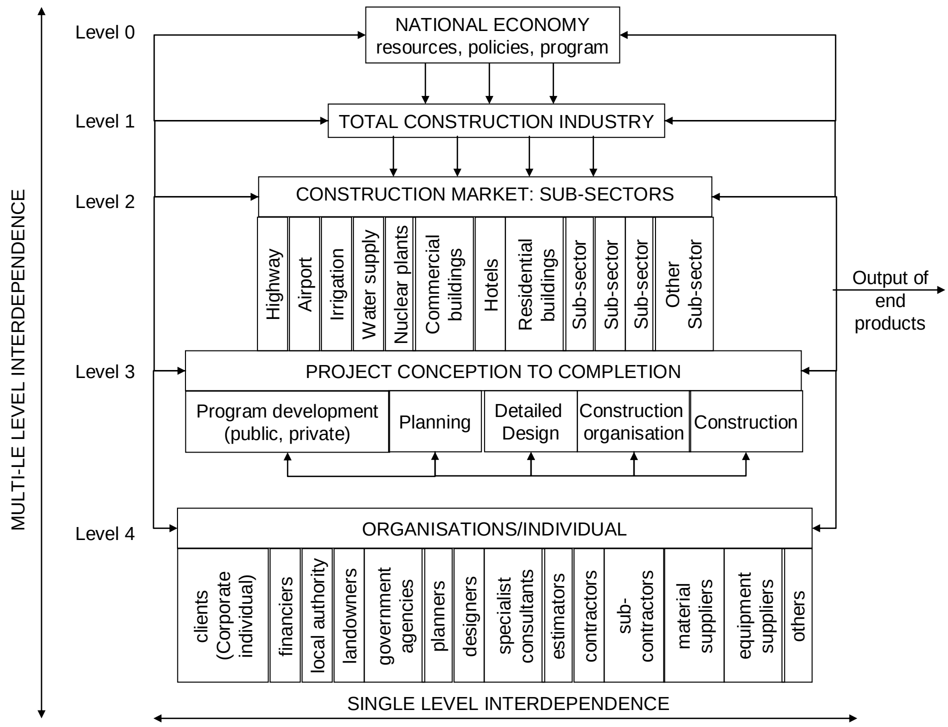


Figure 4.1. The Construction Process: Fragmentation and Interaction

Source: Ganesan S. (1984) *Construction Productivity* Habitat International. Vol. 8 No. 3/4 P.31

Fairclough (2002) summarized the reasons of fragmented nature of the industry as:

1. The industry is characterised by a large number of relative small firm, a large number of relatively small construction projects, and low barriers to entry, particularly in the (small) contracting sub-sector.
2. There are many disciplines involved in the industry – designers, constructors, professional consultants and engineers, and specialist contractors.
3. The construction process involve with long and complex supply chains, bringing together the different specialists.
4. The defensive stance of the various professional institutions which strictly maintain their independence, in the process discouraging the development of multi disciplinary skills (Fairclough 2002).

The separation of design and construction also causes increased complexity and resource needs. Ganesan noted that due to this separation and intricacy of the projects, construction activities demand a high level of knowledge and skill from workers, compared to manufacturing industries. This is one of the reasons why productivity in construction generally lags behind manufacturing industry.

Lee and Barrett (2008) proposed to recast the ‘fragmentation’ as ‘differentiation’, the debate shift from the structure of the industry as ‘problem’ to accept it as positive characteristics of the industry that is inevitable, indeed, appropriate response that provides ‘requisite variety’ to meet the complex and dynamic nature of the built environment. The design and construction of buildings is carried out by organisations that act more like coalitions than teams. The manner in which the coalitions reach compromise or better yet, synergies, between their different goals is a major factor in determining their effectiveness. The fragmented structure and predominance of SMEs in its project-based environment have developed over time as it adapts to successfully meet the challenges of its turbulent business environment (The National Academy of Sciences 2009).

c. ***Subcontracting***

Large organisations generally resort to greater use of subcontractors in a bid to reduce the overhead burden of tax (The National Academy of Sciences 2009). The firms often form a loosely organized set of subcontractors who work from time to time for a main contractor under the subcontracting system. The subcontractors tend to develop long-term relationships and rarely based on price competition because usually the subcontractors do not bid to win the work. The contractor solicits, selects and compiles, with judgement, quotations from subcontractors into a single tender (Skitmore, Runeson et al. 2006).

The need for firms to be flexible in terms of volume of trade, has also resulted in work practice that rely on a major part of the work being done through subcontracting (Runeson 2000). Subcontracting system provides flexibility in response to variations in demand and in size of project. The industry always need to respond to the market instability – the slumps and booms and demand differences in types of input needed for individual projects and the varying, often intermittent, time periods needed for each project. It was difficult for any contractor to guarantee permanent employment for large groups of tradesmen. The subcontracting makes it easier to accommodate such cyclical demand on skills (Chau, Poon et al. 2005). Although the contractor could hire and lay off workers as they required, the tradesmen themselves may keep themselves being employed constantly by subcontracting work from the several different main contractors; and they could also continue to do smaller jobs themselves independently (Morton 2002).

In addition, subcontracting is an example of the division of labour which has been seen as one of the underlying generators of economic efficiency. Productivity gains from specialization may be available, if workers are becoming increasingly proficient in their niche tasks (Productivity Commission 2004). Although there are few scale economies in the production of building site, there are scale economies not only in the production but also the installation of individual components across the industry as a whole. Besides, the most important stimulus to the growth of subcontracting (other than the labour only variety) has more recently been the highly specialized nature of much of the work (which is also, incidentally, another indication of the industry's increasing technical sophistication). To take an example, it would be uneconomic for a medium-sized contractor that builds multi-storey offices to employ its own lift engineers, who would be used once for a short period on each contract. The specialist lift firms, on the other hand, can provide continuous employment to the engineers who will install lifts in projects over a wide geographical area (Morton 2002).

While subcontracting tends to increase the flexibility of the contractors, it also has a number of adversarial effects, for example, the apportionment of responsibility for health and safety, training and the undermining of the apprenticeship system, levels of supervision on work sites. Sub-contracting requires considerable co-operation between site management and sub-contractors but contractual responsibilities are a continual source of divisiveness and also profitability (Langford and Male 2001; Productivity Commission 2004).

The subcontracting system is one of the causes of the fragmentation of the industry which had been reviewed in Section 4.3.2b. The extensive subcontracting has been creating management problems that impact on efficiency (Ganesan 1984). Failure of subcontractors to perform to required standards (which may not be their fault) or even business failure of the subcontracting firm itself can cause major disruption to building programmes (Morton 2002).

#### 4.3.3 MARKET STRUCTURE

a. ***Scale effects***

I. THE LARGE FIRM SECTOR

The economies of scale in the construction industry are limited due to the labour intensive characteristic and non-standards products of construction industry (Mao, Goh et al. 2003). Larger firms may be more efficient, since they are likely to be more technological advanced, systematically managed and gaining the advantages of specialization and of the risk-spreading of diversification to obtain all the technical and managerial economies of scale in a number of markets, such as, residential and civil engineering works, at the same time (Hillebrandt 2000). Its reserves for risk do not have to increase in proportion to its turnover as, with an increasing number of projects, the probability that they will all show losses together decreases. Another aspect of the decreasing risk with an increase in size is that the larger firm can afford to take larger risks with a possible reward of higher profits on average. It is quite possible that the large companies have been moving on decreasing cost curve overtime and through different technologies, for example improvements in management techniques and the use of IT (Chau, Poon et al. 2005).

A large company has advantages on the financial side with lower resource and finance costs due to better marketing and bargaining power in the purchase of materials. The size may give the large firm bargaining advantages, not only in price, but also in delivery dates and service. The large firm faces fewer competitors, if a company wishes to obtain finance, its size gives it direct access to the capital market and its very size gives confidence to investors (Hillebrandt 2000).

On the employment side too, there are great advantages in being able to offer good career prospects for management. Larger-firm own or invest in larger amounts of plant and equipment or other fixed capital per worker. Gruenberg and Ive found an implied bargain that workers will work with above average intensity and in return will receive above average wages in larger firms. The larger firm are able to achieve lower porosity of working day, higher work intensity, or greater non-capital-embodied efficiency and appears to show much higher levels of productivity (Gruneberg and Ive 2000).

The larger construction firms have also benefited from the pre-qualification system. Due to the risk characteristics of large projects a contractor must have demonstrated the ability to manage and coordinate such works. Prequalification based on expertise and the track record of contractors is common for tendering on larger projects. Because there are only a few major contractors capable of undertaking major projects they tend to develop strong links with major clients (Royal commission into the building and construction industry 2002).

The study by McKinsey Global Institute concluded that large productive companies can increase competition and spur productivity in their sector as a whole (Manyika, Hunt et al. 2011).

However, economic theory suggests that economies of scale will be exhausted, when firms reach a certain level of production. Economies of scale exists at the construction firm level, with the scale effect diminishing as the firm's size increases until it experiences diseconomies of scale (Chau, Poon et al. 2005). One reason why the firm may face a rising long-run average cost curve is that some inputs cannot be increased except at a higher price. If the firm has a large share of the market, the prices of its inputs could rise quite steeply. It may be that the ability to purchase supplies of materials in bulk might offset any increase due to other factor. Sand and gravel, for example, may have to come from considerably further a field or from pits more expensive to operate if the demands are large. When a firm becomes too big, it tends to be less flexible considering the bureaucracy in place, encouraging inertia and resistance to change (Chau, Poon et al. 2005). Company politics are often counterproductive and are likely to be proportionate to the size of the firm (Chau, Poon et al. 2005). The law of diminishing returns will operate and constrain the scale effects.

A firm operating in a limited geographical area may well find that substantially to increase its turnover means extending its catchments' area, and hence its costs of transport and supervision as travelling time increases. Similarly, the geographical spread of demand for projects may not coincide with the availability of manpower, either because of increased transport costs or because of the bargaining power of the operatives (Hillebrandt 2000).

Another reason put forward for eventually increasing long-run average costs is the indivisible nature of 'entrepreneurial ability' – that the decision-making process gets clogged (Hillebrandt 2000).

## II. THE SMALL FIRM SECTOR

Preponderance of the small firm is a feature of all industries; it is much more marked in the construction industry (Harvey 1996). The problems exacerbated by the numbers of small firms are: lack of high level of investment; lack of innovators and tend to rely on traditional and labour-intensive methods. Lack of utilization of plant and machinery leads to lower productivity (Manser 2002). Jaafar and Abdul Aziz (2005) reviews the resource-based view theory and factors relating to the performance of small and medium sized contracting enterprises (SMCEs) in Malaysia. The study found that majority of Malaysian SMCEs overly emphasise on securing projects and less so on profit earning. The lack of capital shows that contractor depend heavily on liability. They suggest that small and medium business owner/managers have to place emphasis on debt capital and debt management, project performance, besides building and keeping strong relationships with clients, influential parties and suppliers (Jaafar and Abdul-Aziz 2005).

The highly fragmented industry structure and lack of scale in the sector have arisen some negative consequences according to the report of Productivity Taskforce (2009):

1. Greater job security risk for employees, with reduced incentives for individual to invest in their own skill development.
2. Reduced ability for firms to develop integrated skill development and management pathways for all new entrants to the sector.
3. Reduced ability for firms to develop integrated career paths for recruits.

4. Reduced management capability and leadership in the sector, as tertiary qualified entrants to the sector are less well placed to lead other staff in managing a diverse range of day-to-day on site practical-issue.

In addition, the Productivity Taskforce found that as firm size increases, more employees stay in their job for longer periods of continuous job tenure (Productivity Taskforce 2009). This is consistent with the finding of a study focused on the perspectives of SME companies located in the East Midlands. It has revealed that the SMEs are suffering in the face of an increasingly tight labour market. They found that it is difficult to attract the requisite numbers of employees to exploit the plentiful market opportunities currently available (Dainty, Ison et al. 2005).

Additionally, smaller firms spent less on training per worker, R&D and capital investment, and that cost pressures were additionally putting pressure on safety and job satisfaction. Research of Mills and Lin (2004) based on benchmarking study of occupational health and safety (OHS) performance of 44 construction companies in Victoria, Australia. The results show that the size of company is a major factor contributing to their OHS performance. Small companies employing less than 25 employees have comparatively low levels of OHS performance compared to larger firms. Company size is limiting factor that impacts on the ability of small firms to implement comprehensive OHS plans (Mills and Lin 2004).

Small and medium-sized enterprises (SMEs) are not very innovative when compared with large-sized construction enterprises. This is particularly evident in the case of adoption and diffusion of innovation associated with information and communication technologies (ICTs). Although ICTS are powerful instruments for the rapid and broader diffusion of technical knowledge, few SMEs are fully able to exploit their benefits (Acar, Kocak et al. 2005). They in general do not consider such technologies as strategic to their business. A study on the current practices of the micro, small and medium sized enterprises in the Singapore construction industry in acquiring new capabilities through ICTs found that the key problems tended to point to costs of investment, and software extendibility and compatibility. The problem is compounded when the SMEs choose the less expensive option without giving due consideration to the extendibility of the technology. It might manifest software compatibility problems, incurring additional expenses if manual re-entry of data is required in order to integrate incompatible systems. Other common traits that had been found to exist in the smaller SMEs are their lesser tendency to use ICT for strategic purposes and for sharing information as compared to their larger counter parts (Goh 2007).

Given the continued reliance on subcontracting within the sector, future performance improvement also requires an acceptance of the benefits of supply chain partnering and integration from the small-to-medium size businesses that carry out the majority of construction work. The study of Dainty, Briscoe and Millett (2001) in U.K. construction industry has uncovered serious concerned among subcontractor that point towards a fundamental mistrust and scepticism within existing supply chain relationships. Another study of the Australia construction industry found that SMEs do not seem to be concerned with a lack of trust and cooperation among supply chain members as this is usually covered by contractual relationships (Zou, McGeorge et al. 2005). A range of attitudinal change requirements for integrating smaller companies into drive for continuous improvement are identified. It is suggested that leading clients should take responsibility for engendering the necessary attitudinal change throughout their supplier networks if further performance improvement is to be realized within the sector (Dainty, Briscoe et al. 2001).

Nevertheless, advocates of the pro-SME policy make three core arguments for its effectiveness. First, they argue that SMEs enhance competition and entrepreneurship and thus have economy-wide benefits in efficiency, innovation, and productivity growth. Second, SMEs are generally more productive than large firms but are impeded in their development by failures of financial markets and other institutions. Finally, the growth of SMEs boosts employment more than the growth of large firms because SMEs are more labour intensive (Beck and Demirguc-Kunt 2004). Oberlender has a similar view. He marked that although most construction projects starts as a single contract between the owner and a large-sized general contractor, much of the work is subcontracted to and performed by small contractors at the jobsite. Thus, small businesses play an important role, even in large construction projects. Small-sized firms perform work as a prime contractor for a large-sized project, whereas the work of large size firm is generally limited to large projects. The free-enterprise spirit and no-nonsense approach to do business is inherent in small firms. Small businesses have a natural tendency towards diversity and flexibility. The very nature of small firms, and the flexible workforce they employ, means that they frequently have difficulty in providing their employees with health and retirement benefits that are readily available for those in large businesses. Despite this difficulty, small businesses are attractive to many employees, and it is widely recognized that small businesses provide high-quality products and services in an efficient manner, and at competitive prices. These individuals are busy in performing their day-to-day work and spend little time promoting or advertising their expertise and accomplishments (Oberlender 1996).

In summary, small construction organisation, are well integrated and highly responsive to project needs, but this is often at the expense of enduring company-based improvements (The National Academy of Sciences 2009).

b. ***Competition***

In most industries, there is a range of competitive pressure that ensures that the industry operates efficiently. Such competitive pressures come from one or more of the following sources:

1. imports;
2. the need to compete in export markets;
3. similar products produced locally;
4. other producers in the industry; and
5. competition within the labour force.

Overall, these factors work together to put pressure on businesses to ensure that they have high levels of productivity. Otherwise, they will become uncompetitive and lose business. These factors also work to ensure that labour and other suppliers improve their productivity (Productivity Commission 2004).

In the building and construction industry several of these competitive pressures are weak or non-existent. Construction is a national rather than an international market. National demand is largely met by national supply. Unlike other industries, imports and exports in construction are marginal (Gruneberg and Ive 2000). Productivity Commission (2004) reports that there is no international competition in the building and construction industry,

> "…while it is possible for an overseas company to come to Australia to tender for a project, the only import is project management. Because it is not possible to import the finished road or building the full price is not subject to import competition. Similarly Australia firms can sell their services overseas, but again they are only exporting the project management component of the building or construction project." (Productivity Commission 2004)

In addition, transport makes it difficult to import many building materials. The high concentration of ownership in building materials and certain specialized contractor sectors indicates that most clients are at the mercy of the system. There are few alternative products produced locally that provide an alternative to a building or piece of infrastructure. There is virtually no competition from alternative products and services (Productivity Commission 2004).

Contrarily, Hillebrandt found that there are five groups of imports:

1. Renewable or non-renewable raw materials those are unobtainable, for natural/geographical reasons.
2. Items temporarily in short supply often used to an unexpected rise in demand.
3. Materials in which a foreign supplier has become established as a second source of supply, often originally in a previous shortage.
4. Products regarded as superior in some way to those available domestically, for which no direct local substitute of equivalent quality exists.
5. Products that are cheaper and/or of lower quality than those available in local market (Gruneberg and Ive 2000).

Grunberg and Ive reviewed the *Engineering News Record* (ENR) market data in international contracting and design and conclude that,

> "…the great majority of this international trade comprises exports from a small number of countries with highly technologically advanced construction industries compared to the rest of the world, especially to developing or less developed economies. There is relatively little trade between countries at broadly similar levels of economic development, and relatively little importing of contracting or design by countries with advanced industrial economies" (Gruneberg and Ive 2000).

Besides, construction markets are characterized by supply schedules where the short term price elasticity of supply is lower than the long run elasticity. This is because construction inputs such as the skills of the labour force, the equipment and construction plant are to a varying degree dedicated to construction or one of its sub-sectors, so it takes time to increase or decrease their supply. Likewise, the construction firms need to build up reputations of competence and probity in construction, and to have organizational structures and staff capable of tendering and managing construction projects. Consequently, their ability to adjust productive capacity is greater in the long run (Ball, Farshchi et al. 2000).

Competitive pressure is a consistent incentive for companies to push for improvements that are needed to realize the full potential economic benefits from the diffusion and scaling of innovations. Productivity growth comes from more productive companies gaining share and less productive ones exiting the market according to the study of McKinsey Global Institute. Sectors shielded from competitive pressure to reduce their costs tend to lag behind in adopting lean and other best operational practices. McKinsey's research found that highly advanced aerospace sector in US lags behind in adopting cutting-edge manufacturing processes because of limited cost competition and the large role of government procurement (Manyika, Hunt et al. 2011).

c. ***Barriers to entry***

Constraints on how freely businesses can move into the industry or between sectors within the industry are referred to as barriers to entry. Barrier to entry include: the cost of investment; access to equity and debt finance; the market power of incumbents; acquisition of a workforce with the necessary skills; and the state of the market, or growth in demand in sectors with high barriers to entry. There is less risk of new player entering the market. Such new players are more likely to be innovative in all parts of their business. In sectors with high barriers to entry the incumbents are more likely to maintain the old approaches to workplace practices and conduct (Productivity Commission 2004).

There are few barriers to entry to the building industry for small firms, and such barriers will remain low while the industry continues its current practices based on a large number of small, specialized subcontractors. Capital requirements are relatively low for entry into most construction work (Skitmore, Runeson et al. 2006). Since there are few items of plant and equipment those odd to be owned by firms, hence it was the industry practice to hire or lease plant and equipment as and when necessary (Productivity Commission 2004).

On the other hand, there are important barriers to entry for large contractors and head contractors. The pre-qualification process, and the importance of a proven track record, financial capacity and technical capability result in strong links developing between large contractors and clients (Productivity Commission 2004).

The market power of incumbents is not great in the construction industry. A more important effect, which is related to market power or position, is the need to get onto client tendering lists. There are only a few major contractors capable of undertaking major projects and they tend to develop strong links with major clients and these relationships are a significant barrier to entry to other contractors (Productivity Commission 2004).

Bidding practices, such as pre-qualification based on the expertise and the track record of contractors, and sometimes the major subcontractors, is now common for tendering on larger projects. Due to the risk characteristics of large projects a contractor must have demonstrated the ability to manage and coordinate such works. Most customers prefer established firms who have knowledge about customers, subcontractors or competitors that new entrants may not have (Skitmore, Runeson et al. 2006). Contrarily, Ball et al. argues that specialization generates benefits to a degree, but clients are always tempted to take a lower price from a firm that might marginally less competent, either because it is a new entrant to the sector or because a competitor is switching resources to it above the optimal level (Ball, Farshchi et al. 2000).

In addition, the relationship contracting widespread in the industry is becoming most important barriers to entry for firms seeking projects with the major clients. In practice, some parts of construction industry are concentrated with only a few firms operating (Productivity Commission 2004).

Most firms enter new markets through growth or diversification, being already established in one or more other markets (Skitmore, Runeson et al. 2006). A new entrant must acquire staff with combination of skills needed to compete with industry incumbents. In an industry with skill shortages, such as during building boom, this will mean recruiting from other firms when demand is strong and employment is high. During industry downturns there is greater potential to recruit or replace employees, but there may not be the workload to justify such expansion (Productivity Commission 2004).

The effects of these barriers to entry is another factor that reduces the incentives for the large businesses operating on major projects to attempt to break ranks and run the risks of trying to improve productivity (Productivity Commission 2004).

## 4.4 NATURE OF WORK

The construction sector is always being perceived as a low productivity sector due to its labour intensive nature of construction process and low-technology image. It suffers from a number of stereotypes, such as long hour, hardworking conditions, relatively low pay, low or no entry level qualification, and uncertainties about prospects (Productivity Taskforce 2009). Construction workers are tended to expose to the high levels of noise, dust and airborne particles, adverse weather conditions, and other factors which are causing fatigue and injuries and reduction in efficiency and productivity (The National Academy of Sciences 2009). The inability to attract and develop local workforce for the industry mainly due to the “Dirty, Dangerous, Difficult” image of the industry (CIDB 2007).

Technical choices of the construction industry are influence by design. Technical processes range from labour–intensive approaches to equipment (automated) processes relying on plant, machinery or robots for on-site construction or the assembly of prefabricated materials. Labour-intensive approaches are suitable for simple construction relying on semi-skilled/unskilled labour using hand tools and light equipment. Equipment-intensive approaches are used in advanced construction relying on small highly skilled and productive labour using heavy plant and machinery (Howes and Robinson 2005).

#### 4.4.1 LABOUR INTENSIVE

Gruneberg and Ive (2000) divides the labour involve in the construction industry into two categories, i.e. productive workers and the administrative, professional, technical and clerical workers (APTC). They view that the net output of the industry is being produced only by productive workers. The APTC staff is similar to the ‘management’ described in scientific management by Taylor’s (1961). They are responsibility for employing, training and equipping workers for the job in order to achieve optimum productivity through proper plans, control and coordination of resources. They need to control transaction costs (rather than production costs) or in efforts to control the terms-of-trade between main contractors on the one hand and both clients and subcontractors on the other (Gruneberg and Ive 2000). Organisations tend to maintain a stable but minimum level of resources and spread them over as many jobs as they can produce, causing slower progress on site (Ganesan 1984). With increased project size and complexity this responsibility has become even more important; management inadequacies can result in a waste of resources with consequent losses in productivity (Gruneberg and Ive 2000).

However, Runesan (2000) noted that the frequency and size of the changes in the level of activity in building and construction industry have a number of implications on the supply of skills formation. He explains

> ‘When employment increases, unskilled or poorly-skilled workers are temporarily to the industry; the overall skills level drops. The periods of high employment are normally short duration; there is no time and no incentive to engage in formal training. Skills development is consequently almost

> exclusively 'on the job' training; very specific and because of the length of time, fairly superficial. When employment in the industry contracts, it will primarily affect the most unskilled. However, because employment is related to projects, many highly skilled tradesmen will also be forced to leave their jobs or the industry. Some also leave voluntarily for more secure employment in other industries. As a rule, these workers do not return to the building and construction industry these when the level of economic increases and employment prospects improve. Hence, we have a continuous drain on skills, together with little interest in investing in new skills formation'(Runeson 2000).

Productive workers or labour acts as the hub for other resources and hence is a major controlling variable in construction productivity. Chau and Lai (1994) comments that the slow in labour productivity in construction industry is partly due to the labour intensive nature of the construction process and partly due to the inherent difficulty the industry has in adopting labour saving technologies. The labour intensive nature of the construction process simply means that output (in value adds terms) per unit of labour, at any point in time, is likely to be lower than the economy. The fragmented structure of the industry and its apparent stagnant technological progress further strengthens this belief (Chau and Lai 1994).

The personal attributes of the worker can also affect productivity in a particular trade, craft or operation through: (i) skills, qualifications, training and experience, (ii) innate ability – both physical and mental energy – and (iii) the intensity of the application both skills and innate ability to the production process (Olomolaiye, Jayawardane et al. 1998). The speed with which activities can be completed is the experience of operatives have had both in working together and in working on a particular form of construction – how far up the learning curve they are, as it is sometimes expressed. There is a considerable degree a new learning curve for each project, but where a number of projects have the same characteristics and are carried out mainly by the same teams, productivity can rise considerably (Morton and Jaggar 1995).

The willingness to work hard is affected by general conditions on site, relationships between managers, supervisors and operatives but also by the terms of employment. It is naturally a matter of individual motivation which will affect the speed of work and hence the productivity. (Morton and Jaggar 1995). When autocratic management puts pressure on employees without removing the causes of low production the result is more absenteeism, staff turnover, sabotage or strikes. On the other hand, democratic management that attempts to change worker attitudes without fulfilling its own functions may result in negligible improvement. Research by Olomolaive (1989) indicates that motivation explains only 25% of the productive time; that is 75% is controlled by management actions, and on-site problems are more important than operative influences. The need to perform management duties properly should be addressed before any attempts to unlock the latent abilities of workers are introduced (Olomolaiye, Jayawardane et al. 1998).

Baily and Solow (2001) discovers that the big productivity differences between the U.S. and Brazil in construction come not so much from skill levels of workers, but from scale and from the ability of the supervisors and project managers to coordinate people and activities. Another advantage in the United States is the use of specialized workers who brought into the site when needed. They move to different project when their task is done and can thus remain fully utilized. Brazil (and also Russia) lacks these mobile, independent, specialized trade workers (Baily and Solow 2001).

#### 4.4.2 CAPITAL INTENSITY

Productivity can be seen as a function of capital intensity. Capital intensity is the ratio of capital to labour and shows the volume of plant and machinery per person employed. The greater the capital intensity of a product process the less labour is required in order to produce a given output. When wages are relatively high firms adopt methods of production that are capital intensive, using plant and equipment to increase productivity of labour. An increase in workloads can be met through the greater use of plant and machinery, rather than by employing more people. When wages are low the incentive to substitute labour with capital equipment is reduced and demand for labour is the responsive to changes in the workload of firms (Ive and Grunberg 2000).

Capital intensity is relatively low in the construction. Capital intensification has been achieved in building only to a limited degree through improvements in the plant and machinery used on site, but more significantly by a shift towards prefabricated components, such as curtain walling and factory produced modularised systems. Thus the increased use of prefabrication techniques has been the response by construction firms to the increase in the wages of site labour relative to site productivity. However, it is not only capital intensity which raises productivity but also the technology embodied in the equipment. New plant and machinery will tend to be more productive than older vintages because of continual research and development. New plant and equipment incorporates the latest technological developments and innovations (Ive and Grunberg 2000). However, the cost of new machinery can drop. This could make it possible to increase the amount of machinery without raising the value of capital, wrongly implying that there would be no improvement in productivity. In fact, it would be possible for workers working with cheaper equipment to produce more than workers working with expensive older plant. This is especially the case with computerised equipment. Nevertheless, provided that the age, price and quality of equipment is taken into account, the value of capital stock owned per employee can be useful for the purpose of making inter-company comparisons (Ive and Grunberg 2000).

The process of increasing the ratio of capital to labour is known as capital deepening, which increases the capital intensity of a production method. Capital intensity is not the only measure of the advancement of an industry, because the vintage of technology used and the rate of technical change are also important. The expense of machinery, high capital to labour ratios are often associated with predictable demand and monopoly control, since high profit margins and minimum risk are needed to undertake, finance and sustain investment in plant and equipment.

Moreover, where mechanisation has occurred, its cost advantages over manual methods are usually far from marginal, and therefore unlikely to be removed by any feasible shift in relative input prices. Since mechanization means providing workers with tools and power, it is really a substitution of capital for labour. The extent of such substitution depends upon how efficient firms are forced to be through competition and the productivity and price of capital compared with the productivity and price of labour.

On the other hand, Harvey (1996) pointed out that capital tends to be specific to one process, so it is not a good substitute for labour. The nature of the work of the industry as a whole limits the substitution of capital for labour (Harvey 1996). Civil engineering represents a different case where machine-for-labour substitution has been a more important process (Ive and Grunberg 2000).

In fact over time technical change makes more capital intensive methods profitable, and this in itself favours those firms able to command larger amounts of capital. Assuming that firms already use the least cost method of production, then the average firm is trying to increase its total output at a rate faster than the whole sector is growing. If an individual firm succeeds in this, then necessarily it becomes, both absolutely and relatively, larger as a firm. However, if the total number of firms remains the same, by definition they cannot all succeed in outgrowing the sector at large, and some must shrink in order for others to grow. Alternatively, the total number of firms in the sector can fall. Competition between firms is then the process which permits some to grow at the expense of others, which shrink or cease to exist (Gruneberg and Ive 2000).

The relative success of a firm in one time period is positively correlated with relative success in the next time period, and so on. It is therefore possible to describe a system of cumulative causation, of virtuous and vicious cycles. This process of cumulative causation occurs in the context of firms competing with one another in an uncertain and continuity changing economic context. Adaptation to these changes normally requires investment of capital, whether to change method of production or change products. Firms that have recently been unsuccessful will lack the retained profit to make these adaptive investments, and are therefore likely to become still less successful as time passes. It is also possible that there are important economies of scale, either to scale of a production unit or of an ownership unit. An ownership unit may be a parent company which owns several completely separate production units. Large ownership units are often in a position to take advantage of financial economies of scale. These parent companies are usually able to raise additional capital, beyond their retained profits, more cheaply than smaller ones, either by borrowing or by issuing new share capital above-average growth makes a firm larger than its rivals, if all started at the same size, and therefore gives it the benefits, if any, of economies of scale (Gruneberg and Ive 2000).

#### 4.4.3 TECHNOLOGICAL PROGRESS

Technology progress involves two aspects: advances in knowledge and rate of diffusion of new knowledge. Advances in knowledge come from two sources: organized R&D activity and informal R&D through job practice. In addition, construction technology change is also affected by technology progress of the country as a whole. New technology can be diffused through modernizing capital goods or through international technology transfer (Mao, Goh et al. 2003).

The influence of technology on the productivity of inputs is fairly straightforward. The more superior of technologies becoming available, the less the direct variable input cost to firms of a given increase in the output volume, and the bigger the saving in direct cost relative to capital of technology. It raises labour productivity relative to the wage rate (Ive and Grunberg 2000).

However, Morton and Jaggar view technical advance, though significant, has not always been the major contributor to increasing site productivity (Morton and Jaggar 1995). Their view is shared by Olomolaiye, Jayawardane et al, (1998):

> 'the 'big bang' approach to increasing productivity, whereby management seeks to improve productivity through large capital expenditure, is naïve because more investment in technology is not necessarily a cure for low productivity. With advances in technology, construction managers should be better equipped with new developments and operatives should be better trained to use new equipment and tools to maximize the advantages'.

a. ***Research and development***

In the Malaysia construction industry, the pace of innovation through Research and Development (R&D) and the adoption of new construction methods are relatively low due to the abundance of cheap foreign labour. Presently, Malaysian construction companies tend to buy technology from abroad rather than invest in innovation (CIDB 2007). Malaysia generally is technologically less advanced than other developed countries; the main source of technological progress in Malaysian construction sector has been technological transfer from other countries. New technologies are imported from other countries through various channels, such as new plants, new equipment, new materials, the use of expatriate professionals, the participation of overseas contractors and so forth.

Despite the lack of R&D initiatives in the Malaysian construction industry, there has been progress on the local front to encourage and stimulate R&D activities in the construction industry. Construction Industry Development Board (CIDB) provides annual allocations for R&D activities which are implemented by the Construction Research Institute of Malaysia (CREAM), a subsidiary of CIDB established to manage R&D activities with status. The R&D allocations provided are divided into three main strategic groups, namely:

1. Construction Material, Product and Design;
2. Construction Process, Project Management, Environment and sustainability; and
3. People (Human Capital) and Financial Issues.

CREAM research activities with local universities were carried out since 2001. The amount of grants approved to December 2009 is RM18,928,435. There are total 34 research projects undertaken by local universities. Out of which 23 projects have been completed which some were already in the commercialization and patenting stages, (CIDB 2010).

Research and development is an expensive activity, and to be profitable, expenditure must be recovered. This requires some control over the market. A high percentage of the money which is paid for the finished product goes into organizations that are deliberately temporary or must concentrate primarily on short-term objectives, when major innovations take 10-15 years to develop and promote. In addition, the design is separated from the production in the building and construction industry. There is not even a guarantee that any innovation can be put into use. The extensive use of subcontracting also means that no-one involved in the construction process has a sufficient financial interest to justify much research on the overall process (Runeson 2000).

However, the low-level of R&D spending may not accurately reflect the innovativeness of the construction industry. The figures may understate the broader commitment to innovation within the industry, given the process and product innovations taking place in supplier industries such as manufacturing. New ideas can emerge from other sources and there may not need to carry out R&D in-house (Productivity Commission 2004). The construction firms do not innovate in construction techniques, but rather apply innovations developed elsewhere by materials and plant producers and by construction related professions. If they innovate in the organization and management of production, competitors are in a position to pick up the technique quickly, as they imply neither re-tooling nor new marketing nor distribution strategies as would be common (Ball, Farshchi et al. 2000).

Thus, the technological capability of the entire construction industry has improved over time without much investment in research and development. However, improvements in efficiency can no longer just rely on the importation of technologies from other countries.

b. ***Innovation***

The low rate of innovation has been provided as the major explanation to the low performance of the construction industry in terms of productivity, quality and product functionality in comparison to other industries. Innovation in construction techniques and technologies is vital for developing a competitive advantage as it allows for improvements in products and services and for more efficient process and business procedures. Innovation may be classified as product and production-process related. Product innovations, if there are any, must be driven by the clients, who by and large are not interested (Runeson and Valence 2009). Profitability of product innovations requires control over design, protection and market power, so that the investments can be recovered. In the construction industry, where there is no control over the design and no market power, the only innovations is process innovations, which are mostly embodied in capital and it is dependent on growth of the industry.

There is rarely any competition to be the first to adopt process innovations. Hence, firms usually adopt new technology after others have paid for the cost of developing them and mostly to defend existing profit rather than create new. The client attitudes are an essential part of promoting innovation. The clients seem to prefer proven products and are focused on price. On the other hand, developers focus on core activities and do not invest in technological change (Productivity Commission 2004).

Productivity improvement may also be closely related to opportunities to innovative given by the designer decisions that are outside the construction firms (Ive, Grunberg et al. 2002). Non-uniformity of regulations within and across governments was a key issue affecting innovation in the industry. This is a particularly important point when considering the costs and benefits of greater levels of uniformity of the technical and administrative regulation of building (Productivity Commission 2004).

In addition, the institutional factors or peculiarities of construction have been identified as the primary hindrance for innovation (Koskela and Vrijhoef 2001). The productivity was significantly improved across manufacturing industries because of two radical innovations in the twenty century. First, mass production and the association ‘modern enterprise form’ were primarily based on the transformation model, and, secondly, lean production was based on the flow model. Direct application of these production models to construction has been limited due to the different context of construction in model of production. The model of mass manufacturing is based on the principles of economy of scale, division of work, mechanization and centralized control. In contrast, because of the peculiarities of the constructed product, most of these principles can be applied to a narrow scope in construction. Economy of scale is prevented by the bulkiness of buildings, and, on the other hand, by the variety needed. The need for mobility on site was a barrier for mechanization. Likewise, lean production was based on seeing production as flow. From the construction viewpoint, this would seem an ideal approach, because the concept of flow takes into account interdependencies and uncertainty. In reality, lean production has been adopted by the construction industry only to a very limited extent (Koskela and Vrijhoef 2001). Runeson explained assembly line is not practical to construction,

> …The introduction of the assembly line did not depend on a technology based on new science, rather, it depended on large scale production. Before the necessary volume of production was reached, there was no point in an assembly line. If an assembly line is not fully utilized, it will just stand there and cost money for part of the time (Runeson 2000).

Vrijhoef (1998) showed that problems in construction practice causing considerable waste and inconvenience. Many actors in the supply chain seem unable or reluctant to recognize the impact of their behaviour on other stages and parties in the supply chain. On the other hand, causes of problems are often not accessible by the party that is encountering the problem and not resolvable by that party alone either. Many problems are not seen or ignored, and are rated among the 'normal features of the business' (Vrijhoef or Koskela, 2000). The multitude of problems emerging for the two mentioned reasons simply fills up the managerial agenda. 'Fire fighting' on construction sites consumes the managerial time (Oglesby *et al.* 1989), and thus frustrates systematic learning and problem solving (Koskela and Vrijhoef 2001).

Bottom-up innovation – systematic learning and problem solving – are being constrained by the managerial methods and organizational deficiencies for present in construction (Koskela and Vrijhoef 2001). The organizational innovations do not transfer well in their original setting over industrial borders. The core idea or concept of organizational innovation must be abstracted and then recreated in an application that fits local conditions. Thus, the reason for the lack of radical managerial innovations in construction is, in the case of mass manufacturing, mainly the mismatch between the new principles and the peculiarities of construction, and in the case of lean production, the failure to abstract the theoretical core of this production model and to apply it to the situation of construction (Koskela and Vrijhoef 2001).

Construction projects involve considerable problem solving when accomplishing the building (Winch, 1998). The inherent problem-solving nature of construction and the specific challenges of individual projects mean that there are frequently high levels of innovation within the project teams. It goes unmeasured by traditional indicators because this normally happens on a local scale. The co-production of novel design solutions between different parts of the design team builds upon their respective knowledge and experience and the day-to-day problem solving on site during the production phase is very much grounded in participants' tacit knowledge and 'learning by doing' (NESTA 2007). Problem solving is only becoming innovation when the solutions found during the particular project are retained and reapplied to future project systematically. The main contractors, i.e. downstream system integrators, often do no or little actual site work, so whatever problem solving goes on is not absorbed and retained by the firm. Instead, in most cases, the site work is subcontracted to various trade contractors on a competitive tendering basis. Therefore the trades have no incentive to share learning experiences for the sake of reapplying them on future projects of the main contractor (Koskela and Vrijhoef 2001)

On the other hand, the reputation of the construction lacking in innovation is undeserved according to the NESTA report (2007). In fact there is a wide range of innovation occurring within the sector, but much of this is hidden from conventional measures and statistics. The construction sector is a major user of products and services from sectors that have some of the highest R&D expenditures in the economy such as machinery and equipment, and telecommunications. However, it does not show up in innovation statistics for the construction sector despite construction being the end user and construction clients being the beneficiaries. Much of this innovation, particularly at the business and project level, does not register with official statistics (NESTA 2007). According to the report of McKinsey & Company, innovations that generate new products or better ways to produce them are a key source of long-term growth. However, for the overall economic impact, who makes an innovation or where it is made matter less than its adoption and diffusion throughout the innovative company and industry – and beyond (Manyika, Hunt et al. 2011).

NESTA's report suggested a broader conceptualisation of the sector – going beyond on-site production to include 'hinterland' activities such as architectural and technical consultancy, as well as building service and management – is required to understand how and where innovation happens in construction (NESTA 2007). The accumulated impact of incremental innovation over time may be significant, both at firm and aggregated sector level. Yet these innovations are far more difficult to capture because the projects in which they occur are typically much smaller, more specific and far less visible than well-known flagship projects.

New metrics need to track the adoption of innovative technologies and approaches, and align with sector performance indicators. Secondly, innovation could be improved by continuing the progress already made and implementing targeted regulation according to the recommendation of NESTA.

Table 4-5
Total Factor of Productivity of Construction Sector, 2001-2010

| | GDP | Labour | Capital | TFP |
|---|---|---|---|---|
| 1994-2004[1] | 3.73 | 1.83 | 0.83 | 1.07 |
| 2001-2010[2] | 2.73 | 0.09 | 1.85 | 0.79 |
| 2001-2005[2] | 0.95 | 0.10 | 0.74 | 0.11 |
| 2006-2010[2] | 4.51 | 0.08 | 2.96 | 1.47 |

Sources: [1]NPC, *Productivity Report 2004*; [2]MPC, *Productivity Report 2010/2011*

Total factor productivity (TFP) of innovation provides some measure of technological advances (NESTA 2007). The method of measurement had been discussed in Section 3.3.3. The results of TFP for the construction sector between 2001 and 2010 in Table 4-5 shows that the TFP of 2006-2010 appears to be better positioned than the 2001-2010 as a whole; it has improved from 0.11% in 2001-2005 to 1.47% in 2006-2010.

c. ***Mechanization***

Significant productivity increases were found in the fast-developing construction intensive countries in a study by Ganesan (1984). The study concluded that mechanization of construction operations has been a major factor in all these countries. Manufacturing and other industries have realized significant improvements in productivity through automation and greater use of technologies. Seeking to apply these lessons to construction, large Japanese construction companies invested significant resources to automate and integrate some construction-related tasks in the 1980s and 1990s. The costs of buying and using some of these technologies were much higher than the cost of using existing practices. As a consequences, robotics and other types of automated systems were not adopted by the industry and are used infrequently (The National Academy of Sciences 2009).

The lack of automated technologies in the United States is attributed to the following range of factors identified by the National Academy of Science (2009):

- Building codes that allow little room for experimentation or innovation in construction technologies;
- The unsuitability of conventional manufacturing processes for construction materials;
- The operating environment of construction projects (exposure to rain, wind, debris, dust, and so on) which is hostile to automated machinery;
- Conventional design practices that typically do not consider the use of automated equipment during preproject planning;
- Significantly smaller product batch sizes as compared with those of industries such as manufacturing;
- The high up-front investment and maintenance costs of automated equipment; and
- Increased labour costs for operators and maintenance crews of automated equipment.

In addition the National Academy of Science listed the examples of types of activities for which available, automated equipment and other technologies can be used on construction projects of  include the following:

- The use of automated construction equipment (e.g. bulldoze) that can be remotely operated and can use global positioning system (GPS) and onboard computer technologies in excavation and earthmoving operations;
- Trenchless technologies for installing an rehabilitating underground utility systems;
- Programmable pumps, automated horizontal distributors, and conveyor systems in the placement of concrete and technologies to perform vibrating, levelling, screeding, cleaning, cutting, and finishing activities;
- Mobile bricklaying and robotic masonry block installation machines in placement of masonry units;
- Remotely-controlled fabrication and erection of structural steel into place;
- Automated technologies to apply paint and coatings;

- Using automated equipment to manipulate and install wallboard, prefabricated partitions, millwork, and other finish materials;
- Remotely controlled site inspection and surveying.

Harvey predicts the possibilities of increasing mechanization are: fall in the price of capital to labour and rise in the physical productivity of capital compared with labour (Harvey 1996).

d. ***Industrialised Building System***

The use of Industrialised Building System (IBS) is still not widespread in the industry despite the government has encouraged the implementation of IBS towards reducing percentage of foreign workers and improving quality, productivity, safety and competitiveness through IBS construction method. IBS is a construction process that utilises techniques, products, components, or building systems which involved prefabricated components and on-site installation (CIDB 2007).

IBS and related techniques allow for numerous benefits over the conventional method (CIDB 2007; The National Academy of Sciences 2009):

- Fewer site workers due to simplified construction methods.
- More controlled conditions for weather, quality controlled end products, improved supervision of labour, easier access to tools, and fewer material deliveries.
- Reduction of construction materials at site, reduced requirements for on-site materials storage, reduction of construction waste at site and fewer losses or misplacements of materials.
- Increased worker safety through reduced exposures to increment weather, temperature extremes, and ongoing or hazardous operations; better working conditions.
- Faster completion of construction due to compressed project schedules that result from changing the sequencing of work flow, usage of standardised prefabricated components and simplified installation process.
- Fewer conflicts in work crew scheduling and better sequencing of crafts persons.

- Fewer job-site environmental impacts because of reduction in material waste, air and water pollution, dust and noise, and overall energy costs.
- Lowered total construction costs – made possible due to all of the above.

Nevertheless, prefabrication and related technologies may also entail higher transportation costs and energy costs at off-site locations (The National Academy of Sciences 2009).

The two main reasons for the low adoption of IBS in Malaysia according to the *Construction Industry Master Plan* (2007) are lack of integration at the design stage and poor knowledge of IBS. IBS components manufacturers are currently involved only after the design stage. This lack of integration among relevant players at the design stage has resulted in the need for plan redesign and additional costs to be incurred if IBS is adopted. On the other hand, the CIDB's IBS survey 2003 found that clients and approving authorities have poor knowledge of IBS compared to architects and engineers. The IBS Survey 2005 which focused on architects and designer's views on IBS reported that the majority of the architects claimed to have relatively poor knowledge in IBS which result a lower uptake on IBS. Familiarity with the IBS concept and its benefits is vital to its success because IBS requires a different approach to construction. The recent study in 2010 reported that the most significant barriers restricting the use of IBS among contractors were higher construction cost, high capital investment, difficulties in achieving economies of scale, inability to freeze design early and complex interfacing. From 2006 to 2010, an approximate of 320 government's projects worth of RM9.43 billion had been identified to be carried out using the IBS (Kamar, Hamid et al. 2010).

### e. ***Information Communication Technology***

ICT has a significant role in the building process from facilitating the creation and modification of building plans to expediting the review and approval process. The ability of ICT to improve performances in numerous industries highlights the opportunities available for the construction industry by enhancing its efficiency in several areas including knowledge sharing (CIDB 2007).

Under-utilisation of information technology resources was a major issue confronting the industry as the use of electronic tendering and procurement, e-commerce and virtual project teams increased (Productivity Commission 2004). In a study of the characteristics of firms using computers, it was found that across industries, firm size, the level of educational qualification of the major decision maker, the average wage of employees, the propensity to use advanced business practices and firm restructuring were positively related to the use of computers and adoption of the internet. It appears that ICT use is having a significant impact on the building industry and its productivity performance (Productivity Commission 2004).

Howard et al. (1998) found high levels of benefit from construction IT in design and administration in Scandinavia, while little change in productivity resulting from materials and site management (Koskela and Vrijhoef 2001). In their study on construction IT in Finland, Enkovaara et al. (1998) found that for contractors, IT had not produced any benefits, whereas in subcontracting and client procurement activities, IT benefits were negative, i.e. the benefits accrued have not offset the costs (Koskela and Vrijhoef 2001). Gann (2000) observed that, in many firms, IT related investment and training costs had been higher than the expected benefits (Koskela and Vrijhoef 2001).

Koskela and Vrijhoef offer the following explanation:

1. The level of personnel competence or the degree of structured data has not corresponded to those required by an IT application.
2. Systems were introduced into traditional organizational structures that hindered the ability to achieve widespread benefits.
3. Incomplete and inconsistent data sets and lack of explicit, codified knowledge hampered the development of IT systems.
4. The low level of trust between organizations prevented the use of interorganizational IT networks.

The most common use of computers was for accounting, book-keeping and billing purposes and email for communication purposes. Other uses included project management, access to business-related information online, access to professional development information, procurement and resource management.

Greater use of information technologies at the job site for supply chain management and other uses could significantly cut waste related to time, materials, and labour and improve the quality of projects. Relevant technologies in widespread use include radio frequency identification (RFID) tags that can be used for the tracking of materials and personal digital assistants (PDAs) that project managers and others can use to input data from the field into a common digital database. Technologies are also available to help with more efficient procurement of materials and supplies in order to improve supply management and delivery and eliminate the need for some on-site storage (NESTA 2007). The use of information technologies varies significantly among the construction participants. The applications and technologies are only rarely integrated across all phases of a project, and thus their benefits are not fully optimized. The National Academy of Sciences found that barriers remain in developing fully operating systems, including legal issues, data-storage capacity, and the ability to search bulk of data items quickly to support real-time decision making. The lack of interoperability within the construction industry has been resulted in inefficiencies and productivity.

Large amounts of resources are wasted through the disjointed processes used in construction. Many of the activities appear not to be value-adding. General ICT trends means that the opportunities to address these problems are available, including the capture of learning by organisation from project to project. The general capability for using ICTs can be built on with effective systems for construction according to Barrett (2008). However, so far these systems have been driven by well-motivated, major clients. For the systems to come into general use will be more of challenge, but work on common standards and a move towards making systems available through 'free-wave' should make progress on a broader front increasingly feasible (CIDB 2011). Technology is not sufficient to drive productivity growth but rather must be accompanied by changes in businesses and operations according to the McKinsey Global Institute research on IT-driven productivity (Manyika, Hunt et al. 2011).

#### 4.4.4 OCCUPATIONAL SAFETY AND HEALTH

One of the reasons for low productivity in the construction industry is attributed to its ‘*non-conducive and accident prone work environment*’ by Master Plan for Occupational Safety and Health in Construction Industry 2005-2010. In addition, the Master Plan also concluded that the poor image of the industry is caused by the ‘*high incidents of accidents, absence of job security, poor management, low wages for high risk jobs an…*’

Overall, the likelihood of suffering a workplace related injury or fatalities is greater for workers in the construction industry than for workers generally. The number of fatalities encounters in the construction industry is alarming. Table 4-6 reveals that the highest incidence of fatalities was happened in construction sector every year. The most common method of fatal injury for workers was falling from a height.

Table 4-6
Fatalities by Sectors

| Sector | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|
| Manufacturing | 63 | 76 | 53 | 59 |
| Mining and quarrying | 9 | 6 | 2 | 1 |
| Construction | 95 | 72 | 62 | 66 |
| Agriculture, Forestry, Logging and Fisheries | 30 | 42 | 40 | 30 |
| Utility | 10 | 19 | 18 | 11 |
| Transport, Storage and communication | 2 | 8 | 8 | 14 |
| Wholesale and retail trade | 3 | 0 | 0 | 0 |
| Hotel and restaurant | 0 | 1 | 0 | 0 |
| Financial, Insurance, Real Estate and Business Services | 4 | 4 | 1 | 1 |
| Public Services and Statutory Bodies | 3 | 2 | 1 | 3 |
| Total | 219 | 230 | 185 | 185 |

Source: Department of Occupation Safety and Health

Construction accidents mostly happen on routine job. Fellows (2002) reports that by far the greatest risk arises from falls and, perhaps more surprisingly, the vast majority of accidents occur to experienced tradesmen and building workers engaged in simple traditional activities. The demand for higher productivity which is being met by new building methods and mechanization has been cast as one explanation (Fellows, Langford et al. 2002).

The following are the summary of the recent accidents happened at the construction site.

1. The abandoned Jaya Supermarket, a six-storey, including two basement levels in Section 14 Petaling Jaya collapsed after demolition operations went awry on Thursday evening. Part of the four-storey building, a landmark of the city, collapsed at about 4:45pm, trapping nine Indonesian construction workers (The Star, 28th May 2009).
2. Three foreign workers fell to their death from the 13th floor of the low-cost flats housing project in Kampung Sungai Sering, Bukit Antarabangsa, Selangor when the gondola they were in tilted and slipped. According to the Department of Occupational Safety and Health, the workers had brought up cement with them on the gondola. The maximum weight it could carry is 350kg but with the workers and the cement in it, the gondola was overloaded and gave way (NST, 4th April 2008).
3. A worker fell to his death at the construction site of Plaza Damas in Sri Hartamas. He was seen working on the 23rd floor before he fell to his death (The Star, 1st February 2007).
4. A bar bender was cutting steel bars at the base of Johor Baru Central Municipal Council building construction site on Jalan Skudai when a 1.5 metre long block of wood fell on his head, killing him (New Straits Time, 5th February, 2006).
5. One of the country's brightest and youngest corporate figures Dr Liew Boon-Horng was killed on the spot when an iron mould weighing almost two tonnes fell on his car from the 20th floor of the two condominium-cum-office blocks under construction along Jalan Sri Hartamas (The Star, 31st December, 2005).
6. Four workers were killed at Batu 15, Jalan Puchong, Kuala Lumpur when a tower crane erected next to the 23-storey apartment under construction collapse (New Straits Time, 28th November, 2005).
7. An Indonesian worker killed and 54 others seriously injured when the steel roof structure for the bowling stadium in Paroi, Negri Sembilan, which is under construction collapsed (The Star, 16th April 2005).

8. Three workers building a dome at the six-storey Wisma Dermal Esthtica in Jalan Astaka U8/88 in Bukit Jelutong, Shah Alam were killed after a concrete floor under construction collapsed (New Straits Time, 3rd April, 2005).

Construction activities are hazardous to the safety and health of workers and others, especially if they are not properly monitored and controlled. An injury, disease or fatality caused by these work hazards does not just affect an individual worker alone. While the economic costs may be borne by his employer, his insurance firm or the Social Security Organisation, the human costs are paid by his family, relatives, friends and immediate community. Good workplace OSH management, while helping to reduce workplace fatalities, also contributes to improving overall business management and operations, thereby boosting the efficiency and productivity of organisations. An enterprise implementing a good OSH management system and integrating that into its own overall business management system will benefit resulted from better efficiency and productivity. This will contribute to the formation of a safe, healthy and productive pool of human capital (MOHR).

## 4.5 THE NATURE OF ENVIRONMENT

### 4.5.1 BUSINESS CYCLES

Variations in aggregate construction demand follow a cyclical pattern, as does demand in the economy as a whole. Macroeconomists put a lot of effort into trying to figure out what causes business cycles and offer alternative explanations for cyclical fluctuations. Investment depends on profits and behaviour of profits is cyclical in nature. The movement of the rate of profit over the cycle is a matter of the balance between countervailing forces. During an early expansion phase of the cycle, lower price elasticity of demand and higher capital utilization rates tend to raise the rate of profit. Productivity tends to increase as long as expansion of the market absorbs the extra output of additional capacity, thus fulfilling investment plans. Booms tend to increase productivity. According to Real Business Cycle (RBC) economists, most economic booms resulted from beneficial productivity shocks, which tend to raise labour productivity, whereas most recessions are caused by the adverse productivity shock which tend to reduce labour productivity. Productivity shocks include the development of new products or production methods, the introduction of new management techniques, changes in the quality of capital or labour, changes in the availability of raw materials or energy, unusually good or bad weather, changes in government regulations affecting production, and any other factor affecting productivity. The example of adverse productivity shock is increase in the price of oil, reduces the marginal product of labour and the demand for labour at any real wage. It causes the equilibrium values of real wage and employment both falls. The equilibrium level of output also falls, both because equilibrium employment declines and because the adverse productivity shock reduces the amount of output that can be produced by any amount of capital and labour. Productivity performance can vary over the business cycle as capacity utilisation rises or falls. Productivity is likely to grow more rapidly when output is growing rapidly and grow more slowly when output is growing slowly (Abel and Bernanke 2005).

According to Verdoorn’s Law productivity growth is a positive function of output growth, though forces exogenous to the business cycle which have a greater influence (Verdoorn 1980). Verdoorn makes the assumptions that industry employs all the labour available at the going wage rate; the supply of labour to industry is influenced by the industrial wage rate, and the wage rate is proportional to industrial productivity. With these assumptions, a rise in industrial productivity causes wages to rise, which attracts new workers from other sectors, notably agriculture, and industrial employment increases. Implicit in Verdoorn’s model is a linear relationship between the growth rate of industrial productivity and output growth which is determined by the conditions of labour supply and is independent of the technology of production (Rowthorn 1979). Verdoorn's Law is usually associated to cumulative causation models of growth, in which demand rather than supply determined the pace of accumulation. RBC theory rejects demand shock; it uses the same model to explain growth and business cycles. RBC theory says that profit maximizing decisions of consumers and firms convert technology shocks into business cycle fluctuations. When technology improves, firms want to hire more workers and capital. The capital stock cannot be increased instantaneously but, once in place, it leads to high demand for labour and rising wages. This, in turn, leads to higher personal income and thus higher consumption. The effect of the positive technological development is thus spread over several periods. In essence RBC theory says that booms are a time of high productivity and good technology shocks. As a result, firms want to produce high levels of output, to employ many workers, and to invest in new machinery. Because productivity is high, firms are willing to pay high wages. So economic expands because it is good time to be economically active. By contrast, recessions happen because productivity/technology is poor. It is a bad time to produce, and firm will not wish to pay high wages, invest, or hire workers. With wages low, workers will not be eager to work. Recessions are simply bad time to be economically active (Miles and Scott 2005).

The rise in productivity provides an opportunity to raise rate of profit. However, if increased capacity is greater than the market can absorb, productivity will suffer and decline in productivity and capital utilization will be followed by closures and redundancies. At certain phases of the cycle, such as at the peak, a loss of relative class bargaining power tends to lower the rate of profit (Ive and Grunberg 2000).

Most economists see the general business cycle as influenced by random as well as predictable events. Short-run macroeconomic theory looks at what happens when they are subject to 'shocks' – that is sudden, sharp exogenous events. These shocks may come from various sources - for example, mistaken government fiscal or monetary policy, rising raw material prices, turbulence of foreign exchange markets (Ball, Lizieri et al. 1998).

Therefore productivity growth is very cyclical. It typically increases markedly in the early phases of upswings and declines in the early phases of downswings. This pattern can largely be explained by an adjustment lag. After demand fluctuations companies tend not to (or cannot) adjust labour and capital inputs instantaneously. The speed of adjustment is influenced by factors such as employment legislation, the liquidity of assets or expectations about whether the demand trend is sustained (Crawford and Vogi 2006). During boom years demand for higher value goods and services enabled companies to rapidly boost productivity. However, during economic downturns, weak demand can cause savings from higher productivity to be saved rather than spent, introducing friction to the virtuous cycle for growth and slowing down the economic recovery (Manyika, Hunt et al. 2011).

However, the economy we have today is vastly different in terms of inter-relationships, magnitude, control, and in particular, in terms of the sophistication of the financial sector and the degree of involvement of government in economic policy. Runeson (2000) suggests that the discussion of the 'long building cycle' theory appears insufficient, and evidence is incomplete, ambiguous and conflicting. It appears much more reasonable to assume that building and construction activity is subject to the same influences as the rest of the economy and that it varies with the general level of economic activity as it changes over the business cycle.

Construction involves long term investment and long term risks; it will be the first to be suspended at the first sign of an economic downturn, and the last to be revived during an economic upturn leading to long periods of recession for the construction sector whenever a general business cycle is experienced (Gruneberg and Ive 2000). In addition, the need for space, and therefore the demand for new are also fairly flexible. There is seldom a precise point when a household or a firm must move to a larger building. It is possible to delay the move for a few months or a year if the individual circumstances seem to indicate that this would be economically advantageous. This, together with the nature of long life and expensive for construction output are the main reasons why the demand for construction fluctuates so much (Runeson 2000). The prices rise will reduces demand and ends boom in the construction. As sales of property drops, the developer will reduce their output or withdraw from the market. The slowdown in property development activity will create a backlog of demand. It will attract the property developer back into the market and after a time lag for production supply begins to catch up on demand once more (Ive and Grunberg 2000). Nevertheless, it needs to recognize that not all construction demand is subject to market force. The government accounts for the majority of infrastructure construction. The government could use its development programmes as an influential tool in its economic stabilisation policy so as to compensate for cyclical changes in the private sector building activity. The government policies periodically shifted to and from generous subsidy, stimulating or damping demand and prices. This is often determined by political considerations rather than economic (Runeson 2000).

In demand boom, construction firms tend to raise their prices even before their costs begin to increase, in order to take advantage of a sellers' market and to widen their profit mark-ups. Thus constructions businesses profit margins will tend to move proc-cyclically, i.e. widen during cyclical expansions and narrow during contractions (Gruneberg and Ive 2000).

The general level of economic development and buoyancy caused cyclical pattern of demand in construction which makes it difficult to keep workers employed on a continuous basis. Much of the slack is taken up by using causal labour and subcontractors. A down turn in demand ends with not enough work to go round, it will lead to falling productivity. The upswing in demand produces shortage of skilled operative, bottlenecks and delays (Olomolaiye, Jayawardane et al. 1998; Manser 2002).

The wide fluctuation in demand also ends with organizations reluctant to invest in resources, especially fixed assets, which leads to low technology being employed in the industry. There is a tendency to respond to demand by taking on more labour rather than by increasing investment because of labour supply is more easily increased or cutback (Ganesan 1984; Manser 2002).

#### 4.5.2 GOVERNMENT REGULATIONS

Regulation is increasingly perceived as a key determinant of competitiveness, impacting on a number of productivity drivers, particularly enterprise and competition. Regulatory environments which encourage competition, without unnecessary regulatory protection for inefficient players, provides the right incentives for the productivity growth (Manyika, Hunt et al. 2011). Regulations that are product- or institution-specific become highly distortive and prevent competition and innovation. Such regulations also quickly become irrelevant, creating bottlenecks in regulatory oversight. Regulatory barriers to the movement of labour and capital hinder improvements in how that labour and capital can best be put into use by the economy as a whole according to the study by McKinsey Global Institute (Manyika, Hunt et al. 2011). It is important to ensure that regulatory system is as efficient and effective as possible by removing any burdens that are unnecessary in the delivery of economic and social objectives. The use of regulation should be based on a strong market failure argument, where regulation is the most appropriate way to guide markets towards producing the economically and socially desirable outcome (HM Treasury 2007).

Given diversity and the difficulties in quantifying types of regulations, the exact channels of how regulation can impact upon growth are not clear. The two channels categorised by Craft (2006) are direct channels and indirect channels. Resources are diverted to compliance and production methods are limited in the direct channels. Regulations create entry barriers, impose rigidities in the labour market and alter wider incentives to innovate or accumulate human capital in indirect channel. Well designed regulation can promote productivity where it provides a framework within which to innovate, compete and train workers (Crafts 2006). Crafts noted that it is not possible to measure the impact of the compliance costs of regulation on productivity at least at present or to develop robust international comparisons. As a result, most studies use objectives indicators of regulation as a proxy, despite these too can be the subject of methodological concerns.

a. ***Construction Industry Development Board (CIDB) and Contractor Services Centre (PKK)***

There are two registration centres for contractors – CIDB (the acronym of Construction Industry Development Board) and PKK (the acronym of the abbreviated *Pusat Khidmat Kontraktor*, a Malay term, which means ‘Contractor Services Centre’ in English). CIDB registration is a mandatory for contractors enrolling into any construction contract with either the public or private sector clients. PKK registration is required for contractors participating in government contracts. There are about seventy per cent of contractors registered with PKK are also registering with CIDB. The registration with PKK is categorised into *Bumiputera* (or *Bumiputra* is a Malay term embracing indigenous people of the Malay Archipelago) and *Non-Bumiputera* status. Majority of the public sector projects cater the *Bumiputera* except electrical and mechanical works are made available to Non-Bumiputera.

Other regulatory requirements include: contractors to notify CIDB and submit details of construction works bearing contract sum of RM 500,000. A levy 0.125%

of contract sum is imposed. Construction personnel including construction workers, site supervisors, site managers and administration personnel are required to register with and obtain accreditation from CIDB. The contractors are obliged to attend one-day Construction Industry Contractors' Integrity course with effect from 2008. Failing in which will result the registration not be renewed. Contractors are required to collect 'Continuous Contractors Development (CCD) Points' which are allocated through contractors involvement in various events and activities organised either by CIDB, or promoters registered with CIDB throughout their CIDB registration validity period and the accumulated points will be utilised in evaluating their registration renewal.

b. ***Price Control Act***

In Malaysia, competition areas of particular concern are with regard to restrictive business practices such as collusive tendering, market allocation or quota refusal to supply, cartel price fixing, predatory pricing etc. The Price Control Act ( 1946) authorised the Price Controller to fix maximum prices for the sale of price-controlled goods which include cement and steel bars. The Price Controller may by written licence authorize any person to sell price-controlled goods or any particular class of price-controlled goods in any premises or at any place specified in the licence.

The ministry abolished the administrative price control of cement on 5 June 2008. Easing issuance of import and export licences as well as manufacturing licences for producing iron and steel products effectively 1 August 2009. The licensing system for mild steel round bars and cement are scrapped effective July 15, 2010. One of the most remarkable developments in terms of consumer protection is the enactment of the Consumer Protection (Amendment) Act 2010 which addresses the issues of unfair contract terms. The Price Control and Anti-Profiteering Bill 2010 tabled for the first reading in the Parliament on July 13, 2010. The purpose of the Bill is to enable government to determine prices of goods and charges for services and, at the same time, curb profiteering activities, thereby protecting the interest of consumers (Lada and Cieh 2010).

The lesson learnt is the price control gives firms a monopoly or oligopoly over the supply of price-controlled items. The mechanism was not realistic, as supply could not be controlled, artificially low prices had discouraged producers from supplying more of the material, artificial barriers to the supply would emerge and prices would still not be real. Consequently, marketed as poverty alleviation; in reality, the system benefits favoured companies (Master Builders 2007).

c. ***Industrialised Building System (IBS)***

The importance of IBS was highlighted in Section 4.4.3 (d). The government through CIDB has introduced exemption of the construction levy as an incentive on contractors that used IBS at least 50% IBS components in construction of new residential project. IBS Mid Term Review in 2007 reported that in approximate, only 10% of the complete projects used IBS in the year 2006. Government had enforced the use of 70% IBS component in all government's new building construction since 2008.

d. ***One Stop Centre (OSC)***

A recent initiative is the One Stop Centre (OSC) set up by the Ministry of Housing and Local Government (MHLG) to ensure that development projects are given fast-lane approval within four months. The fast-lane approval is applicable for projects under the Build Then Sell (BTS) concepts as a form of incentives for developers who opt for BTS. The Government will also extend the fast-lane approval to high impact projects, projects attracting foreign investment and government projects. Those that are not under any of these categories will require six months for approval. The status of applications received via OSC and the applications approved between 2007 and 2010 are shown in Table 4-7 and **Error! Reference source not found.**.

It was reported on July 06, 2007, that OSCs at local authorities handling applications for development projects have run into teething problems. Architects are complaining that some OSCs are not accepting their development plans. The guidelines of OSC required that planning approval, land alienation, and subdivision and building plans could be submitted at one go for faster approval. But there are times when it is impossible to submit these plans simultaneously when large-scale projects are involved. As such, planners or architects would submit these in stages but the local council will not accept these plans in parts (Anonymous 2007).

Table 4-7
Status of Applications/Received via OSC (2007-2010)

| Period | Application | Approved (a) | Pending Approval (b) | Postpone/ Cancel/ Alter/ Reject (c) | Total (a)+(b)+(c) |
|---|---|---|---|---|---|
| 13 April 07 - 31 Dec 07 | Building Plan Approval | 8,964 | 1 | 861 | 9,826 |
| | Planning Approval | 4,358 | 0 | 948 | 5,306 |
| | CFO | 1,986 | 6 | 74 | 2,066 |
| | **Total** | **15,308** | **7** | **1,883** | **17,198** |
| 1 Jan 08 - 31 Dec 08 | Building Plan Approval | 13,677 | 41 | 3,788 | 17,506 |
| | Planning Approval | 9,232 | 11 | 4,671 | 13,914 |
| | CFO | 2,208 | 8 | 259 | 2,475 |
| | **Total** | **25,117** | **60** | **8,718** | **33,895** |
| 1 Jan 09 - 31 Dec 09 | Building Plan Approval | 13,310 | 178 | 7,404 | 20,892 |
| | Planning Approval | 10,244 | 103 | 10432 | 20,779 |
| | CFO | 1,513 | 63 | 320 | 1,896 |
| | **Total** | **25,067** | **344** | **18,156** | **43,567** |
| 1 Jan 10 - 31 Dec 10 | Building Plan Approval | 10,381 | 2,439 | 9,818 | 22,638 |
| | Planning Approval | 9,399 | 3,577 | 10,942 | 23,918 |
| | CFO | 742 | 84 | 157 | 983 |
| | **Total** | **20,522** | **6,100** | **20,917** | **47,539** |
| **Incomplete Applications** | | | | | **329** |
| **GRAND TOTAL** | | **86,014** | **6,511** | **49,674** | **142,528** |

Source: Pemandu, Annual Report 2010

e. ***Certificate of Compliance and Completion (CCC)***

Another regulatory reform introduced is the Certificate of Compliance and Completion (CCC), which was implemented April 13, 2007, replaces the Certificate of Fitness (CF) for building projects. CCC goes by the matrix responsibility system; more than one person is responsible as the CCC requires 21 forms to be processed for each part of the building process. The initiative is to ensure that those who were involved in building projects would have a greater sense of accountability even though responsibility for overall approval lay with the engineers and architects (Anonymous 2007). Will there be similar teething problem on OSCs remain unknown, as the first CCC under the government's new delivery system would only be issued after the end of 2008. This is because it normally takes more than 18 months to complete a project.

Regulatory reform is likely to have facilitated productivity improvements by allowing firms to take up and adapt new technologies at a faster rate. Therefore, Government plays both positive and negative roles in productivity growth.

Table 4-8
Applications Approved within Client's Charter (2007-2010)

| **Period** | **Application** | **Approved (a)+(b)+(c)** | **Approved within Time Frame (a)** | **Approved but exceeded the Time Frame Limit (b)** | **Time Frame cannot be Determined (c)** |
|---|---|---|---|---|---|
| 13 April 07 - 31 Dec 07 | Building Plan Approval | 8,964 | 6,680 (74.5%) | 2,146 (24.0%) | 138 (1.5%) |
| | Planning Approval | 4,358 | 3,511 (80.6%) | 711 (16.3%) | 136 (3.1%) |
| 1 Jan 08 – 31 Dec 08 | Building Plan Approval | 13,677 | 9,902 (72.4%) | 3,446 (25.2%) | 329 (2.4%) |
| | Planning Approval | 9,232 | 6,840 (74.1%) | 1,855 (20.1%) | 537 (5.8%) |
| 1 Jan 09 – 31 Dec 09 | Building Plan Approval | 13,310 | 10,095 (75.9%) | 3,172 (23.8%) | 43 (0.3%) |
| | Planning Approval | 10,244 | 7,851 (76.6%) | 2,371 (23.2%) | 21 (0.2%) |
| 1 Jan 10 – 31 Dec 10 | Building Plan Approval | 10,381 | 9,416 (90.7%) | 895 (8.6%) | 70 (0.7%) |
| | Planning Approval | 9,399 | 8,490 (90.3%) | 849 (9.0%) | 60 (0.6%) |

Source: Pemandu, Annual Report 2010

f. ***Human Resource Development Fund (HRDF)***

In 1993, the Human Resource Development Fund (HRDF) was established with matching grant from the Government to encourage the private sector employers in the manufacturing and services sectors to retrain and upgrade the skills of their employees. The HRDF operates on the basis of levy system, whereby employers who have paid the levy will qualify for training grants from the Fund to defray or subsidise training costs for their Malaysian employees. The HRDF collection from a levy imposed on companies (equivalent to a compulsory contribution of 1% of the companies' monthly wage bills, or 0.5% in the case of small- and medium-sized industries (SMIs)). Funds from the HRDF are channelled for retraining and skills upgrading of workers employed by companies registered with the HRDC. The rate of financial assistance is 100% of the allowable costs incurred for training in Malaysia and up to 50% for costs incurred overseas, subject to the availability of levy in the employers' accounts with Pembangunan Sumber Manusia Berhad (PSMB) which administers the Fund (BNM 2006).

#### 4.5.3 WEATHER

Construction is an outdoor industry. The adverse climatic conditions can have detrimental impact on the construction programme and hinder productivity. The problem will be more severe during groundwork and before the building is weather tight(Lavender 1996). In addition, hot and wet climates are far less conducive to mental and physical energy, and tropical climate favour muscular activity generating much body heat and discomfort (Olomolaiye, Jayawardane et al. 1998).

Malaysia has a typically tropical climate. It is hot and humid throughout the year with cooler temperature in the highland areas. The temperature fluctuates little throughout the year with the average temperature which is between 11 degree C and 32 degree C. The average rainfall varies from 2,600mm to 2,500mm and the humidity is high all year around. The seasonal variation of rainfall in Peninsular Malaysia is of three main types:

- Over the east coast states, November, December and January are the months with maximum rainfall, while June and July are the driest months in most districts.
- Over the rest of the Peninsula with the exception of the southwest coastal area, the monthly rainfall pattern shows two periods of maximum rainfall separated by two periods of minimum rainfall. The primary maximum generally occurs in October - November while the secondary maximum generally occurs in April - May. Over the north-western region, the primary minimum occurs in January - February with the secondary minimum in June - July while elsewhere the primary minimum occurs in June - July with the secondary minimum in February.
- The rainfall pattern over the southwest coastal area is much affected by early morning "Sumatras" from May to August with the result that the double maxima and minima pattern is no longer distinguishable. October and November are the months with maximum rainfalls and February the month with the minimum rainfall. The March - April - May maximum and

the June -July minimum rainfalls are absent or indistinct (Malaysian Meteorological Department 2011).

Present regional climatic trends are in line with the increase in average surface temperature observed for Malaysia. Nevertheless rainfall trends for Malaysia are not clearly defined as this parameter has large spatial and temporal variation. Significant regional temperature increase is very much correlated to the El Niño events. Higher regional temperature increase is indicated for Peninsular Malaysia compared to East Malaysia, with western Peninsular Malaysia region experiencing the highest increase. The frequency of relatively drier years has increased for Peninsular Malaysia and East Malaysia as of 1970. Most of the El Niño events as of 1970 have resulted in relatively drier years for Peninsular Malaysia and East Malaysia. Most of the severe dry spells in East Malaysia have been recorded during the El Niño events. Though the three driest years for Peninsular Malaysia (1963, 1997 and 2002) were recorded during El Niño events, the substantial frequency of relatively dry years in Peninsular Malaysia not accounted for by El Niño event indicates that El Niño event on its own is not the primary rainfall regulatory mechanism for Peninsular Malaysia (Malaysian Meteorological Department 2009).

Construction activities are, to a large extent, undertaken on open sites which are subject to the effects of weather variations. Weather impact, specifically excessive rainfall, was reported to be one of main factors causing significant delay and cost overruns on construction projects, The impact of rainfall on construction activities can be in the form of work stoppage which is attributed either to the inability of construction personnel to work under severe conditions of heavy rain or simply to compliance with safety regulation in such adverse weather condition.

## 4.6 PROBLEMS ASSOCIATED WITH THE MEASUREMENT OF CONSTRUCTION PRODUCTIVITY

The problems of productivity measures have been reviewed in Section 3.6. Productivity-level comparison for construction is harder compared with other industry in an economy. There are exceptional difficulties of both output and input measurement and problems of finding appropriate rates of conversion to common unit for comparisons. For example, purchasing-power units are increased by the heterogeneity of construction output and complexity of national differences in output mix and quality. In addition, it is less urgent for productivity-level comparison for construction because a construction productivity gap does not have the same direct impact, via comparative unit costs, on international trade competitiveness of the industry, and thus on construction output and GDP levels (Ive, Grunberg et al. 2002).

Conversely, Pilcher (1992) states,

> 'cost to be no more accurate a measure of output than physical quantity or description – even within a fairly close geographical locality. The majority of construction work is undertaken on a competitive bid basis and hence the true cost of a unit work is difficult to establish with reasonable accuracy. In many instances construction contractors are unable to determine the accurate cost of a unit of work so as to form a basis of comparison with or to create an estimate for the next similar work. Such figures, if available, often have a large indeterminate variation within them…'

Likewise, the Construction Productivity Taskforce of Singapore's Construction Industry Development Board reports,

> 'the indicator, therefore, only measures the least productive part of the construction process – that of site production, assembly or erection. The other limitation with this indicator is that it is difficult to use it to compare with those of construction sectors elsewhere. While a value-added per worker will remain a national economic indicator, the taskforce views it would useful to look at another productivity indicator used by construction sectors elsewhere which will enable comparison with Singapore's construction sector'(CIDB 1992).

Measuring construction sector productivity is complex. Firstly it relates to the issues of nature of construction process and industry. Productivity relates to how well firm organise production and, therefore, the quality of management, type and level of workforce skills, capital investment and capital intensity. The unique characteristic of construction projects is seldom similar in size, scope and type of project. Even when projects are similar, factors affecting productivity are rarely constant and may vary from codes/standard requirements, whether from one country to another. The varying climatic and ground conditions from project to project and even when it is on the same locality, it depends on the circumstances such as availability of skilled labour force.

Secondly, it is due to the deficiencies in data collection and to data constraints which produced biased statistic. There is a paucity of feedback from construction sites, reluctant to share the performance data on commercially sensitive consideration among the construction players, the move towards more subcontracting in various forms, causing the output data has become more difficult to collect. There is absence of accurate data on working proprietors and self-employed produce serious distortions in the construction productivity data. According to CIDB registration, 51 per cent of the construction firm is micro-size (Section 4.3.2).

Thirdly, the increasing use of specialist and sub-contracting, off site pre-fabrication, and mechanisation have an effect on contractors to obtain reliable data on project performance.

Fourthly, the accuracy of construction productivity measurement methods is limited because they do not always take into account the factors adding value on the effectiveness of management of the project and the wastage of resources; the quality level reached and innovations.

Lastly is the difficulty of productivity comparisons between countries. National construction industries operate in different environments with different objectives; this means that any comparison based on any one country is biased. National level, construction differs from country to country in construction methods, nature of the workload, structure and size of the sector with direct/indirect employment, skill base, and extent of subcontracting, geography, climate and geology, and the regular framework.

## 4.7 PRODUCTIVITY IMPROVEMENTS

Basically, improvements in productivity can be caused by five different relationships:

1. Output and input increases, but the increase in input is proportionally less than the increase in output.
2. Output increases while input stays the same.
3. Output increases while input is reduced.
4. Output stays the same while input decreases.
5. Output decreases while input decreases even more (Tangen 2002).

Productivity improvement can be due to technological or social factors and have an effect which is short term or long term (Lavender 1996).

Short-term improvements in productivity can be thought of as a 'one-off' improvement which requires no additional resources to be deployed, and no additional investment to be made. It includes certain technological and social possibilities. Technological improvements may include better layout of plant; more intensive use of plant; and more effective flow of materials. Social improvements may include better systems of supervision; improved motivation of employees through participation schemes such as quality circles (Lavender 1996).

Long-term improvements in productivity are through a programme of investment that sustained improvements. Again, there are several technological and social possibilities. Technological improvements may come through investment in new capital equipment. A public sector contribution could be though investment in infrastructure. Social improvements could come through a programme of investment in education and training (Lavender 1996).

Jeremy H. and Tony H. in their books, *competing in the third wave*, says

> "…the biggest improvements in productivity do not come from machines, technology, or incentives, but from how well managers use technology to improve the organization and quality of the workforce, and whether such improvements meet strategic objectives. The right management practices, good work organization, and clearly understood strategic targets make the difference" (Hope and Hope 1997).

They conclude the second way model of productivity is in pursuit of the lowest unit cost, which include: fewer jobs, part-time jobs and lower wages, outsourcing, reengineering, automation and technology, teleworking, stretch goals and incentive pay. They advocate the third wave model should be in pursuit of highest value-adding works. The eight key issues identify are: the right management culture, employment security, right employees, organization of work, participation and empowerment, training and education, information sharing and sharing the benefits (Hope and Hope 1997).

Lewis (2004) advocated that competition is the mechanism that helps more productive and efficient companies expand and take market share from less productive ones, which then go out of business or become more efficient. But government policies sometimes stand in the way of competition and prevent innovation from spreading. Such policies might exclude potential competitors, such as start-ups or foreign companies, or might favour particular classes of companies, such as mom-and-pop retailers. Often policies (zoning laws, for example) have unintended consequences for business. When they do, competition is less intense and inefficient companies aren't pressured to change (Lewis 2004).

On the national level, Department for Business Enterprise & Regulatory Reform (BERR) (2007) recommended the following measures to raise UK's productivity performance: Government trains people in skills and contributes to infrastructure needed for research and innovation; encourage competition and protect intellectual property, ensuring firms have incentives to innovate; launching a significant programme of tax simplification, establishing a modern, risk-based approach to regulation, and reducing administrative burdens, championing free trade and open markets and encourage innovation in regulation and procurement (HM Treasury 2007).

On the industry-wide level, the National Academies (2009) identified the following opportunities for breakthrough improvements:

1. Widespread deployment and use of interoperable technology applications, also called Building Information Modelling (BIM).

2. Improved job-site efficiency through more effective interfacing of people, processes, materials, equipment, and information.
3. Greater use of prefabrication, preassembly, modularization, and off-site fabrication technique and processes.
4. Innovative, widespread use of demonstration installations.
5. Effective performance to drive efficiency and support innovation.

Similarly, Adrian (2004) opined that an individual construction firm will not be likely to alter labour work rules by itself, even if it judges some of the work rules detrimental to its productivity and financial success. Some approaches the construction industry might take as a whole for increasing productivity are:

- Addressing the seasonality and weather-related problems by proceeding with construction on specific dates that would enable a project to be enclosed during winter months and developing methods and technology for enclosing projects.
- Better use of labour through prefabrication and industrialization to fabricate more building components and systems off-site and in a controlled manufacturing plant.
- Studying, analysing and possibly change labour work rules that are detrimental to productivity and of marginal benefit to labour.
- Establishing funds that serve as a source of R&D support to enhance technological changes that result in improved methods and materials of construction.
- Taking steps to lessen costly or wasteful governmental regulations that negatively affect industry productivity and provide little or no benefit to labour or construction firms.
- Pursuing funding an organizational process to enable better technical and management training of craftspeople and supervisory personnel (Adrian 2004).

Some of the more viable approaches for the individual firm recommended by Adrian (2004) are:

- Experimenting with procedures to motivate the workforce at a job site. The purpose would be to develop 'goal congruence' between the workforce and the firm.
- Pursuing available new construction methods and materials with the objectives of improving productivity.
- Implementing management techniques, including techniques for analysing methods, productivity, and scheduling techniques.
- Pursuing and implementing accounting and control procedures aimed at measuring productivity and detecting problems so that the firm can rapidly improve productivity.
- Developing an internal department or other structure with the sole objective of improving productivity (Adrian 2004).

## 4.8 SUMMARY

This chapter has examined determinants of construction productivity. These factors are grouped into three categories that are relevant with nature of industry, nature of work and nature of environment as depicted in Figure 4.2.

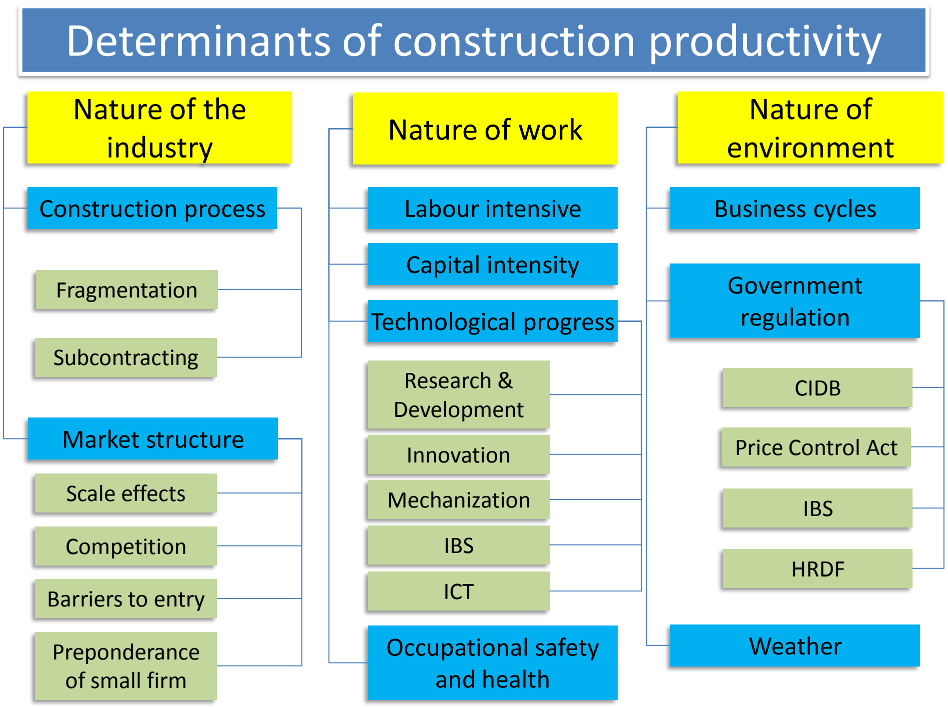


Figure 4.2. Determinants of construction productivity

The complexity in separation of design and construction process gives rise to fragmentation of the industry. The need for flexibility and stronger link between pay and productivity in subcontracting has resulted with a number of negative impacts of the construction sector. Preponderance of small firms is a feature of the construction market. The heterogeneity nature of the construction outputs limited the economies of scale of the construction sector. Competitive pressures of the construction sector are weak because the short term price elasticity of supply is lower than the long run elasticity in the construction market. There are few barriers to entry to the construction market for the small firms but important barriers to entry for large firms in terms of financial and technical capabilities. The way work is arranged in the construction sector has resulted labour intensive nature of construction is most common practice. Capital intensification has been achieved in the construction sector only to a limited degree through improvements in the plant and machinery used on site, but more significantly by a shift towards prefabricated components. Non-uniformity of regulations within and across governments was a key issues affecting innovation in the industry. The non-conducive and accident prone work environment is another reason for low productivity in the sector. Construction activities are hazardous to the safety and health of workers and others, especially if they are not properly monitored and controlled. Variations in aggregate construction demand follow a cyclical pattern, as does demand in the economy as a whole. Following Verdoorn's Law, productivity tends to increase as long as expansion of the market absorbs the extra output of additional capacity, thus fulfilling investment plans. However, if increased capacity is greater than the market can absorb, productivity will decline and capital utilization will suffer. Regulations serve important social objectives, on the other hand they raise unnecessary obstacles to competition, innovation and growth, the Price Control Act in Malaysia gave firms a monopoly or oligopoly over the supply of price-controlled items. The incentives on IBS usage and Human Resource Development Fund provided positive effects to the construction sector.

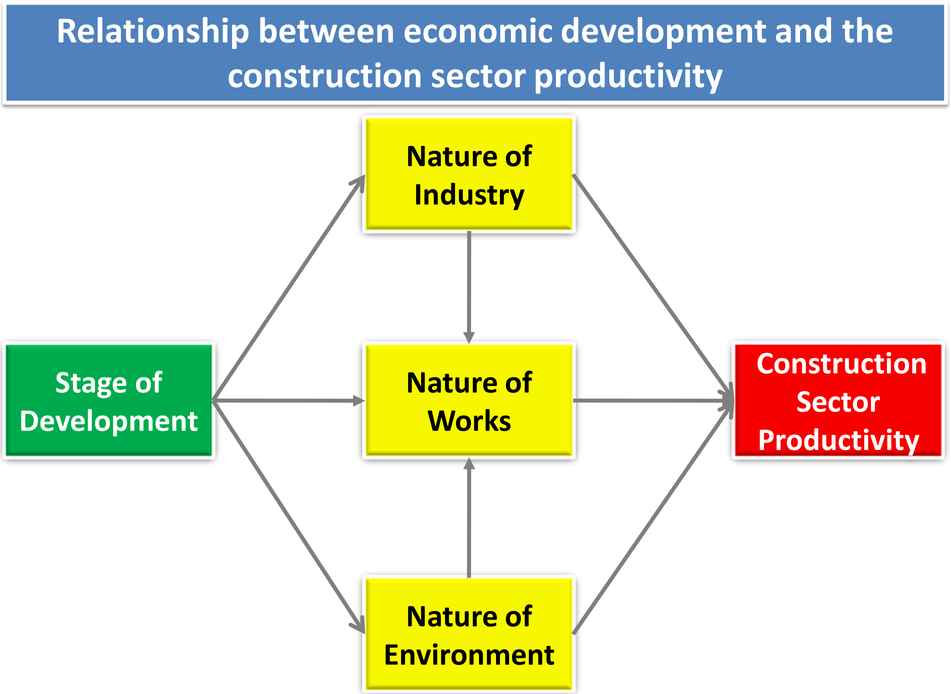


Figure 4.3.Relationship between economic development and construction sector productivity

Figure 4.3 presented the relationships between the economic development and construction sector productivity which has incorporated with the three determinants of construction productivity in Figure 4.2. The stages of development of the country will influence the nature of environment, the nature of industry and the nature of works of the construction sector. Concurrently, the nature of environment and the nature of industry will have some bearing on how the construction works are organised and carried out. The three variables will determine the productive performance of the construction sector.

These findings will be used to design the research instrument for the empirical data collection from the field study. The next chapter will discuss the research methodology and develop the research strategy of the present study.

# Chapter 5: Methodology

## 5.1 INTRODUCTION

Methodology is broader than methods and envelops methods. It is understanding the social organizational context, philosophical assumptions, ethical principles, and political issues of the enterprise of social researchers who use methods (Neuman 2006).

This chapter describes the design adopted in order to answer the research problem and research questions in Section 1.3 of Chapter 1 i.e. how the productivity of construction sector is being influenced in the course of economic fluctuations in Malaysia? Section 5.2 justifies the explanatory research approach adopted for this research. Section 5.3 provides details on the research design including the intersection of philosophy, strategies of inquiry, and specific method. The post positivist worldview is explained in Section 5.3.1. Justification for adopting mixed-methods strategies is provided in Section 5.3.2. Quantitative data analysis will be used to answer the research question 1, while interview will be conducted to collect empirical data to answer question 2, 3, 4 and 5. The details of statistical data analysis of the government reports and semi-structure interview of the industrial practitioners are included in Section 5.3.3. In addition, the sources of statistical data used for quantitative analysis and the participants of the interviews are also disclosed in Section 5.3.3. Purposeful sampling is used to select experienced practitioners in the interviews. Section 5.3.4 gives an account on the specific methods of qualitative and quantitative data analysis adopted in this study. The considerations of reliability, validity and generalization of qualitative research are included in Section 5.3.4. Section 5.4 outlines the ethical consideration of this research. Finally, Section 5.5 summarises the research methodology adopted in this study.

## 5.2 TYPES OF RESEARCH

The type of research can be classified as descriptive, correlational, explanatory or exploratory according to its objectives (Kumar 2005). This study is an explanatory research. It desires to explain the changes of construction productivity in the context of economic fluctuations in Malaysia by providing empirical evidence to support the explanations.

Explanatory research attempts to clarify why and how there is a relationship between two aspects of a situation or phenomenon (Kumar 2005). It goes beyond description and explanation for the phenomenon that the descriptive study only observed. The theories or at least hypotheses are used to account for the causes of certain phenomenon to occur (Cooper and Schindler 2008). Neuman (2006) states an explanatory research builds on exploratory and descriptive research and goes on to identify the reason something occurs. Going beyond focusing on a topic or providing a picture of it, explanatory research looks for causes and reasons.

Multiple strategies are used when doing explanatory research. Some explanatory studies develop a novel explanation and then provide empirical evidence to support it or against it. Other studies outline two or more competing explanations and then present evidence for each, in a type of a 'head-to-head' comparison to see which is strongest. Still others take an existing explanation, often derived from social theory or previous research, and extend it to explain a new issue, setting, or group of people. The goal is to learn how well the explanation holds up and see whether it needs to be modified or is limited to operating in only certain conditions (Neuman 2006).

## 5.3 RESEARCH DESIGN

Research design involves the intersection of philosophy, strategies of inquiry, and specific method. Creswell suggests in planning a study, researchers need to think through the philosophical worldview assumptions that they bring to the study, the strategy of inquiry that is related to this worldview, and the specific methods or procedures of research that translate the approach into practice (Creswell 2009).

### 5.3.1 PHILOSOPHICAL WORLDVIEWS

The four philosophical worldviews are postpositive, social construction, advocacy/participatory and pragmatic (Creswell 2009). The approach adopted in this research is postpositive. Creswell states

> Postpositivists hold a deterministic philosophy in which causes probably determine effects or outcomes. Thus, the problems studied by postpositivists reflect the need to identify and assess the causes that influence outcomes, such as found in experiments. It is also reductionistic in that the intent is to reduce the ideas into a small, discrete set of ideas to test, such as the variables that comprise hypotheses and research questions. The knowledge that develops through a postpositivist lens is based on careful observation and measurement of the objective reality that exists 'out there' in the world. Thus developing numeric measures of observations and studying the behaviour of individuals becomes paramount for a postpositivist. Finally, there are laws or theories that govern the world, and these need to be tested or verified and refined so that we can understand the world. Thus, in the scientific method, the accepted approach to research by postpositivists, an individual begins with a theory, collects data that either supports or refutes the theory, and then makes necessary revisions before additional test are made.

### 5.3.2 STRATEGIES OF INQUIRY

Strategies of inquiry are types of qualitative, quantitative, and mixed methods designs or models that provide specific direction of procedures in a research design (Creswell 2009). The strategies appropriate for this study is mixed methods strategies in line with recommendation of Neuman (2006) in Section 5.3.2. All methods have limitations; the biases inherent in any single method could neutralize or cancel the biases of other methods in the mixed methods strategies. It enables triangulate data sources – a means for seeking convergence across qualitative and quantitative methods (Creswell 2009).

The reasons for mixing methods have led writers to develop procedure for mixed methods strategies of inquiry. The three general strategies are sequential mixed methods, concurrent mixed methods and transformative mixed methods (Creswell 2009). This study used concurrent mixed methods procedures in which the quantitative and qualitative data are converged or merged in order to provide a comprehensive analysis of the research problem. In this design, both forms of data are collected at the same time and then the information is integrated in interpreting the overall results. Also, in this design, one smaller form of data may be embedded within which another larger data collection in order to analyse different types of questions such as the qualitative address the process while the quantitative, the outcomes (Creswell 2009).

#### 5.3.3 RESEARCH METHODS

The third major element in the framework is the specific research methods that involve the forms of data collection, analysis, and interpretation that researchers proposed for their studies (Creswell 2009). The research methods included in this study involve secondary data analysis of published official statistics and semi-structured interviews by purposeful sampling.

The intent of this concurrent mixed methods study is to uncover how the productivity of construction sector is influenced in the course of economic fluctuations in Malaysia. The statistical data of government reports will be used to measure the relationship between economic growth and construction labour productivity. At the same time, the key aspects and issues underlying productivity of the construction sector and the usual course of action taken when encountered with macroeconomic fluctuations will be explored using the qualitative interviews with experienced industrial practitioners in Peninsular Malaysia. The reason for combining both quantitative and qualitative data is to better understand this research problem by converging both quantitative and qualitative data.

a. ***Data Analysis***

The quantitative study involves analysis of the statistics data in the government reports. The analysis address the first investigation question – '*How the productivity of construction sector is affected by the macroeconomic fluctuations?'*

Neuman (2006) called this method as *secondary analysis research*. It involves re-examines the existing quantitative information using various statistical procedures. Existing statistics research can be used for exploratory, descriptive, or explanatory purpose. It is relatively inexpensive; it permits comparisons across groups, nations, or time; it facilitates replication; and it permits asking about issues not thought of by the original researchers (Neuman 2006).

Secondary analysis is a special case of existing statistics; it is the reanalysis of previously collected survey or other data that were originally gathered by others, including the analysis of datasets collated from a variety of sources to create time series or area-based datasets. It consists of re-interpreting tables and statistical evidence in existing reports (Hakim, 2000; Neuman, 2006). As opposed to primary research, the focus is on analysing rather than collecting data. It is relatively inexpensive; it permits comparisons across groups, nations, or time; it facilitates replication; and it permits asking about issues not thought by the original researchers (Cooper & Schindler, 2008; Neuman, 2006; Punch, 2005). The focus here is on the distinctive contributions of secondary analysis, rather than on additional analyses that extend or re-assess the findings of the main report on a study (Hakim, 2000).

Neuman (2006) proposed the researcher can search through collections of information with a research question and variables in mind, and then reassemble the information in new ways to address the research question. Existing statistics research is best for topics that involve information collected by large bureaucratic organizations. Public or private organizations systematically gather many type of information. Such information is gathered for policy decisions or as a public service. It is rarely collected for purposes directly related to a specific research question. Thus existing statistics research is appropriate when a researcher wants to test hypotheses involving variables that are also in official reports of social, economic and political conditions (Neuman, 2006).

Despite the growth and popularity of secondary data analysis and existing statistics research, there are limitations in their use. The use of such techniques is not trouble free just because a government agency or research organization gathered the data. One danger is that a researcher may use secondary data or existing statistics that are inappropriate for his or research question. A second danger is that a researcher does not understand the substantive topic. Because the data are easily accessible, researcher who know very little about a topic and use the data could make erroneous assumptions or false interpretations about results. A third danger is that a researcher may quote statistics in great detail to give an impression of scientific rigor. This can lead to the fallacy of misplaced concreteness, which occurs when someone gives a false impression of precision by quoting statistics in greater detail than warranted and 'overloading' the detail (Neuman 2006).

Secondary analysis of surveys for the study of trends over time is constrained by the existence and accessibility of relevant surveys. But the study of trends over even 'short' periods of one or two decades can reveal substantial amounts of unacknowledged social change. The aggregate data from standard national sources can provide information only on net change at the aggregate level rather than on gross change at the micro-level (Hakim, 2000). There can be both methodological difficulties and difficulties of interpretation of the raw data, and the possibility always exists that the original questions and data are not relevant to the present problem (Punch, 2005).

Large-scale data collection is expensive and difficult. The cost and time required for major national survey that uses rigorous techniques are prohibitive for most researches. Fortunately, the organization, preservation, and dissemination of major survey data sets have improved. The main sources of existing statistics are government or international agencies and private sources. Many types of statistical data about the construction industry and national economy are available in the government reports. Government departments undertake surveys and publish official statistics covering social, demographic and economic topics in Malaysia. The sources of the data included in this research include:

I. SURVEY OF CONSTRUCTION INDUSTRIES, MALAYSIA

The report contains statistics of the construction sector collected through the Survey of Construction Industries by the Department of Statistics Malaysia. Prior to reference year 1975, results of the survey were published in the report entitled 'Survey of Construction Industries'. However, for the reference years 1975 to 1991, the principal statistics containing selected information such as value of gross output, cost of input, census value-added, number of persons engaged, salaries and wages, and value of fixed assets were published together with that of Manufacturing, Mining and Quarrying Industries, in an annual report entitled 'Industrial Surveys'. Commencing reference year 1992, the results of the Survey were again published separately in the report entitled 'Annual Survey of Construction Industries'. Since reference year 1998, this survey covers establishments whose value of construction work done was RM500,000 and above. The main objective of the report is to publish data for the construction sector pertaining to value of gross output, cost of input, number of persons engaged, salaries and wages paid and value of assets for use in economic planning and policy formulation.

II. CONSTRUCTION QUARTERLY STATISTICAL BULLETIN

This bulletin provides information on contractors registration and construction works recorded by Construction Sector Development Board Malaysia (CIDB). The bulletin was first published in the Third Quarter 2006. The latest bulletin included in this study is the Fourth Quarter of 2010.

III. ECONOMY REPORT

The Economy Report published by the Treasury Malaysia annually include the official statistical tables on key economic data, national accounts and prices, trade and production, public finance, monetary and banking, employment, private sector, foreign investment and socio-economic indicators.

IV. MALAYSIAN PLANS

Malaysian Plan is medium-term planning, a comprehensive blueprint prepared by the Economic Planning Unit (EPU) of the Prime Minister's Department, where 5-year development plans are formulated to operationalize the Outline Perspective Plans (OPPs). They set out the macroeconomic growth targets as well as the size and allocation of the public sector development programme. In addition, they provide the direction with respect to promoted sectors, thereby giving guidance to the private sector in determining their own investment policies. Currently, the Tenth Malaysia Plan, covering the period 2011-2015, is in operation.

V. MALAYSIA ECONOMIC STATISTICS – TIME SERIES

This is published by Department of Statistic Malaysia contains statistical data on manufacturing, agriculture, construction and mining and information on national accounts, external trades, balance of payment and employments. The report includes all the retrospective data from the earliest time on each subject area while taking into consideration the inter-temporal comparability of the data series. The first publication of *Malaysia Economic Statistics – Time series* was for 1986 and followed by issues for the selected years.

VI. NATIONAL ACCOUNTS MAIN AGGREGATES DATABASE MAINTAINS BY UNITED NATIONS STATISTIC DIVISION (UNSD)

The National Accounts Statistics database of main national accounts aggregates is maintained by The Economic Statistics Branch of the United Nations Statistics Division. This National Accounts Statistics database contains a complete and consistent set of time series from 1970 onwards of main national accounts aggregates for all UN Members States and all other countries and areas in the world. In addition, to the values of national accounts statistics, it contains analytical indicators and ratios derived from the main national accounts aggregates related to economic structure and development. The latest data uploaded in the web site of United Nations Statistics Division was in December 2010.

b. ***Interview***

The interview is the primary data collection technique for gathering data in qualitative methodologies. Qualitative research aims to achieve an in-depth understanding of a situation. It includes ‘an array of interpretive techniques which seek to describe, decode, translate, and otherwise come to terms with the meaning, not the frequency, of certain more or less naturally occurring phenomena in the social world’ (Cooper & Schindler, 2008).

Interviews vary based on the number of people involved during the interview, the level of structure, the proximity of the interviewer to the participant, and the number of interview during the research (Cooper & Schindler, 2008). A personal interview is a two-way conversation initiated by an interviewer to obtain information from a participant. The differences in the roles of interviewer and participant are well-defined. They are usually strangers, and the interviewer generally controls the topic and patterns of discussion. The participant is asked to provide information and has little hope of receiving any immediate or direct benefit from this cooperation (Cooper & Schindler, 2008).

The great variety and flexibility of the interview as a research tool give it wide applicability, with different types of interview suited to different situations (Punch, 2005). Interviews may be highly formalized and structure, using standardized questions for each respondent, or they may be informal and unstructured conversations. In between there are intermediate positions. One typology that is commonly used is thus related to the level of formality and structure, whereby interviews may be categorized as one of structured interviews, semi-structured interviews and unstructured interviews (Saunders, Lewis, & Thornhill, 2000).

Structured interview use questionnaires based on a predetermined and standardized or identical set of questions. The interviewer read out each question and then records the response on a standardized schedule, usually with a pre-coded answer (Saunders et al., 2000).

By comparison, semi-structured and unstructured interviews are non-standardised. The situations call for unstructured interviews with the people concerned where the researcher might have a vague idea of certain changes taking place in the situation without knowing what exactly they are. In order to understand the situation in its totally, the researcher will interview people at several levels. At the initial stages, only broad, open-ended questions would be asked, and the replies to them would give the researcher an indication of the individuals' perceptions. In semi-structured interviews, the researcher will have a list of themes and questions to be covered although these may vary from interview to interview. This means that the interviewer may omit some questions in particular interviews, given the specific organizational context which is encountered in relation to the research topic. The order of questions may also be varied depending on the flow of the conversation. On the other hand, additional questions may be required to explore the research question and objectives given the nature of events within particular organizations (Saunders et al., 2000). The type and nature of questions asked of the individuals might vary according to the job level and type of work done by them. For instance, managers at top and middle levels might be asked more direct questions about their perceptions of the problems and the situation. Employees at lower levels may have to be approached differently (Sekaran, 2000). The techniques are also open-ended. That is, they use a form of questioning in which the respondents are encouraged to answer in their own words: while the researcher might have some hunches about the kind of answers to expect, he would not be prepared to specify them in advance (Jankowicz, 1995). The nature of the questions and the ensuing discussion mean that data will be recorded by note taking, or perhaps by tape recording the conversation (Saunders et al., 2000).

Each type of interview outlined above has a different purpose. Structured or standardized interviews can be used in survey research to gather data, which will then be the subject of quantitative analysis. Semi-structured and in-depth, or non-standardised, interviews are used in qualitative research in order to conduct exploratory discussion not only to reveal and understand the 'what' and the 'how' but also to place more emphasis on exploring the 'why' (Saunders et al., 2000).

I. PILOT STUDY

In this study, the semi-structured interview has been adopted. Six construction practitioners were contacted to seek their participation in a pilot study in October 2007. All agreed to participate and the pilot research was conducted via face-to-face or telephone semi-structured interview.

Pilot research is a trial run-through to test the research design with a sub-sample of respondents who have characteristics similar to those identifiable in the main sample to be surveyed. Piloting is necessary as it is very difficult to predict how respondents will interpret and react to questions. Conducting a pilot before the main survey allows any potential problems in the proforma of the questionnaire to be identified and corrected (Gill & Johnson, 2002). Instruments piloted to a small number of respondents to test whether the questions are easy to understand, appropriate to the research topic, unambiguous, and to have some idea of time to administer the questionnaire and conduct interview (Fellows & Liu, 1995). It is important to get feedback and input on other important issues that may be worthy of consideration, that the initial instrument has missed. This also gives the researcher an indication of whether the instrument is measuring the right concept and it is consistently measuring the concept being measured, hence its validity and reliability. Moreover, where an interviewer-administered questionnaire is to be used piloting provides the opportunity to refine and develop the interviewing and social skills of the researchers and helps to highlight any possible sources of interviewer bias. When the pilot study is completed it is then possible to conclude the design of the questionnaire and finalize any arrangements for its administration (Gill & Johnson, 2002).

The objective of the unstructured interviews is to cause some preliminary issues to surface so that the researcher can decide what variables need further in-depth investigation. Each of the pilot interviews lasted approximately 40 minutes. An interview schedules consist a list of themes and questions to be covered were used in the pilot study. The questions included in the interview schedules focuses on the impacts of two economics crisis in Malaysian, i.e. 1980s recession and 1997 Asian Economic Crisis, and the significant changes in productivity after the two crisis. Notes were taken during the interview and verbatim transcriptions were produced for data analysis. The interview schedule consists of two parts. The first part is the background information of the participants and the second part is related to the research questions. The questions evolved from a review of literature, experiences of the researcher during 20 years as an industrial practitioner. The interview schedule provide topic or subject areas within which the researcher explored, probed, and ask questions to elucidate and illuminate the subject area. Therefore, the researcher remained free to build a conversation within a particular subject area, word questions spontaneously, and establish a conversational style, albeit with the focus on a particular subject that had been predetermined. This exercise provided valuable insights into how respondents interpreted questions, thereby helping determine the types of questions that could best be answered by the industrial participants and the wording of questions.

II. INSTRUMENTS

The interview guide was revised and improved after the pilot interview. The concluded version is available at Appendix 1 of this thesis. The central research question of this study is how the productivity of construction sector is being influenced in the course of economic fluctuations in Malaysia? The investigation questions (sub questions) follow the central research questions are as follows:

1. What are the key aspects and issues underlying productivity of construction sector? (SQ1)
2. How the productivity of construction sector is affected by the macroeconomic fluctuations? (SQ2)
3. What is the usual course of action taken by the industrial participants when they are encountered with macroeconomic fluctuations? (SQ3)
4. Why such course of action is chosen? (SQ4)
5. What are the impacts of such course of action? (SQ5)

After the pilot study was conducted, the interview questions have been refined as follows:

IQ1 - Outlook of the Malaysian Economy and the Construction Industry

1. What do you think would be the outlook for the Malaysian economy over the next five years?
2. How will it affect the construction industry?

IQ2 - 2008-2009 Global Financial Crisis

1. Does the recent financial crisis affect your company?
2. What are the courses of actions you have taken to counter/mitigate its effects?
3. Could you explain your reasons of doing so?
4. What are their consequences/results?

IQ3 - 1997-1998 Asian Economic Crisis

1. Does the 1997-1998 Asian Economic Crisis affect your company?
2. What are the courses of actions you have taken to counter/mitigate its effects?
3. Could you explain your reasons of doing so?

4. What are their consequences/results?

IQ4 - 1984-1986 Recessions

1. Does 1984-1986 recessions affect your company?
2. What are the courses of actions you have taken to counter/mitigate its effects?
3. Could you explain your reasons of doing so?
4. What are their consequences/results?

IQ 5 - Productivity of construction industry

1. In your opinion, do the changes of the economic situations affect the productivity of the industry?
2. Besides that, do you have any suggestion for further improvement of the productivity of the construction industry?

IQ6 - Managing Productivity

1. Does your company have any special programmes/practices in managing productivity?

The relationships of the investigation questions (sub questions, SQs) and interview questions (IQs) are shown in the following matrix:

Table 5-1
Matrix of investigation questions and interview questions

| | SQ1 | SQ2 | SQ3 | SQ4 | SQ5 |
|---|---|---|---|---|---|
| IQ1(1) | | ● | | | |
| IQ1(2) | ● | ● | | | |
| IQ2(1) | | ● | | | |
| IQ2(2) | | | ● | | |
| IQ2(3) | | | | ● | |
| IQ2(4) | | | | | ● |
| IQ3(1) | | ● | | | |
| IQ3(2) | | | ● | | |
| IQ3(3) | | | | ● | |
| IQ3(4) | | | | | ● |
| IQ4(1) | | ● | | | |
| IQ4(2) | | | ● | | |
| IQ4(3) | | | | ● | |
| IQ4(4) | | | | | ● |
| IQ5(1) | | ● | | | |
| IQ5(2) | ● | | | | |
| IQ6(1) | ● | | | | |

The interviewer may omit some questions in particular interviews, given the specific organizational context which is encountered in relation to the research topic. The order of questions may also be varied depending on the flow of the conversation. On the other hand, additional questions may be required to explore the research question and objectives given the nature of events within particular organizations.

## III. PARTICIPANTS

The concept of purposeful sampling is used in qualitative research. This means that the inquirer selects individuals and sites for study because they can purposefully inform an understanding of the research problem and central phenomenon in the study (Creswell 2007). In purposeful sampling, researchers choose participants arbitrarily for their unique characteristics or their experiences, attitudes, or perceptions; as conceptual or theoretical categories of participants develop during the interviewing process, researcher seeks new participants to challenge emerging patterns (Cooper and Schindler 2008).

The industrial players invited to be interviewed in this study are those with around 20 years experience in the construction industry. This is to ensure that the participants have gone through at least two recessions so that they have relevant experiences to share. The researchers had intentionally select participants who are informed about or have experience with the central concept being investigated.

Participants are usually chosen not because their opinions are representative of the dominant opinion but because their experience and attitudes will reflect the full scope of the issue under study.

One general guideline on the sample size in qualitative research is not only to study a few sites or individuals but also to collect extensive detail about each site or individual studies. The intent in qualitative research is not to generalize the information but to elucidate the particular, the specific (Creswell 2007). Sample sizes for qualitative research vary by technique but generally are small; the intent being that a comparatively small number of individuals can provide a considerable amount of detailed, in-depth information that large sample would not (Fraenkel & Wallen, 2008). Copper and Schindler (2008) suggest to keep sampling as long as breadth and depth of knowledge of the issue under study are expanding; stop when it gain no new knowledge or insights (Cooper & Schindler, 2008).

In total, this study has interviewed 21 persons in Kuala Lumpur, Petaling Jaya, Penang, Butterworth and Johor Bharu. 17 of them have more than 20 years experience in the construction industry. Four of them have been in the industry for 10-20 years. They are holding positions such as managing director, directors, principal, general manager, finance manager, contracts manager, site manager, quantity surveyor and contracts executives. Almost all the participants are from the private sector with exception one is from the public sector. The principal activities of the companies engaged are construction, development, consultation, builders merchant and subcontractors which include small, medium and large enterprises. Further details of the participants are reported in Section 7.2.

#### 5.3.4 ANALYSIS

In some respects however, interview data are problematic, since they are never simply raw, but are always situated and textual (Punch, 2005). They are relatively unstructured and open-ended; they produce large amounts of rich, fertile, but disorganized data (Jankowicz, 1995). On a technical level, this is an issue about the validity of interview responses, aspects of which include the possibility of interviewer bias and effects, the accuracy of respondents' memories, people's response tendencies, dishonesty, self-deception and social desirability (Punch, 2005).

The first step of data analysis is data preparation, which includes editing, coding, and data entry. Editing detects errors and omissions, correct them when possible. Coding involves assigning numbers or other symbols to answers so the responses can be grouped into a limited number of classes or categories. The reduction of information through coding requires the researcher to design category sets carefully, usually as much of the data as possible. The classifying of data into limited categories sacrifices some data detail but is necessary for efficient analysis. In coding, categories are the partitioning of a set. Four rules guide the establishment of category sets. The categories should be: appropriate to the research and purpose (appropriateness), exhaustive (exhaustiveness), mutually exclusive (mutual exclusivity) and derived from one classification principle (unidimensional) (Cooper & Schindler, 2008).

### a. *Qualitative Analysis*

#### I. GROUNDED THEORY

The grounded approach to understand the interview data is adopted. It is endeavour to understand what in actuality has been implemented and the underlying motivations and objectives led to those implementations. The analysis was carried out with raw data coded and classified without using a pre-defined classification scheme. Instead, the categories were derived from the data on an inductive basis. In reviewing the data, categories were defined arising from the case data descriptions. By using this research approach, the data is allowed to speak for itself and room is left for important variations in productivity issues to be identified that nobody had previously identified as important.

Computer software programme QSR NVivo Version 7 has been used to analyse the interview data. Analysis began with open coding, which is the examination of minute sections of text made up of individual words, phrases, and sentences. Open coding identified and developed concepts in terms of their properties and dimensions. In taking apart an observation by a line, a sentence, or a paragraph of transcription, each discrete incident, idea, or event was given a name or code word that represented the concept underlying the observation (Merriam and Associates 2002).

Grouping the code words around a particular concept in the data, called categorizing, reduced the number of code words with which to work. Once again the creative aspect of the data analysis was incorporated with the researcher naming categories as a basis of innovative theoretical formulations (Merriam and Associates 2002).

Open coding was followed by axial coding, which puts data “back together in new ways by making connections between a category and its subcategories”. From this process, categories emerge and were assigned in vivo category labels (Creswell 2007). Whereas open coding fractured the data, axial coding put the data back together in new ways by making connections between a category and its subcategories to develop several main categories. The resulting model denotes causal and intervening conditions, phenomena, contexts, action/interactional strategies, and consequences (Merriam and Associates 2002). Creswell explained, in axial coding, the investigator assembles the data in new ways after open coding. This is presented using a coding paradigm or logic diagram (i.e., a visual model ) in which the researcher identifies a central phenomenon (i.e., a central category about the phenomenon), explores causal conditions (i.e., categories of conditions that influence the phenomenon), specifies strategies (i.e., categories or interactions that result from the central phenomenon), identifies the context and intervening conditions (i.e., the narrow and broad conditions that influence the strategies) and delineates the consequences (i.e., the outcomes of the strategies) for this phenomenon (Creswell 2009).

Finally, selective coding ensued. Selective coding was the integrative process of selecting the core category, systematically relating it to other categories, validating those relationships, and filling in categories that needed further refinement and development (Creswell 2007). The selective coding process integrated the categories to form a substantive theory. This theory describes an interrelated set of categories that emerged from the data through a constant comparative coding and analysis procedure. The identification of core category, one that accounts for most of the variation in a pattern of behavior, was essential for the development of the theory. Once the core category was identified, the remaining categories could then be related to the core category as the conditions that led to the occurrence of the phenomenon and as the phases that represented the phenomenon (Merriam and Associates 2002).

Codes and categories were sorted, compared, and contrasted until saturated – that is, until analysis produced no new codes or categories and when all of the data were accounted for in the core categories of the grounded theory paradigm model. Criteria for core status were (a) a category's centrality in relation to other categories, (b) frequency of a category's occurrence in the data, (c) its inclusiveness and the ease with which it related to other categories, (d) clarity of its implications for a more general theory, (e) its movement toward theoretical power as details of the category were worked out, and (f) its allowance for maximum variation in terms of dimensions, properties, conditions, consequences, and strategies (Creswell 2007).

II. REALIBILITY, VALIDITY AND GENERALIZABILITY

Reliability means dependability or consistency (Neuman 2006). One difficulty of qualitative research is the study processes are not stable over time. Moreover, qualitative research emphasizes the value of a changing and developing interaction between the researcher and what he or she studies. The subject matter and a researcher's relationship to it should be an evolving process according to Neuman (2006). Qualitative researchers use a variety technique to record their observation consistently. The reliability procedures adopted for this study are:

1. Transcripts were checked by the participants to make sure that do not contain obvious mistake during transcription.
2. Data were constantly compare with and the codes to make sure there is not a drift in the definition of codes.

Validity means truthful according to Neuman (2006). Validity is one of the strengths of qualitative research, and it is based on determining whether the findings are accurate from the standpoint of the researcher, the participant, or the readers of an account (Creswell 2009).

> Qualitative researchers are more interested in authentic than in the idea of a single version of truth. Authenticity means giving a fair, honest, and

> balanced account of social life from the viewpoint of someone who lives it every day. Qualitative researchers are less concerned with matching an abstract construct to empirical data and more concerned with giving a candid portrayal of social life that is true to the experience of people being studied. Most qualitative researchers concentrate on capturing an inside view and providing a detailed account of how those being studied understand events (Neuman 2006).

Validity does not carry the same connotations in qualitative research as it does in quantitative research, nor is it a companion of reliability or generalizability (Creswell 2009). Measurement validity in qualitative research does not require demonstrating a fixed correspondence between a carefully defined abstract concept and a precisely calibrated measure of its empirical appearance. Other features of the research measurement process are important for establishing validity. First, to be considered valid, a researcher's truth claim needs to be plausible and 'good enough'. Second, a researcher's empirical claims gain validity when supported by numerous pieces of diverse empirical data. Third, validity increases as researchers search continuously in diverse data and consider the connections among them. Validity grows as a researcher recognizes a dense connectivity in disparate detail (Neuman 2006).

Triangulation of different data sources of information by examining evidence from the sources and using it to build a coherent justification for themes are adopted to validate this study. If themes are established based on converging several sources of data or perspectives from participants, then this process can be claimed as adding to the validity of the study.

Qualitative generalization is a term that is used in a limited way in qualitative research, since the intent of this form of inquiry is not to generalize findings to individuals, sites, or place outside of those under study. The value of qualitative research lays in particular description and themes developed in context of a specific site. Particularity rather than generalizability is the hallmark of qualitative research (Creswell 2009).

b. ***Quantitative analysis***

The quantitative analysis involved in this research include confirmatory data analysis, which is an analytical process guided by classical statistical inferences in its use of significance testing and confidence (Cooper and Schindler 2008). The main emphasis is to conduct a correlational study in order to discover or establish the existence of a relationship/association/interdependence between economic fluctuations and construction productivity. Various objectives are served with correlation analysis. The strength, direction, shape, and other features of the relationship may be discovered. Tactical and strategic questions may be answered by predicting the values of one variable from those of another (Cooper and Schindler 2008). The sections follow examining bivariate correlation analysis, partial correlations and ANOVA adopted for this study.

I. BIVARIATE CORRELATION ANALYSIS

Bivariate correlation analysis requires two continuous variables measured on an interval or ratio scale. The coefficient does not distinguish between independent and dependent variables. It treats the variables symmetrically since the coefficient $r_{xy}$ has the same interpretation as $r_{yx}$ (Cooper and Schindler 2008). The strength of a relationship, or the association, between two variables is typically measured by the coefficient of correlation, whose values range from -1 for a perfect negative correlation up to +1 for a perfect positive correlation. Correlation alone cannot prove that there is a causation effect, i.e. that the change in value of one variable caused the change in the other variable. A strong correlation can be produced simply by chance, by the effect of a third variable not considered in the calculation of the correlation, or by a cause-and-effect relationship (Berenson, Levine et al. 2004).

II. PARTIAL CORRELATIONS

The Partial Correlations is calculated to evaluate why two variable are correlated. Two possible explanations are the common cause and the mediator variable hypothesis. The common cause hypothesis says that variables A and B are correlated because they share the same causal variables. If this hypothesis is correct, then the correlation between A and B should be nonzero in value ($r \neq 0$), but the correlation between A and B partialling out the effects of the common causal variable or variables should be equal to zero ($r_p = 0$). The mediator variable hypothesis says that variables A and B are correlated because A causes B through one or more mediator variables. If this hypothesis is correct, then the correlation between A and B should be nonzero in value ($r \neq 0$), but the correlation between A and B partialling out the effects of the mediator variable or variables should be equal to zero ($r_p = 0$) (Green and Salkind 2008).

III. ANOVA

The statistical method for testing the null hypothesis that the means of several populations are equal is analysis-of-variance (ANOVA). It uses a single-factor, fixed-effects model to compare the effects of one treatment or factor on a continuous dependent variable. In a fixed-effects model, the levels of the factor are established in advance, and the results are not generalizable to other levels of treatment. The samples must be randomly selected from normal populations, and the populations should have equal variances. The distance from one value to its group's mean should be independent of the distances of other values to that mean (independence of error). ANOVA is reasonably robust, and minor variation from normality and equal variance are tolerable. ANOVA breaks down or partitions total variability into component parts. It uses squared deviations of the variance so that computation of distances of the individual data points from their own mean or from the grand mean can be summed. In an ANOVA model, each group has its own mean and values that deviate from that mean. Similarly, all the data points from all of the groups produce an overall grand mean, The total deviation is the sum of the squared differences between each data point and the overall grand mean (Cooper and Schindler 2008). If the overall ANOVA is significant and a factor has more than two levels, follow-up tests are usually conducted. These follow-up tests frequently involve comparisons between pairs of group means. SPSS calls these follow-up tests post hoc multiple comparisons (Green and Salkind 2008).

## 5.4 ETHICAL ISSUES

Research has an ethical-moral dimension; the researcher has a moral and professional obligation to be ethical, even when research subjects are unaware of or unconcerned about ethics recommended by Neuman (2006). The ethical issues are the concerns, dilemmas and conflicts that arise over the proper way to conduct research. Ethics define what is or is not legitimate to do, or what ‘moral’ research procedure involves. Neuman advocated there are few ethical absolutes; although there are few fixed rules, there are agreed-on principles. These principles may conflict in practice. Many ethical issues involved a balance between two values: the pursuit of scientific knowledge and the rights of those being studied or others in society. Potential benefits such as advancing the understanding of social life, improving decision making, or helping research participants must be weighed against potential costs such as loss of dignity, self esteem, privacy, or democratic freedom (Neuman 2006) .

The three most important ethics issues highlighted by Fraenkel & Wallen, (2008) are:

(a) Protecting participants from both physical and psychological harm. This occurs when there is the possibility that certain research findings, in the hands of the powerful, may lead to actions that could actually hurt subjects (or people in similar circumstances) and/or lead to public policies or public attitudes that are actually harmful to certain groups. While a researchers can never be sure how their findings will be received, they must always be sure to think carefully about the implications of their work, who the results of this work may affect, and how (Fraenkel &Wallen, 2008). Neuman (2006) suggested that social research can harm a research participant in several ways: physical harm, psychological harm, legal harm, and harm to a person’s career or income. The risk of physical harm is rare, but researchers may place people in stressful, embarrassing, anxiety-producing, or unpleasant situation (Neuman 2006) .

(b) Treating participants with respect – It is especially important in qualitative studies to seek the cooperation of all subjects in the research endeavour. Usually, subjects should be told of the researcher’s interests and should give their permission to proceed. Researchers should never lie to subjects nor record any conversations using a hidden tape recorder or other mechanical apparatus (Fraenkel &Wallen, 2008). Neuman (2006) suggested that never coerce anyone into participating; participation must be voluntary. It is not enough to get permission from people; they need to know what they are being asked to participate in so that they can make an informed decision. Participants can become aware of their rights and what they are getting involved in when they read and sign a statement giving informed consent, a written agreement to participate given by people after they learn something about the research. The general rule is: The greater the risk of potential harm to subjects; the greater the need for a written consent statement (Neuman 2006).

(c) Protecting participant identity – Survey researchers invade a person's privacy when they probe into beliefs, backgrounds and behaviours in a way that reveals intimate private details. Unless otherwise agreed to, the identities of all who participate in a qualitative should always be protected; care should be taken to ensure that none of the information collected would embarrass or harm them. If confidentiality cannot be maintained, participants must be informed and given the opportunity to withdraw from the study (Fraenkel & Wallen, 2008). Neuman (2006) identified researchers protect privacy take two forms: anonymity and confidentiality, Anonymity means that people remains anonymous, or nameless. Confidentiality means that information may have names attached to it, but the researcher holds it in confidence or keeps it secret from the public. Anonymity protects the identity of specific individuals from being known. For example, a field researcher provides a social picture of a particular individual, but gives a fictitious names and location, and alters some characteristics. The subject's identity is protected, and the individual is unknown or anonymous. Survey and experimental researchers discard the names or addresses of subjects as soon as possible and refer to participants by a code number only, to protect anonymity. Even if anonymity is not possible, researcher should protect confidentiality. The information is not released in a way that permits linking specific individuals to responses and is publicly presented only in an aggregate form (e.g., percentages, means, etc.) (Neuman 2006).

In return for access to sensitive and proprietary information all of these organizations were guaranteed anonymity as stated in the Appendix 2: Participant information and consent form. The participants were being informed that the participation in the interview were voluntary. They are free to withdraw from participation at any time during the interview. All comments and responses are anonymous and will be treated confidentially. The names of individual persons are not required in any of the responses. The transcription of the interview content will be e-mailed to the participant for verification prior to final inclusion. The audio recordings (if there is) will be destroyed after the contents have been transcribed. Pseudonyms for individuals and organizations were used in the subsequent write-up.

## 5.5 SUMMARY

This chapter outlines and describes the research methodology adopted in this research. It highlights that this study is classified as an explanatory study. The postpositivits worldview approach is used in the research design. The mixed-methods strategies are used. Quantitative data analysis will be used to answer the research question 2, which include analyse statistical data available in the annual Economic Reports, Construction Industry Survey/Census reports, annual Bank Negara Reports etc. The statistical tests used in the analysis include Bivariate correlation test, partial correlations and analysis of variance. Purposeful sampling is used in selection of individuals for their unique characteristics or their experiences to participate in the semi structured interview. These participants can purposefully inform an understanding of the research problem and central phenomenon to answer question 2, 3, 4 and 5. Grounded theory approach is used to analyse the interview data. Computer software programme QSR NVivo Version 7 is used to code the interview transcript. The ethical issues on the access to sensitive and proprietary information of individuals and the organizations have been considered. Pseudonyms for individuals and organizations will be used in the subsequent write-up.

The results of the quantitative and qualitative data collected with the method described in this chapter are presented in the following chapters.

# Chapter 6: Quantitative Data Result

## 6.1 INTRODUCTION

This chapter is aim to answer the first research question i.e. 'how the productivity of construction sector is affected by the macroeconomic fluctuations?' The secondary statistical data collected from government reports are examined to identify relationship between construction output and the Malaysian economic fluctuation in Section 6.2. Section 6.3 looks at the aggregated construction labour productivity at the national level and its relationships with economic development indicators between 1970 and 2009. Section 6.4 analyse construction productivity indicators between 1996 and 2007 at the sectoral and sub-sectoral levels according to the type of construction and establishment size group. Section 6.5 summarises the findings.

## 6.2 ECONOMIC FLUCTUATION AND CONSTRUCTION SECTOR

The Gross Domestic Product (GDP), GDP in construction, construction employment and GDP per capita and construction labour productivity between years 1970 and 2009 presented in Table 6-1 are calculated from the data obtained from *Economic Reports* and *Bank Negara Reports* (Annual Report of Central Bank of Malaysia) published between 1970 and 2010. The *Economic Report* and *Bank Negara Report* is annual publication of Ministry of Finance and Central Bank of Malaysia respectively.

Table 6-1
GDP, GDP in construction, construction employment, GDP per capita and construction labour productivity (1970-2009) at constant 2005 price in RM*

| Year | GDP in Total Economy | GDP in Construction | Construction Employment | GDP per Capita | Construction Labour Productivity |
|---|---|---|---|---|---|
| 1970 | 47,691,130,939 | 1,923,522,180 | 91,000 | 4,394 | 21,138 |
| 1971 | 58,627,480,195 | 2,634,494,935 | 102,000 | 5,268 | 25,828 |
| 1972 | 64,131,688,923 | 2,780,585,227 | 114,000 | 5,622 | 24,391 |
| 1973 | 71,635,790,183 | 3,170,159,340 | 127,000 | 6,128 | 24,962 |
| 1974 | 77,594,929,419 | 3,549,994,099 | 143,000 | 6,481 | 24,825 |
| 1975 | 78,216,517,639 | 3,184,768,368 | 160,000 | 6,381 | 19,905 |
| 1976 | 87,261,076,661 | 3,472,079,277 | 206,000 | 6,957 | 16,855 |
| 1977 | 94,026,478,878 | 3,895,741,124 | 205,000 | 7,327 | 19,004 |
| 1978 | 100,282,899,436 | 4,475,232,616 | 219,000 | 7,638 | 20,435 |
| 1979 | 109,658,447,918 | 5,013,285,393 | 234,000 | 8,160 | 21,424 |
| 1980 | 117,821,686,631 | 5,881,571,620 | 270,200 | 8,560 | 21,767 |
| 1981 | 126,000,807,130 | 6,738,470,485 | 310,100 | 8,932 | 21,730 |
| 1982 | 133,528,774,348 | 7,396,090,546 | 377,500 | 9,230 | 19,592 |
| 1983 | 141,829,655,218 | 8,161,890,529 | 425,600 | 9,553 | 19,177 |
| 1984 | 152,838,380,836 | 8,506,358,179 | 428,000 | 10,022 | 19,875 |
| 1985 | 151,194,615,842 | 7,794,648,158 | 419,400 | 9,644 | 18,585 |
| 1986 | 152,862,203,516 | 6,701,461,564 | 369,400 | 9,476 | 18,141 |
| 1987 | 161,102,204,202 | 5,912,886,860 | 336,300 | 9,700 | 17,582 |
| 1988 | 175,276,699,437 | 6,072,309,905 | 339,900 | 10,248 | 17,865 |
| 1989 | 191,367,597,016 | 6,775,479,407 | 376,900 | 10,871 | 17,977 |
| 1990 | 208,609,144,694 | 8,032,895,281 | 423,900 | 11,523 | 18,950 |
| 1991 | 228,521,862,622 | 9,281,742,734 | 465,000 | 12,288 | 19,961 |
| 1992 | 248,826,299,693 | 10,279,963,854 | 506,700 | 13,036 | 20,288 |
| 1993 | 273,447,521,108 | 11,389,574,456 | 538,800 | 13,967 | 21,139 |
| 1994 | 298,637,621,079 | 13,113,969,309 | 597,600 | 14,873 | 21,944 |
| 1995 | 327,990,967,236 | 15,875,143,181 | 717,100 | 15,927 | 22,138 |
| 1996 | 360,798,921,930 | 18,443,527,566 | 796,000 | 17,079 | 23,170 |
| 1997 | 387,219,295,597 | 20,397,127,697 | 876,100 | 17,871 | 23,282 |
| 1998 | 358,722,219,932 | 15,510,985,262 | 765,300 | 16,148 | 20,268 |
| 1999 | 380,739,197,987 | 14,836,222,058 | 748,800 | 16,734 | 19,813 |
| 2000 | 414,468,381,625 | 14,917,622,063 | 755,000 | 17,809 | 19,758 |
| 2001 | 416,613,982,126 | 15,404,518,897 | 769,900 | 17,523 | 20,008 |
| 2002 | 439,073,593,222 | 15,762,217,228 | 767,300 | 18,100 | 20,542 |
| 2003 | 464,489,365,008 | 16,049,443,650 | 774,600 | 18,784 | 20,720 |
| 2004 | 495,997,711,875 | 15,912,770,855 | 767,300 | 19,689 | 20,739 |
| 2005 | 522,445,000,000 | 15,680,000,000 | 759,600 | 20,366 | 20,642 |
| 2006 | 553,002,072,499 | 15,630,883,214 | 755,200 | 21,177 | 20,698 |
| 2007 | 587,183,988,770 | 16,370,838,270 | 757,300 | 21,609 | 21,617 |

| | | | | | |
|---|---|---|---|---|---|
| 2008 | 614,387,179,510 | 16,717,859,040 | 758,400 | 22,157 | 22,044 |
| 2009 | 603,812,683,383 | 17,669,229,826 | 762,400 | 21,331 | 23,176 |

*RM1 is approximately equal to AUS$0.3239 or US$0.3191 in Dec 2010

All the prices employed in the study have been deflated to year 2005 constant price. GDP is the total value of goods and services produced within a given period after deducting the cost of goods and services used up in the process of production but before deducting allowances for the consumption of fixed capita (Ministry of Finance 2010). GDP per capita is GDP per head calculated as the aggregate of production (GDP) divided by the population size. GPD per capita is used as proxy for economic development in this study. Construction refers to '*new construction, alteration, repairs and demolition. Installation of any machinery or equipment which is built-in at the time of the original construction but which requires structural alteration in order to install*' done by registered contractors (Ministry of Finance 2010). Construction labour productivity (CLP) is derived from the GDP of construction divided by the employment in the construction sector.

Variations in aggregate construction demand follow a cyclical pattern of demand in the economy as a whole. There are two different types of demand; one that is expressed as a long-term trend where a growing economy and population need more space over time. Superimposed on this is the short-term fluctuation closely following the business cycle. The latter demand is affected by expectations about the future, about interest rates and particular perception about job security and future income. The longer cycle is termed as *building cycle* and the short cycle is identified as *construction business cycle* in this study.

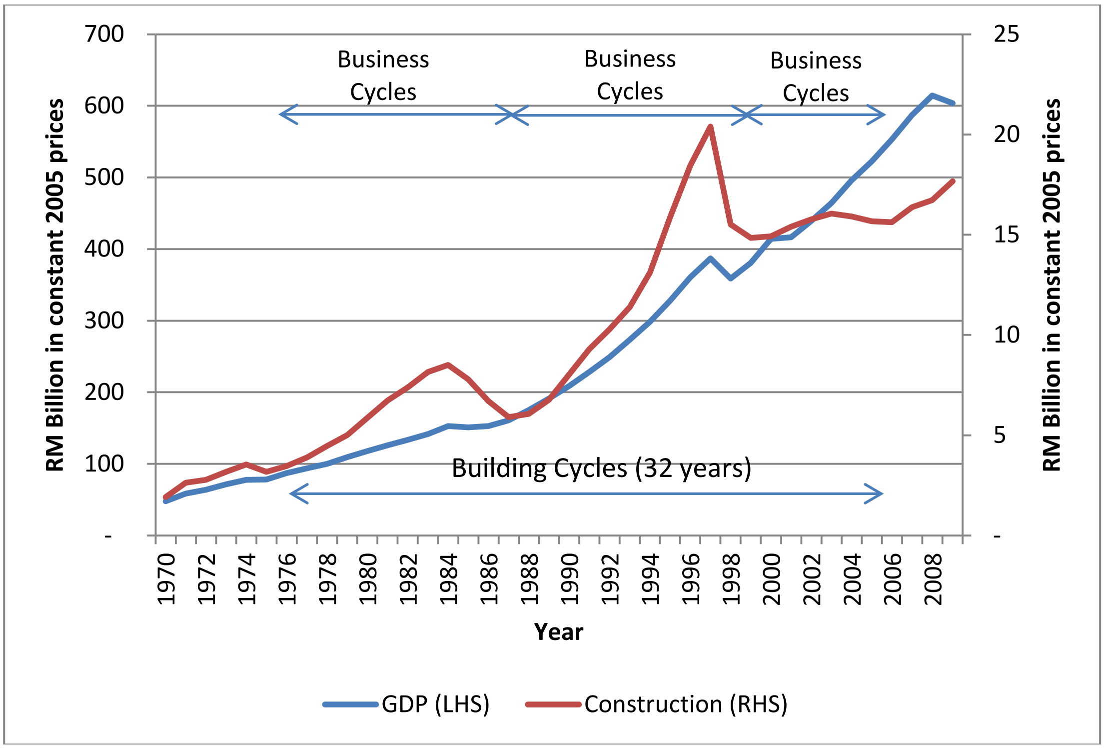


Figure 6.1. GDP and construction value-added in Malaysia (1970-2009, in constant 2005 price)

Table 6-1 shows that there is a contraction of GDP in construction from RM3.5 in 1974 to RM3.1 billion in 1975 nonetheless there is no corresponding decline in the GDP of whole economy. Similarly there is fall of GDP in construction from RM16.0 billion in 2003 to RM15.6 billion in 2006; however, the GDP of whole economy is indeed on the growing trend. Therefore period from 1975 to 2006 is identified as a building cycle in this study, which is 32 years in length from trough to trough. The shorter cycles in 1975-1987, 1987-1999 and 1999-2006 are labelled as construction business cycles.

The construction sector recorded a rapid increase of 9.6% per annum during 1970s, raising its share in total GDP from 3.9% in 1970 to 4.5% in 1980. This rapid increase was large due to the construction boom during the second half of the decade in response to demand for housing which rose rapidly, aided by improved conditions in the mortgage and real estate markets. Non residential construction also increased significantly resulting from implementation of major public sector infrastructure projects and construction investment associated with private sector (Economic Planning Unit 1991). The Bretton Woods system fell apart in 1971, the world moved to a system of flexible exchange rates. This move unshackled monetary authorities that, freed of constraints of a fixed-rate regime, could print as much money as they want. The result was a rise in inflation and commodity prices, even before the 1973 Yom Kippur War led to an oil embargo and a quadrupling of oil prices. Stagflation, a deadly combination of high inflation and recession, followed the two oil shocks of 1973 and 1979 (Roubini and Mihm 2010). Malaysia is a small economy, which is much depends on export of its primary industry was badly hit. The export declined by 3% in 1975. As a result the demand for construction contracted, the annual growth of construction is -4.9 in 1975 (Figure 6.1).

The construction expanded at an average rate of 8.1% per annum in 1981-1985. Underlying this rate of growth was a sharp deterioration from 14.6% in 1981 to 2.0% following the global recession in 1985. The strong growth during the first half of 1981-1985 was sustained mainly by the expansionary programmes of the public sector in the construction of physical infrastructure as well as upsurge in private sector construction activities for office space and hotels. The rationalization of public development expenditure since 1983 affected these expansionary programmes tapper off. The slowdown in the growth of the construction sector was due to the sluggish performance of residential construction with demand weakening on account of higher prices, the glut in office space, tightness in credit availability, higher cost on mortgage loans, and partial freeze on housing loans for the public sector employees (Economic Planning Unit 1986).

The construction sector underwent a correction with negative annual growth rate of -8.4%, -14.0% and -11.8% for three consecutive years of 1985, 1986 and 1987 respectively. The panic that followed a stock market collapse on Black Monday of October 1987 led to a sharp recession that hit hardest those countries most closely linked to the United States, including Canada, Australia and the United Kingdom. Malaysia being an open and small economy was susceptible to external shock, the GDP of construction was plummeted to RM5.9 billion in 1987 from the peak of RM8.5 billion in 1984. Thereafter, the sector emerged from the doldrums and expanded by an average rate of growth of 12.9% during the period 1988-1997. Growth of the construction sector was broad-based, covering the civil engineering, residential and non-residential sub-sectors. The civil engineering sub-sector expanded by 12.8%, benefiting from the government’s privatised projects and the accelerated implementation of large infrastructure and civil engineering projects such as roads, highways, power transmission, telecommunication, rail transport and ports. Increased activity in the residential sub-sector, on the other hand, was supported by buoyant demand in response to higher disposable incomes. The aggressive promotion of the tourism industry also contributed to the rapid development of the non-residential sector, in particular, hotels, resorts and golf courses (BNM 1999).

During the later part of the 1990s, growth in demand for residential and non-residential property was also fuelled by speculative demand following the wealth effect from a booming stock market and rising income. As a result, property transactions rose significantly, and property prices escalated, especially in major towns. The strong demand was also reflected in the significant increase in rental rates and high take-up of more than 90% for retail space in shopping complexes. Purpose-built office space in the Klang Valley more than doubled during the period 1990-1997 (BNM 1999).

Following the adverse impact of the 1997/1998 Asian Finance Crisis began in July 1997; the construction sector contracted 23% in 1998. The crisis occurred following a decade of strong economic performance in all affected countries. The crisis resulted in a significant wealth loss, declines in asset prices, sudden capital flight and threats to currency and banking system stability to varying degrees across these countries. Paul Krugman attributed the crisis to macroeconomic policy slippages and weaknesses in financial systems in the affected countries (Arulampalam 2011). The impact to Malaysia economy is GDP declined by 6.7% in 1998 after 12 years of uninterrupted expansion averaging 7.8% per annum. Value added of the construction sector declined by 24.0% in the same year (Table 6-1).

Following three consecutive years of decline, the construction sector turned around to record three consecutive years of growth at 4.6% in 2007, 2.1% in 2008 and 5.7% in 2009. The GDP per capita declines 3.7% in 2009 after seven years of positive growth (Table 6-1).

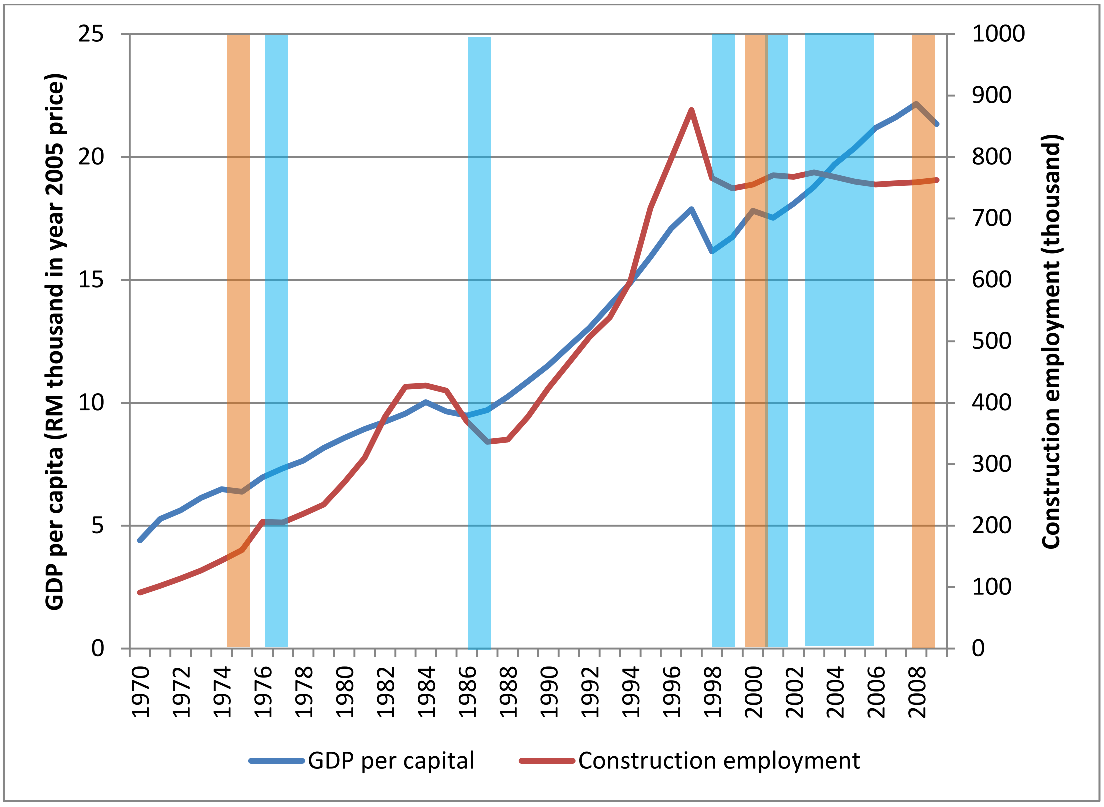


Figure 6.2. GDP per capita and construction employment 1970-2009

Figure 6.2 depicts the times series of gross domestic product (GPD) per capita and construction employment. In general, the construction employment is procyclical. Within the 39 years of the time series, the construction employment is moving in the same direction as the changes of GDP per capita in 31 years. The countercyclical happened:

1. in 1976/1977, 1986/1987, 1998/1999, 2001/2002, and 2003/2005 where the construction employment declined despite the growth in GDP per capita; and
2. in 1974/1975, 2000/2001 and 2008/2009 where the construction employment have risen although the GDP per capita declined.

## 6.3 THE PRODUCTIVITY OF THE CONSTRUCTION SECTOR

The GDP per capita of Malaysia expand by almost four times from RM4,394 in 1970 to RM21,331 in 2009, however, the construction labour productivity (CLP) only grows one-tenth from RM21,138 in 1970 to RM23,176 in 2009. The average annual growth of GDP per capita within the period is 4.2%, but the average annual growth of CLP is 0.5%.

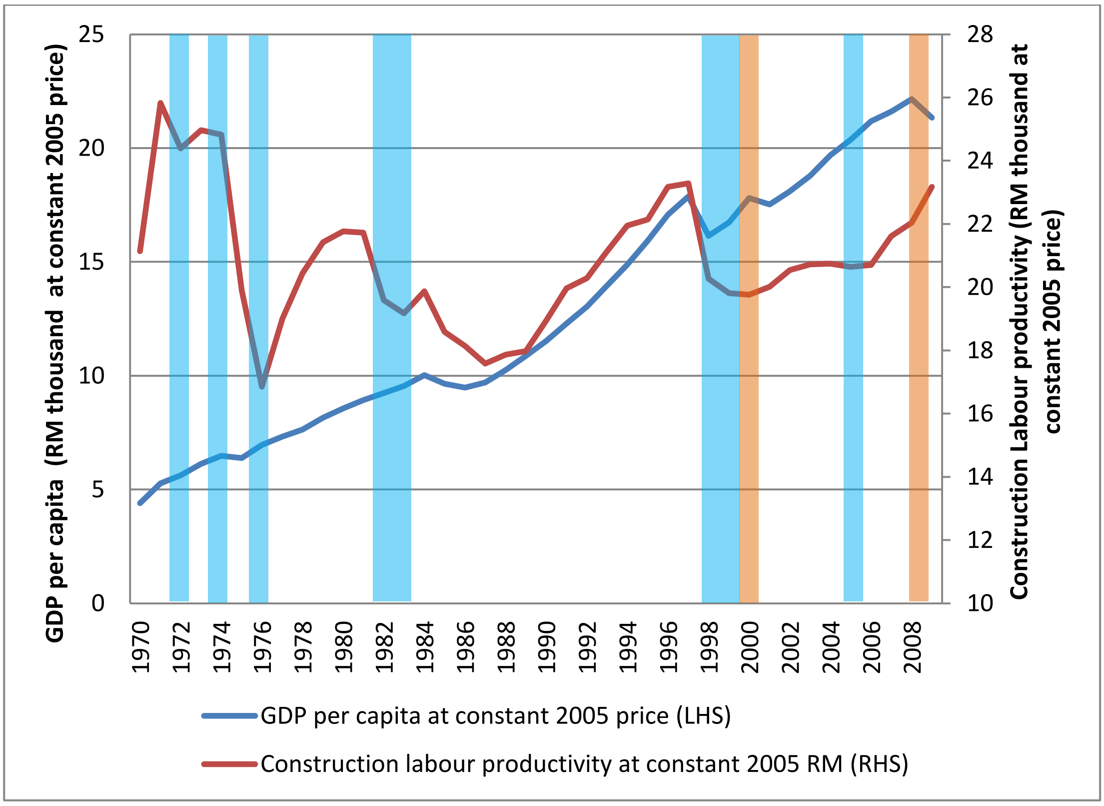


Figure 6.3. Time series of GDP per capita and construction labour productivity indicators 1970-2009 (at constant 2005 prices)

Figure 6.3 depicts the times series of gross domestic product (GPD) per capita and aggregate labour productivity of the construction sector (CLP). The time series seems bear no relation to one another before mid of 1980s. There is a radical change end of 1980s. The CLP is procyclical i.e. moving in the same direction as the changes of GDP per capita in 29 years out of 39 years. The countercyclical happened:

1. in 1971/1972, 1973/1974, 1975/1976, 1981/1983, 1998/2000 and 2005/2006 where the CLP declined despite the growth in GDP per capita; and

2. in 2000/2001 and 2008/2009 where the CLP have risen although the GDP per capita declined.

The changes of CLP fluctuated greater than the GDP per capita, the cycle of CLP also spans longer than GDP per capita. The CLP declines in years 1971-1976 (except 1973), 1980-1987 (except 1984) and 1997-2000. On the other hand, GDP per capita declines in years 1974-1975, 1984-1986, 1997-1998 and 2008-2009.

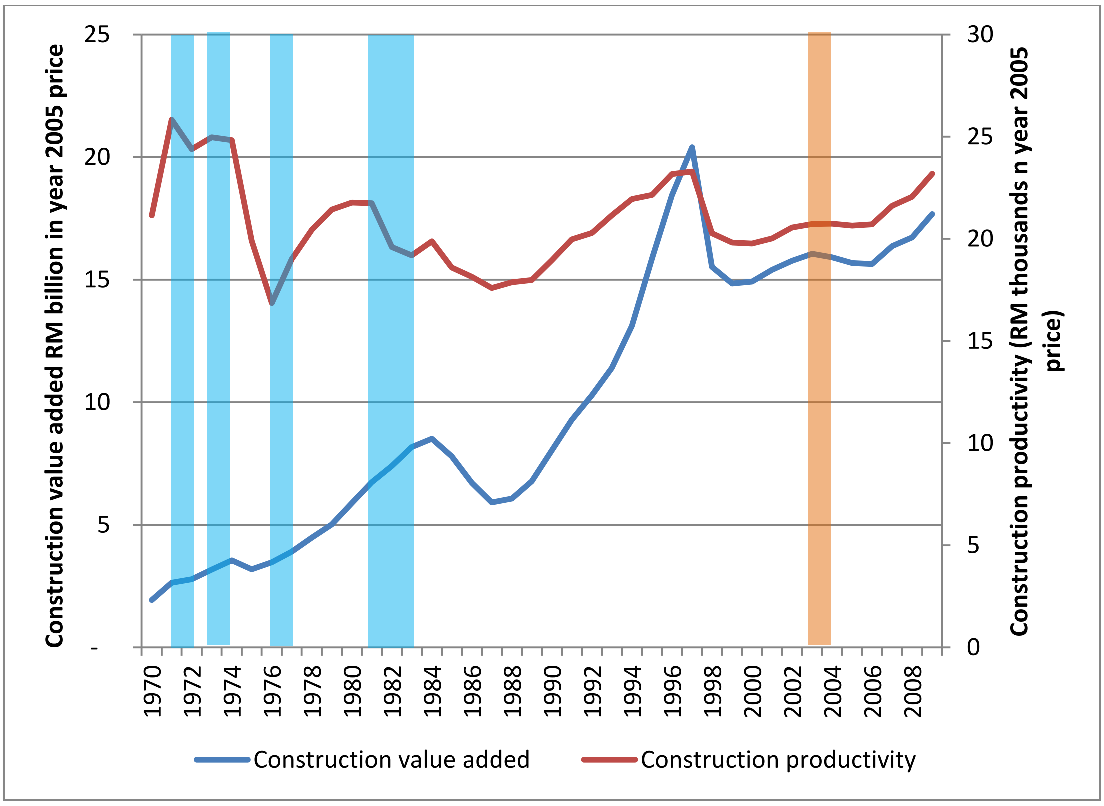


Figure 6.4. Time series of construction value added and construction labour productivity 1970-2009 (at constant 2005 prices)

Figure 6.4 shows that CLP is also moving in the same direction as GDP in construction in most of the time. Within the 39 years of the time series, the CLP is moving in the same direction as the changes of construction value added in 33 years. The exceptions are:

1. In 1971/1972, 1973/1974, 1976/1977, 1981/1982 and 1982/1983 where the CLP declined despite the growth in construction value added; and
2. In 2003/2004 where the CLP have risen although there is fall in the construction value added.

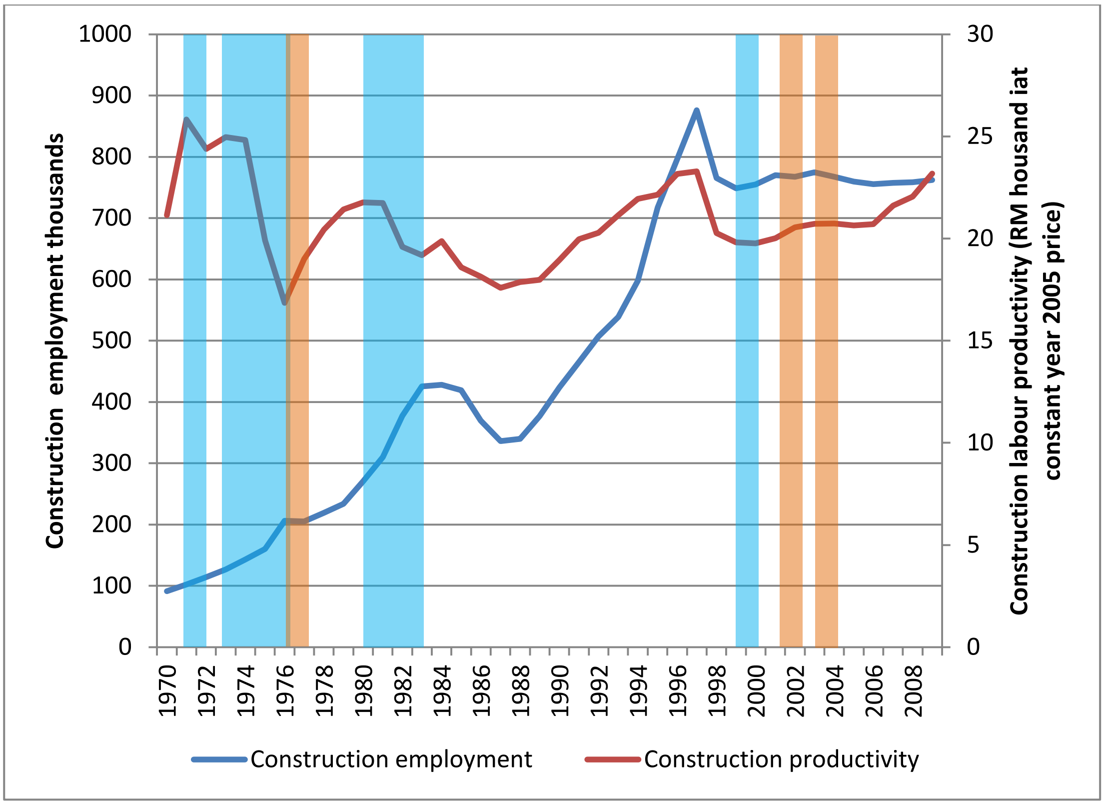


Figure 6.5. Time series of construction employment and construction labour productivity 1970-2009 (at constant 2005 prices)

Figure 6.5 shows that CLP is also moving in the same direction as construction employment. Within the 39 years of the time series, the CLP is moving in the same direction as the changes of construction employment in 28 years. The exceptions are:

1. in 1971/1972, 1973/1974, 1974/1875, 1975/1976, 1980/1981, 1981/1982, 1982/1983 and 1999/2000 where the CLP declined despite the growth in construction employment; and
2. in 1976/1977, 2001/2002 and 2003/2004 where the CLP have risen although there is fall in the construction employment.

Table 6-2 shows the correlation coefficients between the CLP and GDP per capita of building cycle (1975-2006) is *r* (32) = 0.456; $\rho$ = 0.009. In addition, CLP is significantly related with GDP (*r* (32) = 0.405; $\rho$ = 0.022), value added in construction (*r* (32) = 0.592; $\rho$< 0.001) and employment in construction (*r* (32) = 0.489; $\rho$ = 0.005) of business cycle (1975-2006). However, CLP is not significant correlated with population.

Table 6-2
Bivariate Correlations of Construction Labour Productivity and GDP, GDP per Capita and Construction Employment

| Variables | 1975-2006<br>N = 32 | 1975-1987<br>N = 13 | 1987-1999<br>N = 13 | 1999-2006<br>N = 8 |
|---|---|---|---|---|
| Gross domestic product per capita | 0.456<br>*(0.009)* | -0.045<br>*(0.885)* | 0.806<br>*(0.001)* | 0.793<br>*(0.019)* |
| Gross domestic product | 0.405<br>*(0.022)* | -0.183<br>*(0.549)* | 0.901<br>*(0.000)* | 0.825<br>*(0.012)* |
| Population | 0.337<br>*(0.059)* | -0.299<br>*(0.321)* | 0.723<br>*(0.005)* | 0.841<br>*(0.009)* |
| Construction | 0.592<br>*(0.000)* | 0.078<br>*(0.799)* | 0.867<br>*(0.000)* | 0.935<br>*(0.001)* |
| Construction employment | 0.489<br>*(0.005)* | -0.154<br>*(0.616)* | 0.839<br>*(0.000)* | 0.495<br>*(0.213)* |

Figures in parentheses are level of statistical significance.

In the case of construction business cycle, the correlation of CLP and GDP per capita is not significant in 1975-1987 ($r$ (13) = -0.045; $\rho$ = 0.885). The correlations of CLP and GDP, CLP and population, CLP and value added in construction and CLP and construction employment are not significant too.

The correlation between CLP and GDP per capita is correlated in 1987-1999 ($r$ (13) = 0.806; $\rho$ = 0.001). They are also correlated with GDP ($r$ (13) = 0.901; $\rho$< 0.001), population (r (13) = 0.723; $\rho$ = 0.005), valued added in construction ($r$ (13) = 0.867; $\rho$< 0.001) and employment in construction ($r$ (13) = 0.839; $\rho$< 0.001).

The correlation between CLP and GDP per capita is correlated in 1999-2006 ($r$ (8) = 0.793; $\rho$ = 0.019). They are also correlated with GDP ($r$ (8) = 0.825; $\rho$< 0.012), population ($r$ (13) = 0.841; $\rho$ = 0.009) and valued added in construction ($r$ (13) = 0.935; $\rho$< 0.001).

Partial correlation procedure is adopted to identify the underlying factors drive the correlation of CLP and GDP per capita. The partial correlation procedure computes partial correlation coefficients that describe the linear relationship between two variables while controlling for the effects of one or more additional variables. If the two variables correlate substantially with the third variable, the partial correlation between them may be much smaller than the original correlation; indeed, it may be statistically insignificant. In that case, it may be reasonable to interpret the original correlation as having been driven by the third variable (Green and Salkind 2008).

There are three ways the productivity ratio will change: increase or decrease of the output (e.g. GDP or GDP on construction activity), increase or decrease of the input (construction employment), or effect a combination of both. GDP, GDP construction activity, population and construction employment were adopted as the third variable in the following partial correlation procedure.

Table 6-3
Partial Correlations of Construction Labour Productivity and GDP, GDP per Capita and Construction Employment

| Control variables | 1975-2006 df = 29 | 1975-1987 df = 10 | 1987-1999 df = 10 | 1999-2006 df = 5 |
|---|---|---|---|---|
| Gross domestic product | 0.521 *(0.003)* | 0.671 *(0.017)* | 0.982 *(0.000)* | -0.717 *(0.070)* |
| Population | 0.790 *(0.000)* | 0.611 *(0.035)* | 0.936 *(0.000)* | -0.430 *(0.335)* |
| Construction | -0.408 *(0.023)* | -0.342 *(0.277)* | -0.204 *(0.526)* | 0.816 *(0.025)* |
| Employment in construction | -0.065 *(0.727)* | 0.314 *(0.320)* | 0.480 *(0.114)* | 0.884 *(0.008)* |

*Figures in parentheses are level of statistical significance.*

In the case of building cycle (1975-2006), Table 6-3 shows that partial correlations between CLP and GDP per capita with value added of construction partialled out is significantly lower ($r_p$ (29) = -0.408; $\rho$ = 0.023). In this case, it may be reasonable to interpret the original correlation as having driven by value added in construction in the 1975-2006 building cycle.

In the 1987-1999 construction business cycle, the partial correlations with value added in construction and employment in construction partialled out are $r_p$ (10) = -0.204; $\rho$ = 0.526 and $r_p$ (10) = 0.480; $\rho$= 0.114) respectively; which are significantly lower than the original coefficient. In this case, it may be reasonable to interpret the original correlation as having driven by value added in construction and employment in construction in the 1987-1999 construction business cycle.

In the 1999-2006 construction business cycle, the partial correlations with GDP and population partialled out are $r_p$ (5) = -0.717; $\rho$ = 0.070 and $r_p$ (5) = -0.430; $\rho$= 0.335) respectively; which are significantly lower than the original coefficient. In this case, it may be reasonable to interpret the original correlation as having driven by GDP and population in the 1999-2006 construction business cycle.

## 6.4 CONSTRUCTION INDUSTRY SURVEY/CENSUS REPORTS

Table 6-4 shows the productivity indicators of the construction sector generated from Census of Construction Industry 1996 and 2005 and Construction Industry Survey 1998, 2000, 2002, 2004 and 2007 published by Department of Statistics, Malaysia (DOSM). Department of Statistics, Malaysia (DOSM) conducts a biennial Construction Industry Survey and quinquennial Census of Construction Industry. The surveys/censuses cover 25 industries from the Construction Sector (based on the Malaysia Standard Industrial Classification, 2000). The respondents are the establishments primarily engaged in construction activities, with a value of construction work RM500,000 and above. The surveys collect information pertaining to growth, composition and distribution of output, value added, employment and other variables of the sector (Department of Statistics Malaysia, 2009). The biennial survey was last carried out in 2008 for reference year 2007. The Construction Industry Survey and Census of Construction Industry contain data on value of gross output, cost of input, total number of persons engaged, salaries and wages paid and value of assets owned. The statistics are grouped by work state, legal status, ownership, output size group, employment size group, assets size group and type of construction (DOS, 2006, 2009).

All the values from the surveys/censuses are deflated to 2000 prices using the Implicit Price Deflators for construction obtained from the National Accounts. The definitions of productivity indicators computed for this study are following the definitions adopted by Malaysia Productivity Corporation (NPC 2005) which include:

1. Labour productivity – There are two indicators included to gauge the productivity performance of the industry.
   a. Added value per employee (Added Value/Number of Employees) reflects the amount of wealth created by the company relative to its number of employees. A high ratio indicates the favourable effects of the labour factor in the wealth creation process.
   b. Total output per employee (Total output/Number of Employees) measures the size of output generated by the enterprise.

2. Labour cost competitiveness – competitiveness in terms of labour cost indicates the comparability of the industry in producing products or services at the lowest possible labour cost. There are three competitiveness ratios:

   a. Added value per labour cost (Added Value/Labour Cost) indicates how competitive the activity is in terms of labour cost. A low ratio indicates high labour cost which does not match with the creation of added value.

   b. Labour cost per employee (Labour cost/Number of Employee) measures the average remuneration per employee. A high ratio means high returns to individual workers and vice-versa.

   c. Unit labour cost (Labour Cost/Total output) indicates the relationship of labour cost to total output. A high ratio indicates high labour cost.

3. Capital productivity (Added Value/Fixed assets) – indicates the degree of utilisation of tangible fixed assets. A high ratio indicates the efficiency of asset utilisation.

4. Capital intensity (Fixed assets/Number of Employees) –the ratio measuring the amount of fixed assets allocated to each employee. This ratio is used to measure whether an industry is relatively capital-intensive or labour-intensive. A high ratio indicates high capital intensity and low ratios mean dependence on labour-intensive methods.

5. Added value content (Added value/Total output x 100) – this ratio is used to gauge the degree of utilisation of bought-in materials and services and changes in the price differentials between products and purchases. A high ratio indicates efficient usage of purchase or favourable price differentials. A low ratio means high cost of bought-in materials and services, poor products quality and low price competition.

The labour productivity declined in 1998. Both the total output per employee and added value per employee declined by 1.07% and 0.73% respectively. The labour cost competitiveness deteriorated; the unit labour cost and labour cost per employee recorded an increase of 6.14% and 5.00% respectively led to the added value per labour cost contracted by 5.46%. There capital intensity increased by 20.27% accompany by contraction of employment in construction sector from 796,000 in 1996 to 765,000 in 1998 (Table 6.1). Therefore the increase in capital intensity is attributed to the reduction in the construction employment. The capital productivity fell by 20.37%. Added value content was marginally improved from 38.48% in 1996 to 38.61% in 1998.

Table 6-4
Productivity indicators of Malaysian construction sector 1996-2007 at constant 2000 prices

| **Productivity Indicators** | **1996** | **1998** | **2000** | **2002** | **2004** | **2005** | **2007** |
|---|---|---|---|---|---|---|---|
| Total output per employee | 75040 | 74236 *(-1.07)* | 86947 *(17.12)* | 92237 *(6.08)* | 98083 *(6.34)* | 91592 *(-6.62)* | 88646 *(-3.22)* |
| Added value per employee | 28875 | 28662 *(-0.73)* | 31820 *(11.01)* | 32610 *(2.48)* | 33717 *(3.40)* | 32245 *(-4.37)* | 26424 *(-18.05)* |
| Added value per labour cost | 1.70 | 1.60 *(-5.46)* | 1.67 *(4.23)* | 1.62 *(-3.07)* | 1.69 *(4.52)* | 1.75 *(3.14)* | 1.40 *(-20.09)* |
| Labour cost per employee | 17008 | 17859 *(5.00)* | 19020 *(6.50)* | 20110 *(5.73)* | 19894 *(-1.07)* | 18447 *(-7.28)* | 18917 *(2.55)* |
| Unit labour cost | 0.227 | 0.241 *(6.14)* | 0.219 *(-9.06)* | 0.218 *(-0.33)* | 0.203 *(-6.97)* | 0.201 *(-0.71)* | 0.213 *(5.96)* |
| Capital productivity | 2.79 | 2.22 *(-20.37)* | 2.18 *(-1.68)* | 2.42 *(10.70)* | 2.29 *(-5.17)* | 2.38 *(3.75)* | 1.87 *(-21.18)* |
| Capital intensity | 10926 | 13140 *(20.27)* | 14585 *(10.98)* | 13583 *(-6.86)* | 14192 *(4.48)* | 12708 *(-10.46)* | 12257 *(-3.54)* |
| Added value content | 38.48 | 38.61 *(0.35)* | 36.60 *(-5.22)* | 35.35 *(-3.39)* | 34.38 *(-2.77)* | 35.21 *(2.41)* | 29.81 *(-15.33)* |

Figures in parentheses are percentage changes with previous survey/census.

The labour productivity improved in 2000, both the total output per employee and added value per employee grew by 17.1% and 11.0% respectively. The labour cost per employee raised by 6.5% but this was significantly lower than the increase in productivity, resulting in the improvement in labour cost competitiveness with unit labour cost declined by 9.1%. The added value per labour cost, thus improved 4.2%. The capital intensity continued to increase by 11.0% because of the further decrease of employment in construction sector from 765,000 in 1998 to in 755,000 in 2000 (Table 6-1). The capital productivity decreased 1.7%. Added value content contracted from 38.6% in 1998 to 36.6% in 2000.

The labour productivity continued to improve in 2002. Both the total output per employee and added value per employee grew by 6.1% and 2.5% respectively. The labour cost competitiveness was sustained with the unit labour cost declined by 0.3% despite the labour cost per employee increased 5.7%. However, the added value per labour cost declined by 3.1%. Notwithstanding increase of employment in construction sector from 755,000 in 2000 to 767,300 in 2002 (Table 6-1), capital intensity declined by 6.9%, this indicated that less investment in fixed assets was made. The capital productivity improved by 10.7%, it reflected improvement in the utilisation of fixed asset in the sector. Added value content contracted from 36.6% in 2000 to 35.4% in 2002.

The labour productivity improvement sustained in 2004. The construction sector registered 6.3% growth in total output per employee and 3.4% growth in added value per employee. The sector experienced sustained labour cost competitiveness as reflected by continued decrease in unit labour cost of 7.0% and decreased in labour cost per employee by 1.1%. It led to the improvement of added value per labour cost by 4.5%. Capital intensity recorded a 4.5% growth despite there was no significant change in the employment in construction sector between 2002 and 2004; it implied that there was an increased investment in fixed assets of the sector. However, the capital productivity declined by 5.2%, it was attributed to the gestation period that occurred before the equipment could be fully utilised. Added value content continual contracted from 35.4% in 2002 to 34.4% in 2004.

The labour productivity declined in 2005. The construction sector registered contraction in total output per employee and added value per employee of 6.6% and 4.4% respectively. However, the sector continued to experience sustained labour cost competitiveness as reflected by a marginal decrease of 0.7% in unit labour cost and 7.3% in labour cost per employee. It led to the improvement of added value per labour cost by 3.1%. Capital intensity declined by 10.5% despite decrease in construction employment from 767,300 in 2004 to 759,600 in 2005; it implied less investment in fixed assets were made. Capital productivity grew by 3.8%; which indicated improvement in efficiently in utilised the existing fixed assets. It is evidenced by the improvement of added value content expanded from 34.4% in 2004 to 35.2% in 2005.

The construction sector continued to register decline in labour productivity in 2007. The total output per employee and added value per employee decreased by 3.2% and 18.1% respectively. The labour cost competitiveness is weaken, there was 6.0% increase in unit labour cost. It is due to increase in labour cost per employee by

2.6% and plunge of the added value per labour cost by 20.1%. Capital intensity fell by 3.5% despite decrease in construction employment from 759,600 in 2005 to 757,300 in 2007 (Table 6-1) indicated that there was lack of investment in fixed assets. Capital productivity declined by 21.2% pointed out that inefficient utilisation of fixed assets of the sector. The contraction of added value content contracted from 35.2% in 2005 to 29.8% in 2007.

The highest level of labour productivity was recorded in 2004 within the period of 1996-2007. Although there was contraction in GDP of construction sector, but the total economy recorded the fastest growth since 2000. The labour cost competitiveness has been improving since 1998 and was the most competitive in 2005. There capital intensity grew between 1996 and 2000 and it declined between 2004 and 2007, in the meantime, the capital productivity shown a falling trend. Overall, the added value content was declining since 1998 except a slight recovery from 34.4% in 2004 to 35.2% in 2005 before the sharp fall to 29.8% in 2007.

Over the period 1996-2007 under analysis, the year 2007 was marked with lowest added value per employee, added value per labour cost, capital productivity and lowest added value content.

### 6.4.1 SUB-SECTOR COMPARISON

This section reports the performance of the productivity indicators of construction sub-sectors according to the type of work. The construction sector comprises two categories namely, general construction and special trade. General construction comprises three sub-sectors those are residential construction, non-residential construction and civil engineering construction. The second category concerns special trade, which involves activities such as metal work, electrical, plumbing, sewerage and sanitary, refrigeration and air-conditioning, painting, carpentry, tiling and flooring, and glass (Malaysia Productivity Corporation, 2008).

Table 6-5
Distribution of construction output (1996-2007)

| Sub-sectors | 1996 | 1998 | 2000 | 2002 | 2004 | 2005 | 2007 |
|---|---|---|---|---|---|---|---|
| Civil engineering | 40.87 | 37.48 | 36.26 | 38.39 | 36.80 | 34.09 | 34.89 |
| Non-residential | 25.11 | 24.63 | 24.92 | 22.14 | 22.04 | 20.02 | 21.96 |
| Residential | 15.96 | 19.05 | 21.79 | 23.78 | 24.83 | 27.12 | 24.51 |
| Special trade | 18.05 | 18.84 | 17.03 | 15.69 | 16.33 | 18.78 | 18.64 |

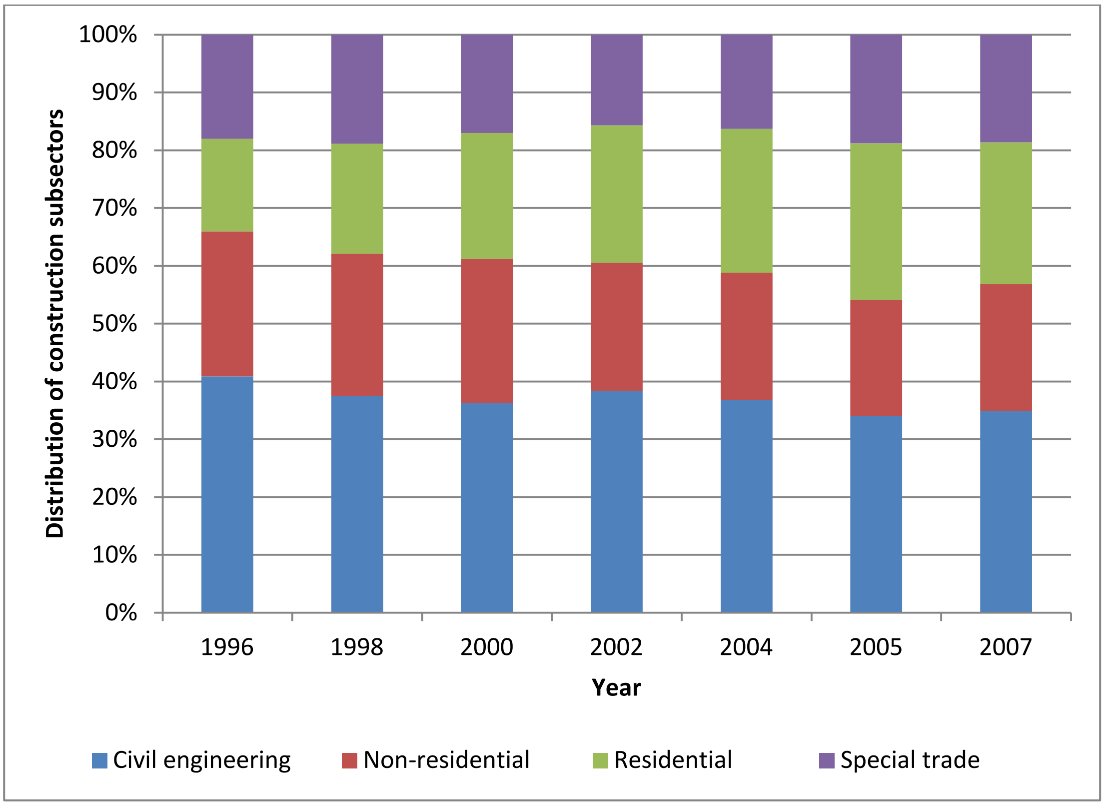


Figure 6.6. Distribution of type of construction (1996-2007)

The average values of productivity indicators of the four construction sub-sectors are shown in Table 6-6. A one-way analysis of variance (ANOVA) was conducted to compare the group means of the productivity indicators according to the type of works. The result shows that the productivity indicators of labour productivity, labour cost competitiveness and capital productivity among the four type of work are statistically significant different. However, they are not significantly different in the added value content.

Follow-up tests were conducted to evaluate pairwise differences among the means. The Levene’s test results (Table 6-7) shown that all the productivity indicators, except the unit labour cost, were not significant; equal variances were assumed among the four subsectors and Tukey test was selected for the post hoc comparisons. Game-Howell was used for post hoc comparisons of unit labour cost.

Table 6-6
Mean and One-way ANOVA F Test Statistic (F Ratio) of productivity indicators of construction sub-sectors, 1996-2007 in 2000 price

| Productivity Indicators | Civil engineering works | Non-residential works | Residential works | Special trades works | F | Sig. |
|---|---|---|---|---|---|---|
| Added value per employee | 34747 | 27501 | 27711 | 31410 | 7.32 | 0.001 |
| Total output per employee | 97632 | 77041 | 78104 | 91873 | 5.97 | 0.003 |
| Added value per labour cost | 1.76 | 1.57 | 1.52 | 1.63 | 5.80 | 0.010 |
| Labour cost per employee | 19700 | 17551 | 18170 | 19300 | 3.07 | 0.047 |
| Unit labour cost | 0.20 | 0.23 | 0.24 | 0.21 | 580 | 0.004 |
| Capital productivity | 2.01 | 2.88 | 2.97 | 2.10 | 20.24 | 0.000 |
| Capital intensity | 17424 | 9680 | 9358 | 15182 | 28.32 | 0.000 |
| Added value content | 35.66 | 35.88 | 35.96 | 34.30 | 0.43 | 0.734 |

Table 6-7
Test of homogeneity of variance of productivity indicators

| Productivity Indicators | Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|
| Added value per employee | 1.888 | 3 | 24 | .159 |
| Total output per employee | 1.338 | 3 | 24 | .286 |
| Capital productivity | 0.562 | 3 | 24 | .645 |
| Capital intensity | 1.901 | 3 | 24 | .156 |
| Added value per labour cost | 0.166 | 3 | 24 | .919 |
| Wages per employee | 1.507 | 3 | 24 | .238 |
| Unit labour cost | 3.968 | 3 | 24 | .020 |

The results of the significant pairwise post-hoc comparison are shown in Table 6-8. The total output per employee and added value per employee of the civil engineering construction is significantly higher than the residential construction. It implies that civil engineering construction is more productive than the residential construction. The added value per labour cost in the civil engineering construction is significantly higher than the residential construction. The civil engineering construction is most capital intensive among the subsectors (RM17,424). The least capital intensive is the residential construction (RM9,358). However, in terms of capital productivity, residential construction shows better capital utilisation of 3.0 compared with 2.0 of civil engineering construction.

Table 6-8
Selected results of multiple comparisons of productivity indicators

| Dependent Variable | (I) Types of works | (J) Types of works | Mean Difference (I-J) | Std. Error | Sig. |
|---|---|---|---|---|---|
| Added value per employee | Civil engineering works | Non-Residential works | 7245.47* | 1649.06 | .007 |
| Added value per employee | Civil engineering works | Residential works | 7035.86* | 1924.89 | .015 |
| Total output per employee | Civil engineering works | Non-Residential works | 20591.43* | 4614.96 | .004 |
| Total output per employee | Civil engineering works | Residential works | 19528.71* | 6394.11 | .047 |
| Capital productivity | Civil engineering works | Non-Residential works | -.87* | .16 | .001 |
| Capital productivity | Civil engineering works | Residential works | -.96* | .15 | .000 |
| Capital productivity | Non-Residential works | Special trades works | .78* | .17 | .003 |
| Capital productivity | Residential works | Special trades works | .87* | .16 | .001 |
| Capital intensity | Civil engineering works | Non-Residential works | 7743.86* | 1054.63 | .000 |
| Capital intensity | Civil engineering works | Residential works | 8065.57* | 949.82 | .000 |
| Capital intensity | Non-Residential works | Special trades works | -5502.00* | 1177.12 | .005 |
| Capital intensity | Residential works | Special trades works | -5823.71* | 1084.21 | .004 |
| Added value per labour cost | Civil engineering works | Residential works | .24* | .07 | .031 |
| Wages per employee | Civil engineering works | Non-residential works | 2148.57 | 598.31 | .021 |
| Unit labour cost | Civil engineering works | Non-Residential works | -.03# | .01 | .005 |

* The mean difference is significant at the .05 level using Tukey HSD test.
#The mean difference is significant at the .05 level using Games-Howell test.

The total output per employee and added value per employee of the civil engineering construction are significantly higher than the non-residential construction. It suggested that civil engineering construction is more productive than the non-residential construction. Although the labour cost per employee of civil engineering construction is significantly higher than non-residential construction, the unit labour cost of civil engineering construction is significantly more competitive than non-residential construction. The civil engineering construction is more capital intensify than the non-residential construction, its capital productivity is significantly lesser than non-residential construction. The special trade construction is significantly more capital intensive than the residential and non-residential construction, but it is relatively less competitive in capital productivity.

Table 6-9
The growth of productivity indicators of construction sector and sub-sectors between 1996 and 2007

| Productivity Indicators | Civil engineering works | Non-residential works | Residential works | Special trades works | Construction Sector |
|---|---|---|---|---|---|
| Total output per employee | 3.5 | 17.4 | 48.1 | 25.1 | 18.1 |
| Added value per employee | -19.1 | -9.3 | 6.8 | 3.3 | -8.5 |
| Added value per labour cost | -21.8 | -16.6 | -11.2 | -14.7 | -17.7 |
| Labour cost per employee | 3.4 | 8.7 | 20.4 | 21.1 | 11.2 |
| Unit labour cost | 0.0 | -7.4 | -18.7 | -3.2 | -5.8 |
| Capital productivity | -38.2 | -6.1 | -32.8 | -44.6 | -32.8 |
| Capital intensity | 7.8 | -20.4 | 31.1 | 53.7 | 12.2 |
| Added value content | -21.8 | -22.8 | -27.9 | -17.4 | -22.5 |

Table 6-9 shows the changes of productivity indicators of construction sector and the four sub-sectors between 1996 and 2007. The value added of the construction sector declines 22.5%. It attributes to the worsen performance of both labour and capital productivity. The capital productivity declines by 32.8% despite capital intensity increases 12.2%. The added value per labour cost declines 17.7% although the labour competitiveness has improved 5.8%. The average earning of labour has increased by 11.2%. Consequently, there is improvement of labour productivity in terms of total output per employee at 18.1% but the labour productivity is declining at 8.5% if it is measured as value added per employee.

a. ***Civil engineering sub-sector***

The labour productivity decline in 1998, the total output per employee and added value per employee of civil engineering subsector contracted 2.2% and 3.2% respectively. The labour cost is relatively less competitive because of higher unit labour cost and labour cost per employee, which have risen by 5.4% and 3.0% respectively. As a result, the added value per employee declined by 3.2%. Despite the capital intensity grew strongly by 24.0%, capital productivity declined by 24.7%. The added value content contracted marginally from 38.8% in 1996 to 38.4% in 1998.

The sub-sector recorded a growth in labour productivity in 2000; the total output per employee and added value per employee increased by 18.5% and 16.1%

respectively. Although labour cost per employee has increased by 6.7% but the labour cost competitiveness improved, the unit labour cost decreased by 10.0%, this has contributed to the improvement of added value per labour cost by 8.9%. The capital intensity continuously grows by 17.5% while the contraction of capital productivity narrows to 2.9%. The added value content continual contracted by 38.4% in 1998 to 37.7% in 2000.

Table 6-10
Productivity indicators of the civil engineering sub-sector 1996-2007 at 2000 constant price

| **Productivity Indicators** | **1996** | **1998** | **2000** | **2002** | **2004** | **2005** | **2007** |
|---|---|---|---|---|---|---|---|
| Total output per employee | 89,220 | 87,255 (-2.20) | 103,409 (18.51) | 109,274 (5.67) | 109,400 (0.12) | 93,616 (-14.43) | 92,310 (-1.40) |
| Added value per employee | 34,657 | 33,535 (-3.24) | 38,944 (16.13) | 38,121 (-2.11) | 37,234 (-2.33) | 33,100 (-11.10) | 28,036 (-15.30) |
| Added value per labour cost | 1.86 | 1.75 (-6.09) | 1.90 (8.88) | 1.74 (-8.37) | 1.81 (4.02) | 1.81 (-0.33) | 1.45 (-19.48) |
| Labour cost per employee | 18,635 | 19,200 (3.04) | 20,478 (6.66) | 21,876 (6.82) | 20,540 (-6.10) | 18,320 (-10.81) | 19,272 (5.20) |
| Unit labour cost | 0.2089 | 0.2200 (5.36) | 0.1980 (-10.00) | 0.2002 (1.09) | 0.1878 (-6.21) | 0.1957 (4.23) | 0.2088 (6.68) |
| Capital productivity | 2.43 | 1.83 (-24.70) | 1.78 (-2.85) | 2.31 (30.16) | 1.97 (-14.78) | 2.00 (1.60) | 1.50 (-25.02) |
| Capital intensity | 15,062 | 18,673 (23.97) | 21,940 (17.50) | 16,600 (-24.34) | 18,231 (9.83) | 15,496 (-15.00) | 16,240 (4.80) |
| Added value content | 38.84 | 38.43 (-1.06) | 37.66 (-2.01) | 34.89 (-7.37) | 34.04 (-2.44) | 35.36 (3.89) | 30.37 (-14.10) |

Figures in parentheses are percentage changes with previous survey/census.

In 2002, the sub-sector recorded a growth in total output per employee of 5.7% and decline of added value per employee by 2.1%. The higher labour cost per employee and unit labour cost of 6.8% and 1.1% respectively has resulted with 8.4% fall in added value per labour cost. This has weakened the labour cost competitiveness. There was a significant improvement in capital productivity by 30.2% with significant declining in capital intensity of 24.3%. The added value content continuously contracted from 37.7% in 2000 to 34.9% in 2002.

The sub-sector registered a marginal growth in total output per employee of 0.1% and decline in added value per employee of 2.3% in 2004. There was an improvement in the labour cost competitiveness. The labour cost per employee and the unit labour cost declined by 6.1% and 6.2% respectively. Therefore the value added per labour cost improved by 4.0%. The capital intensity recorded a rise of

9.8% but capital productivity decreased by 14.8%. The added value content continuously contracted from 34.9% in 2002 to 34.0% in 2004.

The labour productivity declined in 2005, the total output per employee and added value per employee plummeted at 14.4% and 11.1% respectively. Although there was 10.8% declined in the labour cost per employee, the 4.2% increase in unit labour cost caused added value per labour cost declined marginally by 0.3%. Capital productivity grew by 1.6% while the capital intensity declined by 15.0%. The added value content turned around and expanded from 34.0% in 2004 to 35.4% in 2005.

The labour productivity continues to decline in 2007. The total output per employee and added value per employee by 1.4% and 15.3%. The 6.7% increase in unit labour cost and 5.2% increase in the labour cost per employee has resulted with the added value per labour cost plunge by 19.5%. Capital intensity grew by 4.8%, however capital productivity declined by 25.0%. The added value content contracted from 35.4% in 2005 to 30.4% in 2007.

Comparing the changes between years 1996 and 2007 (Table 6-9), there is 3.5% growth in the total output per employee but 19.1% slump in the added value per employee. The change in unit labour cost is marginal although the labour cost per employee has increased by 3.4% between years 1996 and 2007. As a result, the added value per labour cost reduced by 21.8%. There was 7.8% increased in the capital intensity, but the capital productivity declined by 38.2%. On the whole, the added value content contracted by 21.8%.

b. ***Residential sub-sector***

The residential sub-sector recorded a growth in labour productivity with total output per employee and added value per employee increased by 3.8% and 3.5% respectively in 1998. The higher labour cost per employee of 7.6% brought about weakens labour cost competitiveness in increased unit labour cost of 3.7%. This was reflected in the decrease in added value per labour cost of 3.8%. Capital productivity declined by 23.5% but capital intensity grew by 30.6%. The added value content contracted marginally from 40.6% in 1996 to 40.5% in 1998.

The residential sub-sector continued to record growth in labour productivity with total output per employee and added value per employee increased by 23.6% and 9.4% respectively in 2000. Although there was increase in labour cost per employee of 9.4% but the considerable decline in unit labour cost of 11.5% reflecting improvement of the labour cost competitiveness. The added value per labour cost remained no change. Capital productivity turned around and grew by 2.2% along with 5.3% increased in capital intensity. The added value content continual contracted from 40.5% in 1998 to 35.8% in 2000.

Table 6-11
Productivity indicators of the residential sub-sector 1996-2007 at 2000 constant price

| **Productivity Indicators** | **1996** | **1998** | **2000** | **2002** | **2004** | **2005** | **2007** |
|---|---|---|---|---|---|---|---|
| Total output per employee | 58,781 | 61,001 (3.78) | 75,397 (23.60) | 83,041 (10.14) | 91,237 (9.87) | 91,254 (0.02) | 87,075 (-4.58) |
| Added value per employee | 23,860 | 24,693 (3.49) | 27,019 (9.42) | 29,604 (9.57) | 32,484 (9.73) | 31,135 (-4.15) | 25,493 (-18.12) |
| Added value per labour cost | 1.51 | 1.46 (-3.81) | 1.46 (0.00) | 1.52 (4.48) | 1.66 (8.95) | 1.69 (2.00) | 1.34 (-20.52) |
| Labour cost per employee | 15,754 | 16,950 (7.60) | 18,547 (9.42) | 19,451 (4.87) | 19,589 (0.71) | 18,407 (-6.03) | 18,963 (3.02) |
| Unit labour cost | 0.2680 | 0.2779 (3.68) | 0.2460 (-11.47) | 0.2342 (-4.78) | 0.2147 (-8.34) | 0.2017 (-6.05) | 0.2178 (7.96) |
| Capital productivity | 3.47 | 2.65 (-23.54) | 2.71 (2.17) | 3.05 (12.65) | 3.12 (2.25) | 3.02 (-3.25) | 2.33 (-22.84) |
| Capital intensity | 7,260 | 9,479 (30.57) | 9,979 (5.27) | 9,764 (-2.15) | 10,041 (2.84) | 9,663 (-3.77) | 9,514 (-1.55) |
| Added value content | 40.59 | 40.48 (-0.28) | 35.84 (-11.47) | 35.65 (-0.52) | 35.60 (-0.13) | 34.12 (-4.17) | 29.28 (-14.19) |

Figures in parentheses are percentage changes with previous survey/census.

The residential sub-sector continued to record growth in labour productivity with total output per employee and added value per employee increased by 10.1% and 9.6% respectively in 2002. The labour cost competitiveness improved as evidenced by the decline in unit labour cost of 4.8% despite increase in labour cost per employee of 4.9%. It was reflected in the increase in added value per labour cost of 4.5%. Capital productivity continual grew by 12.7% despite capital intensity declined by 2.2%. The added value content continual contracted marginally from 35.8% in 2000 to 35.7% in 2002.

Labour productivity continued to grow at 9.9% in total output per employee and 9.7% in added value per employee in 2004. Labour cost competitiveness was sustained with continued decrease in unit labour cost by 8.3% despite the 0.7%

marginal growth in labour cost per employee. It was reflected by the 9.0% improvement in the added value per labour cost. Capital productivity continued to grow by 2.3%, along with 2.8% in capital intensity. The added value content continual contracted marginally from 35.7% in 2002 to 35.6% in 2004.

In 2005, total output per employee grew marginally at less than 0.1% but added value per employee declined by 4.2%. The labour cost competitiveness continued to improve as evidenced by decrease of unit labour cost by 6.1% and 6.0% decline in labour cost per employee. It was reflected by the 1.7% increase in added value per labour cost. The capital productivity continual improved as evidence by fall of 3.3% and capital intensity decreased by 3.8%. The added value content continual contracted 35.6% in 2004 to 34.1% in 2005.

Labour productivity declined in 2007, the total output per employee of the residential sub-sector decreased by 4.6% and added value per employee slumped by 18.1% in 2007. The labour cost competitiveness was weakened. The labour cost per employee increased by 3.0% but the added value per labour cost decreased sharply at 20.5% result in increase unit labour cost by 8.0%. There was a sharp decrease in capital productivity by 22.8% compare with a relatively small downward adjustment of 1.6% in capital intensity. The added value content continual contracted 34.1% in 2005 to 29.3% in 2007.

Comparing the changes between years 1996 and 2007 (Table 6-9), there was 48.1% growth in the total output per employee but 6.8% decline in the added value per employee. It attributed to the declined in labour cost competitiveness. The labour cost per employee has increased by 20.4% between years 1996 and 2007 but the added value per labour cost was reduced by 11.2%. Although there was 31.1% increased in the capital intensity, the capital productivity declined by 32.8%. On the whole, the added value content was contracted by 27.9%.

c. ***Non-residential sub-sector***

The non-residential sub-sector consists of construction of offices and/or commercial buildings, stores, hospitals, hypermarkets, and other public and utility buildings.

Table 6-12
Productivity indicators of the non-residential sub-sector 1996-2007 at 2000 constant price

| Productivity Indicators | 1996 | 1998 | 2000 | 2002 | 2004 | 2005 | 2007 |
|---|---|---|---|---|---|---|---|
| Total output per employee | 69,654 | 67,941 (-2.46) | 76,613 (12.76) | 74,659 (-2.55) | 86,851 (16.33) | 83,555 (-3.79) | 81,778 (-2.13) |
| Added value per employee | 26,761 | 26,535 (-0.85) | 28,034 (5.65) | 27,420 (-2.19) | 29,598 (7.95) | 30,580 (3.32) | 24,264 (-20.65) |
| Added value per labour cost | 1.62 | 1.56 (-3.87) | 1.63 (4.32) | 1.55 (-4.78) | 1.59 (2.26) | 1.66 (4.67) | 1.35 (-18.42) |
| Labour cost per employee | 16,482 | 17,000 (3.14) | 17,217 (1.27) | 17,685 (2.72) | 18,667 (5.56) | 18,425 (-1.30) | 17,921 (-2.74) |
| Unit labour cost | 0.2366 | 0.2502 (5.74) | 0.2247 (-10.19) | 0.2369 (5.41) | 0.2149 (-9.26) | 0.2205 (2.60) | 0.2191 (-0.62) |
| Capital productivity | 3.12 | 2.85 (-8.69) | 2.96 (3.93) | 2.41 (-18.40) | 2.42 (0.29) | 3.00 (24.03) | 2.93 (-2.55) |
| Capital intensity | 9,057 | 9,488 (4.76) | 9,480 (-0.08) | 11,433 (20.59) | 11,792 (3.14) | 9,542 (-19.08) | 7,208 (-24.46) |
| Added value content | 38.42 | 39.06 (1.65) | 36.59 (-6.31) | 36.73 (0.37) | 34.08 (-7.21) | 36.60 (7.39) | 29.67 (-18.93) |

Figures in parentheses are percentage changes with previous survey/census.

In 1998, the sub-sector recorded a decline in labour productivity, the total output per employee and added value per employee decreased by 2.5% and 0.9% respectively. Labour cost per employee registered a growth of 3.1% resulting in an increase in unit labour cost of 5.7%, which worsen labour cost competitiveness. This was also reflected by the decrease in added value per labour cost of 3.9%. There was an increase in the capital intensity at 4.8% during the year. Nevertheless, the capital productivity was declined by 8.7%. The added value content expanded from 38.4% in 1996 to 39.1% in 1998.

In 2000, the labour productivity of non-residential sub-sector turned around to post an increase in total output per employee and added value per employee of 12.8% and 5.7% respectively. Labour cost competitiveness of the sub-sector improved in 2000. This is indicated by the decline in unit labour cost of 10.2% and slower growth of labour cost per employee of 1.3% which led to growth in added value per labour cost of 4.3%. Capital intensity for the non-residential subsector recorded marginal decline of 0.1%. However, capital productivity turned around to grow by 3.9%. The added value content contracted 39.1% in 1998 to 36.6% in 2000.

The labour productivity declined in 2002. The total output per employee and added value per employee decreased by 2.6% and 2.2% respectively. Labour cost per employee registered a growth of 2.7% resulting in increased unit labour cost of 5.4%, which weaken the labour cost competitiveness. This was also reflected by the decrease in added value per labour cost of 4.8%. The capital productivity declined by 18.4% despite there was an increase in the capital intensity of 20.6%. The added value content marginally expanded from 36.6% in 2000 to 36.7% in 2002.

The non-residential sub-sector recorded a growth in total output per employee of 16.3% and added value per employee of 8.0% in 2004. Labour cost competitiveness of the sub-sector recorded an improvement. This is shown by the growth in added value per labour cost per employee of 2.3%. The higher growth of 8.0% in added value per employee compare with 5.6% in labour cost per employee. Consequently, the unit labour cost decreased by 9.3%. The capital intensity recorded increase of 3.1 in 2004 but the capital productivity grew marginally by 0.3%. The added value content contracted from 36.7% in 2002 to 34.1% in 2004.

The non-residential sub-sector recorded a decline in total output per employee of 3.8% but a growth in added value per employee of 3.3% in 2005. Labour cost competitiveness was weakened. There was an increase in unit labour cost by 2.6% although the labour cost per employee was decreased by 1.3%. Nevertheless, the added value per labour cost continued increase by 4.7%. Capital productivity increased considerably by 24.0% while capital intensity declined by 19.1%. Consequently, the added value content expanded from 34.1% in 2004 to 36.6% in 2005.

The labour productivity continual declined in 2007. The total output per employee and added value per employee decreased by 2.1% and 20.7% respectively. Labour cost competitiveness was enhanced with a marginally 0.6% decline in unit labour cost. It is attributed to the 2.7% decrease in labour cost per employee, however, the added value per employee decreased by 18.4%. Capital productivity declined by 2.6% and capital intensity declined by 24.5%. Consequently, the added value content contracted from 36.6% in 2005 to 30.0% in 2007.

Comparing the changes between years 1996 and 2007 (Table 6-9), there was 17.4% growth in the total output per employee but 9.3% decline in the added value per employee. It attributed to the declined in labour cost competitiveness. The labour cost per employee has increased by 8.7% between years 1996 and 2007 but the added value per labour cost was reduced by 16.6%. The capital productivity was declined by 7.4% which was less than the 20.4% cutback in the capital intensity. On the whole, the added value content was contracted by 22.8%.

d. ***Special trade sub-sector***

The special trade contractors are engaged in part of the work of a construction project. They may engage in such activities as: plumbing installation; heating, air conditioning and refrigeration installation; roofing installation and concrete work; lighting and electrical wiring, sheet metal; bricklaying, stone setting, tiles setting, marble and stone works; floor-laying, plastering and lathing, carpentry; and painting and decorating.

In 1998, the sub-sector recorded a growth in total output per employee of 2.5% and a marginal decline in added value per employee of 0.7%. Labour cost per employee registered a growth of 11.3% resulting in an increase in unit labour cost of 6.7%, which worsen labour cost competitiveness. This was also reflected by the decrease in added value per labour cost of 4.6%. There was an increase in the capital intensity at 35.2%. Nevertheless, the capital productivity was declined by 24.3%. The added value content expanded from 38.5% in 1996 to 38.6% in 1998.

In 2000, the sub-sector recorded a growth in labour productivity with total output per employee and added value per employee increased by 2.5% and 11.01% respectively. Although the labour cost per employee registered a continuously growth of 12.4%, there is a decrease in unit labour cost of 5.1%, which improved labour cost competitiveness. This was also reflected by the increase in added value per labour cost of 1.9%. There was a continuous increase in the capital intensity at 24.3%. Nevertheless, the capital productivity was declined by 9.4%. The added value content contracted from 38.6% in 1998 to 36.6% in 2000.

In 2002, the sub-sector continuously recorded growth in labour productivity with total output per employee and added value per employee of rise by 13.8% and 2.5% respectively. Although the labour cost per employee registered a continuously growth of 9.2%, there is a decrease in unit labour cost of 4.0%, which continually enhanced labour cost competitiveness. This was also reflected by the marginal increase in added value per labour cost of 0.7%. There was continuous increase in the capital intensity at 7.5%. The capital productivity was improved by 2.9%. The added value content continual contracted from 36.6% in 2000 to 35.4% in 2002.

Table 6-13
Productivity indicators of the special trade sub-sector 1996-2007 at 2000 constant price

| **Productivity Indicators** | **1996** | **1998** | **2000** | **2002** | **2004** | **2005** | **2007** |
|---|---|---|---|---|---|---|---|
| Total output per employee | 74,466 | 77,629 (4.25) | 91,949 (18.45) | 104,646 (13.81) | 103,849 (-0.76) | 98,337 (-5.31) | 93,153 (-5.27) |
| Added value per employee | 26,707 | 28,335 (-0.73) | 32,471 (11.01) | 35,703 (2.48) | 34,974 (3.40) | 34,431 (-4.37) | 27,590 (-18.05) |
| Added value per labour cost | 1.66 | 1.58 (-4.64) | 1.61 (1.92) | 1.62 (0.65) | 1.66 (2.65) | 1.83 (10.22) | 1.41 (-22.92) |
| Labour cost per employee | 16,121 | 17,935 (11.25) | 20,165 (12.43) | 22,029 (9.24) | 21,021 (-4.57) | 18,775 (-10.68) | 19,520 (3.97) |
| Unit labour cost | 0.2165 | 0.2310 (6.72) | 0.2193 (-5.08) | 0.2105 (-4.01) | 0.2024 (-3.84) | 0.1909 (-5.68) | 0.2095 (9.75) |
| Capital productivity | 2.82 | 2.13 (-24.30) | 1.93 (-9.39) | 1.99 (2.93) | 2.03 (2.09) | 2.00 (-1.34) | 1.56 (-22.12) |
| Capital intensity | 9,999 | 13,520 (35.21) | 16,809 (24.32) | 18,065 (7.47) | 16,610 (-8.06) | 16,101 (-3.06) | 15,371 (-4.53) |
| Added value content | 38.48 | 38.61 (1.77) | 36.60 (-3.25) | 35.35 (-3.39) | 34.38 (-1.29) | 35.21 (3.96) | 29.81 (-15.41) |

Figures in parentheses are percentage changes with previous survey/census.

In 2004, the sub-sector recorded a marginal decline in total output per employee of 0.8% and a growth of added value per employee at 3.4%. The improvement of labour cost competitiveness sustained evidenced by decrease of the unit labour cost and labour cost per employee by 3.8% and 4.6%. This was also reflected by the increase in added value per labour cost of 2.7%. There was a decrease in the capital intensity of 8.1% reflecting slow down of investment in capital during the year. It is evidenced by the 1.3% increased in the change of capital compare with 10.2% increase in the employment. The capital productivity continually improved by 2.1% indicated improvement in usage of fixed assets efficiently. The added value content contracted from 35.4% in 2002 to 34.4% in 2004.

In 2005, the sub-sector recorded decrease in labour productivity with a bigger decline in total output per employee and a decline in added value per employee of 5.3% and 4.4% respectively. The labour cost competitiveness continual to improve. The unit labour cost and the labour cost per employee decreased by 5.7% and 10.7% respectively. This was also reflected by the increase in added value per labour cost of 10.2%. There was a decrease in the capital intensity of 3.1%. The increased of capital investment of 34.8% was slower than the 39.0% increased in the employment. The capital productivity was decreased by 1.3%. The added value content expanded from 34.4% in 2004 to 35.2% in 2005.

In 2007, the labour productivity continual declined; the total output per employee and added value per employee decreased by 5.3% and 18.1% respectively. The labour cost competitiveness declined; the unit labour cost and the labour cost per employee increased by 9.8% and 4.07% respectively. This was also reflected by the slump in added value per labour cost of 22.9%. There was a decrease in the capital intensity of 4.5%. The increased of capital investment of 4.4% was smaller than the 9.4% increased in the employment. The capital productivity continually plunged in 22.1%. The added value content contracted from 35.2% in 2005 to 29.8% in 2007.

Comparing the changes between years 1996 and 2007 (Table 6-9), there was 25.1% growth in the total output per employee but only 3.3% improvement in the added value per employee. It attributed to the declined in labour cost competitiveness. The labour cost per employee has increased by 21.1% between years 1996 and 2007 but the added value per labour cost was reduced by 14.7%. Although the capital intensity have grown by 53.7% indicated capital deepening in the sub-sector, but the capital productivity declined by 44.6%. In general, the added value content was declined by 17.4%.

#### 6.4.2 ESTABLISHMENT SIZE COMPARISON

A one-way analysis of variance (ANOVA) was conducted to compare the group means of the productivity indicators according to the groupings of establishment sizes. The comparison of productivity indicators (Table 6-14) shows that the differences among the four groupings of establishment sizes are statistically significant in labour productivity in terms of total output per employee but not added value per employee. The differences in the labour competitiveness indicators i.e. labour cost per employee, unit labour cost and added value per labour cost are statistically significant. Lastly, the differences in capital productivity and capital intensity are also statistically significant. Follow-up tests were conducted to evaluate pairwise differences among the means of the statistically significant indicators.

Table 6-14
Mean and One-way ANOVA F Test Statistic (F Ratio) of productivity indicators of groupings of construction establishment sizes, 1996-2007 in 2000 price

| Productivity Indicators | Micro | Small | Medium | Large | F | Sig. |
|---|---|---|---|---|---|---|
| Added value per employee | 34857 | 29627 | 29209 | 31160 | 1.82 | .151 |
| Total output per employee | 118579 | 92813 | 83620 | 87778 | 3.08 | .033 |
| Added value per labour cost | 1.03 | 1.31 | 1.65 | 2.81 | 24.79 | .000 |
| Labour cost per employee | 50505 | 24244 | 17694 | 11552 | 23.66 | .000 |
| Unit labour cost | 2.88 | 2.02 | 1.76 | 1.61 | 66.49 | .000 |
| Capital productivity | 12188 | 14658 | 16543 | 19446 | 26.80 | .000 |
| Capital intensity | 0.12 | 0.17 | 0.20 | 0.22 | 54.31 | .000 |
| Added value content | 33.60 | 33.23 | 35.22 | 35.73 | 1.27 | .293 |

Table 6-15
Test of homogeneity of variance of productivity indicators of groupings of construction establishment sizes, 1996-2007 in 2000 price

| Productivity Indicators | Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|
| Total output per employee | 16.870 | 3 | 71 | .000 |
| Capital productivity | 6.607 | 3 | 71 | .001 |
| Capital intensity | 3.008 | 3 | 71 | .036 |
| Added value per labour cost | 6.012 | 3 | 71 | .001 |
| Wages per employee | 66.546 | 3 | 71 | .000 |
| Unit labour cost | 25.791 | 3 | 71 | .000 |

Table 6-15 indicated that all Levene's tests for the productivity indicators are significant; equal variances were not assumed among the four groupings. Hence, Game-Howell tests were used for post hoc comparisons.

The statistically significant pairwise comparisons of the test are shown in (Table 6-16). There is no statistically significant pairwise-comparison identified in total output per employee and added value per employee in the Games Howell test. The added value per labour cost in the large-sized establishment is significantly higher than the medium-sized, small-sized and micro size establishments. The added value per labour cost in the medium-sized establishment is significantly higher than the small-sized establishment. It suggests that the larger establishments are able to achieve higher added value with same unit of labour cost compare with the smaller-size establishments.

The labour cost per employee of large-sized establishment is significantly lower than the medium-sized establishment. It implies that individual employee able to enjoy higher return in medium--sized establishment than in the large-sized establishment. However large-sized establishment benefit from more competitive labour cost. This is supported by the unit labour cost of large establishment is significantly lower than the medium-sized establishments. The capital productivity of large establishment is significantly higher than the medium-sized establishments. In general, the large-sized establishment is more efficient in utilization of capital than the medium-sized establishments. The capital intensity of large establishment is significantly higher than the medium-sized establishments.

Table 6-16
Selected multiple comparison results of productivityindicators of groupings of construction establishment size, 1996-2007 in 2000 price

| Dependent Variable | (I) Types of works | (J) Types of works | Mean Difference (I-J) | Std. Error | Sig. |
|---|---|---|---|---|---|
| Added value per labour cost | Large | Medium | 1.16 | 0.17 | .000 |
| Added value per labour cost | Large | Small | 1.50 | 0.19 | .000 |
| Added value per labour cost | Large | Micro | 1.78 | 0.36 | .003 |
| Added value per labour cost | Medium | Small | 0.34 | 0.12 | .044 |
| Wages per employee | Large | Medium | -12691.73 | 2691.67 | .002 |
| Wages per employee | Large | Small | -6141.71 | 1045.52 | .000 |
| Unit labour cost | Large | Medium | -0.15 | 0.04 | .001 |
| Unit labour cost | Large | Small | -0.42 | 0.05 | .000 |
| Unit labour cost | Large | Micro | -1.27 | 0.23 | .006 |
| Unit labour cost | Medium | Small | -0.26 | 0.05 | .000 |
| Unit labour cost | Medium | Micro | -1.11 | 0.04 | .001 |
| Unit labour cost | Small | Micro | -0.85 | 0.24 | .039 |
| Capital productivity | Large | Medium | 2903.08 | 511.28 | .000 |
| Capital productivity | Large | Small | 4788.01 | 944.32 | .001 |
| Capital productivity | Large | Micro | 7258.79 | 1381.92 | .006 |
| Capital intensity | Large | Medium | 0.02 | 0.01 | .001 |
| Capital intensity | Large | Small | 0.06 | 0.01 | .000 |
| Capital intensity | Large | Micro | 0.10 | 0.01 | .001 |
| Capital intensity | Medium | Small | 0.04 | 0.01 | .001 |
| Capital intensity | Medium | Micro | 0.08 | 0.01 | .002 |

The labour cost per employee of large-sized establishment is significantly lower than the small-sized establishment. It implies that individual employee able to enjoy higher return in the small-sized establishment than in the large-sized establishment. However large-sized establishment benefit from more competitive labour cost. This is supported by the unit labour cost of large establishment is significantly lower than the small-sized establishments. The capital productivity of large establishment is significantly greater than the small-sized establishment. In general, the large-sized establishment is more efficient in utilization of capital than the small-sized establishments. The capital intensity of large establishment is significantly higher than the small-sized establishments.

The unit labour cost of large establishment is significantly lower than the micro-sized establishments. The capital productivity of large establishment is significantly greater than the micro-sized establishments. In general, the large-sized establishment is more efficient in utilization of capital than the micro-sized establishments. The capital intensity of large establishment is significantly higher than the micro-sized establishments.

The unit labour cost of medium-sized establishment is significantly lower than the small-sized establishments. The capital intensity of medium-sized establishment is significantly higher than the small-sized establishments.

The unit labour cost of medium-sized establishment is significantly lower than the micro-sized establishments. The capital intensity of medium-sized establishment is significantly higher than the micro-sized establishments.

The unit labour cost of small-sized establishment is significantly lower than the micro-sized establishments.

In general, the labour cost is more competitive in the relatively larger size establishment. It is reflected in the added value per labour cost is higher in larger sized establishment despite the individual employee is enjoying higher return in the relatively smaller establishment. The large-sized establishment is more efficient in utilization of capital than the smaller establishments and there is greater capital deepening in the larger establishment than the smaller one.

a. ***Large-sized establishment***

The large-sized establishment is the establishment that employed more than 50 employees. The large-sized establishment recorded a decline in labour productivity in 1998. The total output per employee and added value per employee decreased by 7.2% and 6.2% respectively. Labour cost per employee was marginally decreased by 0.3%, but the unit labour cost was increased by 7.4%, which resulted deteriorate in labour cost competitiveness. This was also reflected by the decrease in added value per labour cost of 5.9%. Although there was an increase in the capital intensity at 11.1%, nevertheless, the capital productivity was declined by 18.5%. The added value content was marginally expanded from 38.3% in 1996 to 38.7% in 1998. There was a decline of capital productivity although there was an increase in capital deepening reflected not efficient utilisation of the fixed assets. Similarly, the individual workman's return decreased but the unit labour cost was still increasing, it indicates there was overcapacity in labour. The overall improvement of added value content from 38.3% in 1996 to 38.7% in 1998 represented marginal improvement in the production process.

Table 6-17
Productivity indicators of the large-sized establishment 1996-2007 at 2000 constant price

| **Productivity Indicators** | **1996** | **1998** | **2000** | **2002** | **2004** | **2005** | **2007** |
|---|---|---|---|---|---|---|---|
| Total output per employee | 80,438 | 74,655 *(-7.19)* | 88,740 *(18.87)* | 91,615 *(3.24)* | 94,086 *(2.70)* | 93,324 *(-0.81)* | 88,078 *(-5.62)* |
| Added value per employee | 30,791 | 28,884 *(-6.19)* | 32,606 *(12.89)* | 32,522 *(-0.26)* | 33,025 *(1.55)* | 33,181 *(0.47)* | 26,141 *(-21.22)* |
| Added value per labour cost | 1.68 | 1.58 *(-5.89)* | 1.64 *(3.48)* | 1.56 *(-4.55)* | 1.63 *(4.08)* | 1.69 *(4.11)* | 1.35 *(-20.4)* |
| Labour cost per employee | 18,320 | 18,261 *(-0.32)* | 19,921 *(9.09)* | 20,818 *(4.50)* | 20,310 *(-2.44)* | 19,601 *(-3.49)* | 19,401 *(-1.02)* |
| Unit labour cost | 0.2278 | 0.2446 *(7.40)* | 0.2245 *(-8.22)* | 0.2272 *(1.22)* | 0.2159 *(-5.00)* | 0.2100 *(-2.70)* | 0.2203 *(4.87)* |
| Capital productivity | 2.94 | 2.40 *(-18.53)* | 2.63 *(9.90)* | 3.05 *(15.89)* | 2.71 *(-11.01)* | 3.18 *(17.06)* | 2.10 *(-33.87)* |
| Capital intensity | 10,798 | 11,999 *(11.12)* | 12,386 *(3.23)* | 10,769 *(-13.06)* | 11,697 *(8.62)* | 9,758 *(-16.58)* | 10,816 *(10.85)* |
| Added value content | 38.28 | 38.69 *(1.07)* | 36.74 *(-5.03)* | 35.50 *(-3.39)* | 35.10 *(-1.12)* | 35.55 *(1.29)* | 29.68 *(-16.53)* |

Figures in parentheses are percentage changes with previous survey/census.

The labour productivity recorded a growth 2000. The total output per employee and added value per employee increased by 18.9% and 12.9% respectively. Although the labour cost per employee registered a growth of 9.1%, there was a decrease in unit labour cost of 8.2%, which improved labour cost competitiveness. This was also reflected by the increase in added value per labour cost of 3.5%. The capital intensity continued to increase by 3.2%. The capital productivity rose by 9.9%. The added value content contracted from 38.7% in 1998 to 36.7% in 2000.

In 2002, the large-sized establishment continuously recorded a growth in total output per employee of 3.2%. The added value per employee was marginally declined by 0.3%. The labour cost per employee registered a continuously growth of

4.5% and the unit labour cost increased by 1.2%, which weaken labour cost competitiveness. This was also reflected by the decrease in added value per labour cost of 4.6%. There was a decrease in the capital intensity by 13.1%. The capital productivity continued to improve by 15.9%. The added value content contracted further from 36.7% in 2000 to 35.5% in 2002.

In 2004, the large-sized establishment recorded growth in labour productivity with continuously increased in total output per employee of 2.7% and a growth of added value per employee of 1.6%. The labour cost per employee registered a decline of 2.4%, there was a decrease in unit labour cost of 5.0%, which improved labour cost competitiveness. This was also reflected by the increase in added value per labour cost of 4.1%. There was an increase in the capital intensity at 8.6%. The capital productivity was declined by 11.0%. The added value content continually contracted from 35.5% in 2002 to 35.1% in 2004.

In 2005, the large-sized establishment recorded a marginal decline in total output per employee of 0.8% but a marginal growth in added value per employee of 0.5%. The labour cost per employee continually decline by 3.5%, the unit labour cost fell by 2.7%, which improved labour cost competitiveness. This was reflected by the increase in added value per labour cost of 4.1%. The capital intensity declined 16.6%. The capital productivity improved 17.1%. The added value content recovered from 35.1% in 2004 to 35.6% in 2005.

In 2007, large-sized establishment recorded a decline in labour productivity. The total output per employee continuously recorded a decline 5.6% and sharp fall in added value per employee of 21.2%. Despite with the fall of labour cost per employee narrowed to 1.0%; the unit labour cost raised by 4.9%, which deteriorated labour cost competitiveness. This was reflected by the slump in added value per labour cost of 20.4%. Although the capital intensity increased10.9%, the capital productivity slumped 33.9%. The added value content declined from 35.6% in 2005 to 29.7% in 2007.

Comparing the changes between years 1996 and 2007, the total output per employee grew 9.5% and the added value per employee contracted 15.1%. It attributed to the decline in the added value per labour cost. The added value per labour cost was decreased by 19.8% although there was improvement in the labour cost competitiveness. The unit labour cost reduced 3.3% despite 5.9% increased in the average wages. The capital intensity was marginally increased by 0.2%, but the capital productivity declined by 28.5%. On the whole, the added value content contracted from 38.3% in 1996 to 29.7% in 2007. The increase in individual workman's return and decrease in the unit labour cost indicate efficient labour utilisation. Therefore the decrease in added value per labour cost must be attributed to the poor capital utilisation which was reflected with increase in capital intensity and decrease in capital productivity. As a result, the overall process efficiency declined, it was indicated by the contractions of added value content.

b. ***Medium-sized establishment***

The medium-sized establishment is the establishment that employed between 20-50 employees. The medium-sized establishment recorded a growth in labour productivity. The total output per employee and added value per employee increased 9.8% and 9.4% respectively. Labour cost per employee increased 9.1%, but unit labour cost decreased marginally by 0.6%, which improved labour cost competitiveness. This was also reflected by the marginal increase in added value per labour cost of 0.3%. There was a sharp rise in the capital intensity at 38.8%. Nevertheless, the capital productivity was declined by 23.9%. The added value content was marginally improved from 38.6% in 1996 to 38.7% in 1998.

Table 6-18
Productivity indicators of the medium-sized establishment 1996-2007 at 2000 constant price

| Productivity Indicators | 1996 | 1998 | 2000 | 2002 | 2004 | 2005 | 2007 |
|---|---|---|---|---|---|---|---|
| Total output per employee | 59,804 | 65,648 (9.77) | 80,508 (22.64) | 93,090 (15.63) | 104,839 (12.62) | 92,896 (-11.39) | 88,809 (-4.40) |
| Added value per employee | 23,083 | 25,253 (9.40) | 29,520 (16.90) | 32,940 (11.58) | 34,923 (6.02) | 31,806 (-8.93) | 27,148 (-14.64) |
| Added value per labour cost | 1.67 | 1.67 (0.28) | 1.75 (4.64) | 1.79 (2.61) | 1.88 (4.84) | 1.84 (-2.23) | 1.56 (-15.40) |
| Labour cost per employee | 13,854 | 15,115 (9.10) | 16,885 (11.71) | 18,362 (8.75) | 18,569 (1.13) | 17,297 (-6.85) | 17,453 (0.90) |
| Unit labour cost | 0.2317 | 0.2302 (-0.61) | 0.2097 (-8.91) | 0.1972 (-5.95) | 0.1771 (-10.21) | 0.1862 (5.13) | 0.1965 (5.54) |
| Capital productivity | 2.21 | 1.68 (-23.91) | 1.56 (-7.10) | 1.57 (0.90) | 1.68 (7.00) | 1.59 (-5.84) | 1.45 (-8.60) |
| Capital intensity | 10,783 | 14,962 (38.75) | 18,920 (26.45) | 21,135 (11.71) | 19,934 (-5.68) | 18,740 (-5.99) | 16,282 (-13.11) |
| Added value content | 38.60 | 38.47 (-0.33) | 36.67 (-4.68) | 35.38 (-3.50) | 33.31 (-5.86) | 34.24 (2.78) | 30.57 (-10.72) |

Figures in parentheses are percentage changes with previous survey/census.

In 2000, the medium-sized establishment continuously recorded a growth in labour productivity. The total output per employee and added value per employee were increased by 22.6% and 16.9% respectively. Although the labour cost per employee continuously registered increase of 11.7%, there was a decrease in unit labour cost of 8.9%, which further improved labour cost competitiveness. It also reflected by the increase in added value per labour cost of 4.6%. There was continuous increase in the capital intensity at 26.5%. The capital productivity declined 7.1%. The added value content declined from 38.5% in 1998 to 36.7% in 2000.

In 2002, the medium-sized establishment continuously recorded a growth in total output per employee of 15.6%. The added value per employee was marginally declined by 11.6%. The labour cost per employee registered a continuously growth of 8.8% and the unit labour cost decreased by 6.0%, which sustained improvement of labour cost competitiveness. This was also reflected by the increase in added value per labour cost of 2.6%. The capital intensity and capital productivity continued increase 11.7% and 0.9% respectively. The added value content declined further from 36.7% in 2000 to 35.4% in 2002.

In 2004, the medium-sized establishment recorded improvement in labour productivity. The total output per continuously recorded growth of 12.6% and added value per employee increased by 6.0%. The labour cost per employee registered an increase of 1.1%, there was a decrease in unit labour cost of 10.2%, which improved labour cost competitiveness. This was also reflected by the increase in added value per labour cost of 4.8%. There was a decrease in the capital intensity at 5.7%. The capital productivity improved 7.0%. The added value content continued contract from 35.4% in 2002 to 33.3% in 2004.

In 2005, the medium-sized establishment recorded a decline labour productivity. The total output per employee and added value per employee decreased by 11.4% and 8.9% respectively. The labour cost per employee continued decline by 6.9%, the unit labour cost increased by 5.1%, which weaken labour cost competitiveness. This is reflected by the decrease in added value per labour cost of

2.2%. The capital intensity and capital productivity declined 6.0% and 5.8% respectively. The added value content recovered from 33.3% in 2004 to 34.2% in 2005.

In 2007, the labour productivity of medium-sized establishment continuously declined. The total output per employee and added value per employee declined by 4.4% and 14.6% respectively. The labour cost per employee marginally increased by 0.9%; hence the unit labour cost increased by 5.5%, which deteriorated labour cost competitiveness. This is reflected by the slump in added value per labour cost of 15.4%. The capital intensity and capital productivity decreased 13.1% and 8.6% respectively. The added value content declined from 34.2% in 2005 to 30.6% in 2007.

Comparing the changes between years 1996 and 2007, the total output per employee grows by 48.5% and the added value per employee by 17.6%. It attributed to the decline in the added value per labour cost. The added value per labour cost decreased 6.6% although there is improvement in the labour cost competitiveness. The unit labour cost decreased 15.2% despite 26.0% increased in the average wages. The capital intensity is marginally increased by 51.0%, but the capital productivity declined by 34.3%. On the whole, the added value content contracts from 38.6% in 1996 to 30.6% in 2007. The increase in individual workman's return and decrease in the unit labour cost indicate efficient labour utilisation. Therefore the decrease in added value per labour cost must be attributed to the poor capital utilisation which was reflected with increase in capital intensity and decrease in capital productivity. As a result, the overall process efficiency declined, it was indicated by the contractions of added value content.

c. ***Small-sized establishment***

The small-sized establishment is the establishment that employed between 5-19 employees. The small-sized establishment recorded a growth in labour productivity. The total output per employee and added value per employee increased 37.5% and 31.0% respectively. Labour cost per employee grew 37.3%, but unit labour cost was decreased marginally by 0.1%, which improved labour cost competitiveness. However, the labour cost increase faster than the added value, resulting decrease in added value per labour cost of 4.6%. There was a sharp rise in the capital intensity at 112.4%. Nevertheless, the capital productivity declined 40.5%. The added value content declined from 39.3% in 1996 to 37.4% in 1998.

Table 6-19
Productivity indicators of the small-sized establishment 1996-2007 at 2000 constant price

| **Productivity Indicators** | **1996** | **1998** | **2000** | **2002** | **2004** | **2005** | **2007** |
|---|---|---|---|---|---|---|---|
| Total output per employee | 48,723 | 66,967 *(37.45)* | 94,667 *(41.36)* | 113,951 *(20.37)* | 134,122 *(17.70)* | 75,959 *(-43.37)* | 101,972 *(34.25)* |
| Added value per employee | 19,138 | 25,061 *(30.95)* | 32,056 *(27.91)* | 35,405 *(10.45)* | 38,246 *(8.02)* | 26,502 *(-30.71)* | 29,365 *(10.80)* |
| Added value per labour cost | 1.99 | 1.90 *(-4.61)* | 1.97 *(3.66)* | 1.93 *(-1.90)* | 2.15 *(11.02)* | 2.03 *(-5.62)* | 1.78 *(-12.41)* |
| Labour cost per employee | 9,599 | 13,177 *(37.27)* | 16,259 *(23.40)* | 18,306 *(12.59)* | 17,812 *(-2.70)* | 13,077 *(-26.58)* | 16,542 *(26.49)* |
| Unit labour cost | 0.1970 | 0.1968 *(-0.12)* | 0.1718 *(-12.71)* | 0.1607 *(-6.46)* | 0.1328 *(-17.33)* | 0.1722 *(29.64)* | 0.1622 *(-5.77)* |
| Capital productivity | 2.13 | 1.27 *(-40.50)* | 1.23 *(-3.16)* | 1.22 *(-0.59)* | 1.23 *(1.02)* | 1.34 *(8.60)* | 1.13 *(-15.74)* |
| Capital intensity | 9,273 | 19,692 *(112.36)* | 26,142 *(32.75)* | 29,339 *(12.23)* | 29,863 *(1.79)* | 18,520 *(-37.98)* | 22,660 *(22.35)* |
| Added value content | 39.28 | 37.42 *(-4.73)* | 33.86 *(-9.51)* | 31.07 *(-8.24)* | 28.52 *(-8.22)* | 34.89 *(22.35)* | 28.80 *(-17.46)* |

Figures in parentheses are percentage changes with previous survey/census.

In 2000, the small-sized establishment continuously recorded a growth labour productivity. The total output per employee and added value per employee continued increase 41.4% and 27.9% respectively. Although the labour cost per employee further rose to 23.4%, the unit labour cost continuously decreased 12.7%, which enhanced labour cost competitiveness. This was reflected by 3.7% turnaround increase of added value per labour. There was a continuous increase in the capital intensity at 32.8% and decline capital productivity at 3.2%. The added value content declined further from 37.4% in 1998 to 33.9% in 2000.

In 2002, the small-sized establishment continuously recorded a growth labour productivity. The total output per employee and added value per employee continuously increased 20.4% and 10.5% respectively. The labour cost per employee registered a continuous growth of 12.6% and the unit labour cost decreased further by 6.5%, which sustained labour cost competitiveness. However, the added value per labour cost declined 1.9%. There was a continuous increase in the capital intensity by 12.2%. The capital productivity was marginally declined by 0.6%. The added value content declined further from 33.9% in 2000 to 31.1% in 2002.

In 2004, the small-sized establishment continuously recorded a growth labour productivity. The total output per employee and added value per employee continued increase 17.7% and 8.0% respectively. The labour cost per employee registered a decrease of 2.7%. There was a decrease in unit labour cost of 17.3%, which continuously enhanced labour cost competitiveness. This was also reflected by the increase in added value per labour cost of 11.0%. The capital intensity continued to increase by 1.8%. The capital productivity improved 1.0%. The added value content declined further from 31.1% in 2002 to 28.5% in 2004.

The labour productivity of small-sized establishment declined in 2005. The total output per employee and added value per employee recorded a decline 43.4% and 30.7% respectively. The labour cost per employee continuously declined by 26.6%, however, the 29.6% increase in unit labour cost weakened labour cost competitiveness. This was reflected by the decrease in added value per labour cost of 5.6%. The capital intensity declined 38.0% but the capital productivity further improved 8.6%. The added value content expanded from 28.5% in 2004 to 34.9% in 2005.

In 2007, small-sized establishment recorded a recover in labour productivity. The total output per employee and added value per employee increased 34.3% and 10.8% respectively. Although the labour cost per employee increased 26.5%, the unit labour cost decreased 5.8%, it improved labour cost competitiveness. The added value per labour cost decreased 12.4%. The capital intensity increased 22.4% but the capital productivity declined 15.7%.  The added value content declined from 34.9% in 2005 to 28.8% in 2007.

Comparing the changes between years 1996 and 2007, the total output per employee and the added value per employee grew by 109.3% by 53.4% respectively. It attributed to the decline in the added value per labour cost. The added value per labour cost decreased 11.0% although there was an improvement in the labour cost competitiveness. The unit labour cost reduced by 17.7% despite 72.3% increased in the average wages. The capital intensity is marginally increased by 144.4%, but the capital productivity declined by 47.0%.  On the whole, the added value content contracted from 39.3% in 1996 to 28.8% in 2007. The increase in individual workman's return and decrease in the unit labour cost indicate efficient labour utilisation. Therefore the decrease in added value per labour cost must be attributed to the poor capital utilisation which was reflected with increase in capital intensity and decrease in capital productivity. As a result, the overall process efficiency declined, it was indicated by the contractions of added value content.

d. ***Micro-sized establishment***

The micro-sized establishment is the establishment that employed less than 5 employees. The micro-sized establishment recorded a growth in labour productivity in 1998. The total output per employee and added value per employee increased 60.0% and 6.8% respectively. Labour cost per employee grew 47.2%, but unit labour cost decreased 8.0%, which improved labour cost competitiveness. However, the labour cost increased faster than the added value, resulting decreased in added value per labour cost of 27.5%. There was a sharp rise in the capital intensity at 360.7%. Nevertheless, the capital productivity declined 77.6%. The added value content declined from 38.5% in 1996 to 38.6% in 1998.

Table 6-20
Productivity indicators of the micro-sized establishment 1996-2007 at 2000 constant price

| Productivity Indicators | 1996 | 1998 | 2000 | 2002 | 2004 | 2005 | 2007 |
|---|---|---|---|---|---|---|---|
| Total output per employee | 49,048 | 78,454 *(59.95)* | 137,394 *(75.13)* | 152,411 *(10.93)* | 249,632 *(63.79)* | 50,227 *(-79.88)* | 112,890 *(124.76)* |
| Added value per employee | 26,680 | 28,480 *(6.75)* | 38,749 *(36.05)* | 41,622 *(7.41)* | 59,146 *(42.10)* | 19,539 *(-66.97)* | 29,784 *(52.44)* |
| Added value per labour cost | 3.65 | 2.65 *(-27.46)* | 2.68 *(1.07)* | 3.20 *(19.47)* | 3.55 *(11.09)* | 2.41 *(-32.13)* | 1.98 *(-17.89)* |
| Labour cost per employee | 7,305 | 10,749 *(47.15)* | 14,470 *(34.61)* | 13,010 *(-10.09)* | 16,642 *(27.92)* | 8,100 *(-51.33)* | 15,037 *(85.64)* |
| Unit labour cost | 0.1489 | 0.1370 *(-8.00)* | 0.1053 *(-23.13)* | 0.0854 *(-18.95)* | 0.0667 *(-21.90)* | 0.1613 *(141.91)* | 0.1332 *(-17.41)* |
| Capital productivity | 2.86 | 0.64 *(-77.64)* | 0.48 *(-25.59)* | 0.52 *(10.21)* | 0.60 *(14.33)* | 1.17 *(94.64)* | 0.96 *(-17.87)* |
| Capital intensity | 9,631 | 44,373 *(360.72)* | 81,542 *(83.77)* | 80,278 *(-1.55)* | 94,984 *(18.32)* | 15,669 *(-83.50)* | 27,057 *(72.68)* |
| Added value content | 38.48 | 38.61 *(-33.26)* | 36.60 *(-22.31)* | 35.32 *(-3.17)* | 34.38 *(-13.24)* | 35.21 *(64.18)* | 29.81 *(-32.18)* |

Figures in parentheses are percentage changes with previous survey/census.

In 2000, the micro-sized establishment continuously recorded a growth in labour productivity in 2000. The total output per employee and added value per employee increased 75.1% and 36.1% respectively. The labour cost per employee continuously registered a growth of 34.6%, and further decreased in unit labour cost of 23.1%, which enhanced labour cost competitiveness. This was also reflected by the increase in added value per labour cost of 1.1%. There was a continuous increase in the capital intensity at 83.8%. The capital productivity further declined 25.6%. The added value content continuously contracted from 38.6% in 1998 to 36.6% in 2000.

In 2002, the micro-sized establishment continuously recorded a growth in labour productivity in 2002. The total output per employee and added value per employee increased by 10.9% and 7.4% respectively. The labour cost per employee decreased by 10.1% and the unit labour cost decreased by 19.0%, which sustained labour cost competitiveness. However, the added value per labour cost improved by 19.5%. There was a decrease in the capital intensity by 1.6%. The capital productivity improved 10.2%. The added value content declined further from 36.6% in 2000 to 35.3% in 2002.

In 2004, the micro-sized establishment continuously recorded a growth in labour productivity in 2004. The total output per employee and added value per employee increased 63.8% and 42.1% respectively. Although the labour cost per employee registered an increase of 27.9%, there was a decrease in unit labour cost of 21.9%, which continuously maintained the labour cost competitiveness. This was also reflected by the increase in added value per labour cost of 11.1%. The capital intensity and capital productivity increased 18.3% and 14.3% respectively. The added value content continuously contracted from 35.3% in 2002 to 34.4% in 2004.

In 2005, the micro-sized establishment continuously recorded decline in labour productivity. The total output per employee and added value per employee decreased 79.9% and 67.0% respectively. The labour cost per employee declined by 51.3%, the unit labour cost increased by 141.9%, which weakened labour cost competitiveness. This was reflected in the decrease in added value per labour cost of 32.1%. The capital intensity declined 83.5% but the capital productivity improved 94.6%. The added value content expanded from 34.4% in 2004 to 35.2% in 2005.

In 2007, micro-sized establishment recorded a recover in labour productivity; the total output per employee and added value per employee increased 124.8% and

52.4% respectively. The labour cost per employee increased 85.6%. The unit labour cost decreased 17.4%, which improved labour cost competitiveness but the added value per labour cost decreased 17.9%. The capital intensity increased 72.7% but the capital productivity declined 17.9%. The added value content declined from 35.2%in 2005 to 29.8% in 2007.

Comparing the changes between years 1996 and 2007, the total output per employee expands 130.2% and the added value per employee grows 11.6%. It attributed to the decline in the added value per labour cost. The added value per labour cost decreases 45.8% although there is improvement in the labour cost competitiveness. The unit labour cost reduces 10.6% despite 105.8% increases in the average wages. The capital intensity increases 180.9%, but the capital productivity declines 66.5%. On the whole, the added value content contracted from 38.5% in 1996 to 29.8% in 2007. The increase in individual workman's return and decrease in the unit labour cost indicate efficient labour utilisation. Therefore the decrease in added value per labour cost must be attributed to the poor capital utilisation which was reflected with increase in capital intensity and decrease in capital productivity. As a result, the overall process efficiency declined, it was indicated by the contractions of added value content.

## 6.5 SUMMARY

The CLP is procyclical. The CLP cycle is seen fluctuate far more than the GDP per capita and it spans longer than GDP per capita too.

The 32-year long building cycle appears in 1975-2006. It is superimposed with three shorter construction business cycles in 1975-1987, 1987-1999 and 1999-2006. CLP and GDP per capita driven by construction activity are correlated in the 1975-2006 building cycle. The correlation between CLP and GDP per capita of shorter 1987-1999 construction business cycle is driven by construction activities and employment. However, the correlation between CLP and GDP per capita of 1999-2006 construction business cycle is driven by GDP and population.

Analysis of the construction sector survey/census data between 1996 and 2007 reveals that although there is contraction of construction sector in 2004, it recorded with highest level of labour productivity. The lowest value added per employee within the period is in 2007. The continuous decline of value added content reflects inefficiency production process and high cost of bought in materials and services of the sector.

The civil engineering construction is more productive than the residential and non residential construction in labour productivity. However, the capital utilisation of the sector is behind the residential and non residential construction. Despite the individual employees of civil engineering sub-sector enjoying higher return than employees in non-residential construction, the unit labour cost of civil engineering construction is more competitive than non-residential construction. The special trade construction does not efficiently use its fixed assets.

In general, the labour cost is more competitive in the relatively larger size establishment. It is reflected in the added value per labour cost is higher in larger sized establishment despite the individual employee is enjoying higher return in the relatively smaller establishment. The large-sized establishment is more efficient in utilization of capital than the smaller establishments and there is greater capital deepening in the larger establishment than the smaller one.

This chapter have analysed the statistical data of the construction industry obtained from the official publications which provide a macro view of the industry performance. The next chapter will look at the micro perspective of the perceptions and practices of industrial players from the interview of the purposive samples.

# Chapter 7: Qualitative Data Result

## 7.1 INTRODUCTION

This chapter report results of semi-structured interviews by purposeful sampling with industrial practitioners. The interview was designed to address the following research questions:

1. What are the key aspects and issues underlying productivity of construction sector?
2. What is the usual course of action taken by the industrial participants when they are encountered with macroeconomic fluctuations?
3. Why such course of action is chosen?
4. What are the impacts of such course of action?

Section 7.2 presents the profiles of the interviewees participated in the interview. Section 7.3 presents the summary of the interview results. Section 7.4 looks at the key aspects and issues underlying productivity of construction sector. Section 7.5 examines the usual course of action taken by the industrial participants when they are encountered with economic changes. Section 7.6 explains the reasons for such course of action are chosen. Section 7.7 accounts for the impacts of such course of action.Section 7.8 summaries the findings of the interviews.

## 7.2 DEMOGRAPHIC DIFFERENCES

In total, 21 persons participated in this study. All the participants are from the private sector with exception one from the public sector. In return for access to sensitive and proprietary information all of these organizations were guaranteed anonymity.

### 7.2.1 SIZE OF ORGANIZATIONS

The smallest organization in this study employs five persons. The largest employs over 4,000 employees. The annual turnover of the organization ranges from two hundred thousand ringgit to nine billion ringgit. Eight out of the eleven large companies are public companies listed in the Kuala Lumpur Stock Exchange (KLSE). The detail distribution of the company size is shown in Table 7-1.

Table 7-1
Distribution of company size

| Company size classification | Count |
|---|---|
| Small enterprise | 6 |
| Medium enterprise | 4 |
| Large enterprise | 11 |
| **Total** | **21** |

### 7.2.2 PRINCIPAL ACTIVITIES

The principal activities of the companies engaged are construction, development, consultation, builders merchant and subcontractors. The majority of the organizations studied are involved with construction business. The detail distributions of the principal activities are shown in Table 7-2.

Table 7-2.
Principal activities of the companies

| Principal activities | Count |
|---|---|
| Construction | 13 |
| Development | 2 |
| Consultation | 4 |
| Builders merchant | 1 |
| Subcontractor | 1 |
| **Total** | **21** |

### 7.2.3 INTERVIEWEE PROFILE

The participants of the interviews are ‘experienced’ industry players. 17 of them are with more than 20 years experience with the construction industry. Four of them have been in the industry for 10-20 years. The details of current positions held by the interviewees are listed in Table 7-3

Table 7-3
Current positions of interviewees

| Profession | Count |
|---|---|
| Managing Director | 1 |
| Director | 3 |
| Principal | 1 |
| General Manager | 2 |
| Finance Manager | 1 |
| Construction Manager | 1 |
| Quantity Surveyor | 3 |
| Contract Executive/Manager | 6 |
| Site Manager | 3 |
| Total | 21 |

## 7.3 RESULTS

The grounded approach to understanding the research questions is adopted. It aims to understand what are the key aspects and issues underlying productivity of construction sector. It is endeavour to understand what in actuality has been implemented and the underlying motivations and objectives led to those implementations.

A total of 455 items are identified around the key aspects and issues underlying productivity and economic development of construction sector in this investigation. The 455 open coding items are reduced to 11 categories around a particular concept of codes words with which to work. Evaluating the various issues against any one model is avoided at this stage. The efforts are kept in an unedited form as they are represented by quotations from the transcripts.

Table 7-4 shows the matrix of the major categories of information identified from this investigation and categories prescribed by Strauss and Corbin (1990). The categories prescribed by Strauss and Corbin consist of causal conditions, strategies, contextual and intervening conditions, and consequences. Most of the coded items are fit in the ‘strategies’ category. Only limited items are coded in the ‘intervening conditions’ and ‘causal conditions’ categories. Majority of the coded words are relevant with ‘economic context’, which is following by ‘managing finance’. The least coded word are related to ‘managing organization’.

Table 7-4
Counts on coded words

| Code words | Context | Causal conditions | Intervening conditions | Phenomenon | Strategies | Consequences | Total |
|---|---|---|---|---|---|---|---|
| Economic environment | 86 | 5 | 3 | 26 | 5 | 11 | 136 |
| Construction industry | 16 | 0 | 1 | 38 | 9 | 3 | 67 |
| Construction method | 0 | 1 | 1 | 13 | 0 | 4 | 19 |
| Contract arrangement | 0 | 0 | 0 | 33 | 17 | 3 | 53 |
| Payment chain | 0 | 2 | 2 | 9 | 0 | 25 | 38 |
| Regulatory policies | 22 | 0 | 4 | 1 | 0 | 8 | 35 |
| Managing finance | 0 | 6 | 1 | 1 | 57 | 11 | 76 |
| Managing people | 0 | 0 | 2 | 1 | 30 | 8 | 41 |
| Managing market | 0 | 0 | 1 | 0 | 39 | 4 | 44 |
| Managing organization | 0 | 0 | 0 | 3 | 25 | 5 | 33 |
| Managing performance | 0 | 4 | 0 | 0 | 38 | 7 | 49 |
| Total | 124 | 18 | 15 | 125 | 220 | 89 | 455 |

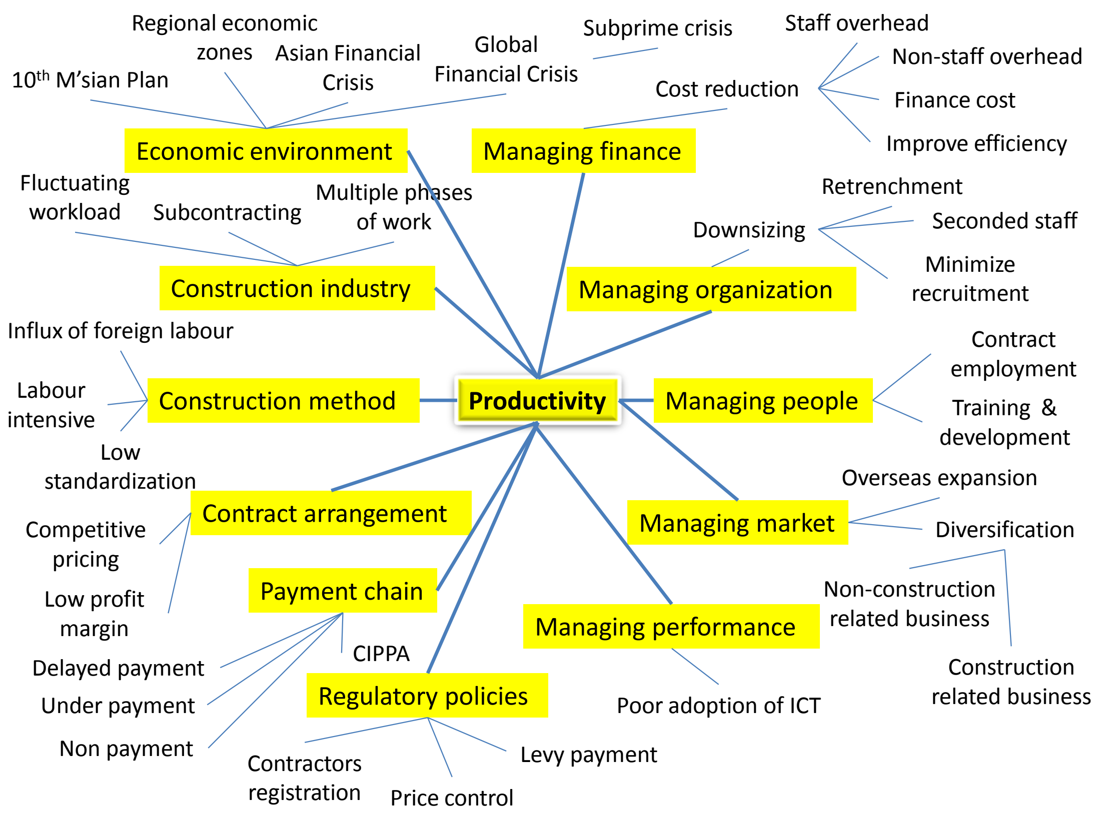


Figure 7.1. Key issues underlying productivity and strategies of the construction participants

The coded items relevant to the key aspects and issues underlying productivity of construction sector and action taken by the industrial participants when they are encountered with macroeconomic fluctuations are summarised diagrammatically in Figure 7.1.

## 7.4 WHAT ARE THE KEY ASPECTS AND ISSUES UNDERLYING PRODUCTIVITY CONSTRUCTION SECTOR?

The coded items relevant to the key aspects and issues underlying productivity of construction sector have been reduced to six items, which include economic environment, the nature of the industry, construction methods, contract arrangement, payment chain and regulatory policies.

### 7.4.1 ECONOMIC ENVIRONMENT

Among the 136 coded phrases or words in the economic outlook category, most of the interviewee related with the development plans and actions taken by the government such as '*Ninth Malaysian Plan',* '*Tenth Malaysian Plan*' and '*the first and second stimulus packages*' with the outlook of construction industry. For example interviewee C said, "*The next five years will be good in view of implementation of Ninth Malaysian Plan and launching of the new regional economic zones, namely Iskandar Development Region and Northern Corridor Economic Region by the present government. The projects may keep the construction sector busy for the next five years, after that growth is expected to slow down*." Interviewee G said, "*It is definitely very promising due to the government pump priming exercises. The local industry has been in the doldrums for the past 10 years. The earlier developments are concentrated around the Western coast. Now we are developing the Southern, Northern and Eastern Economic Regions together*." Interviewee O commented, "*the construction industry in Malaysia grew at a commendable 5.8% pace in 2009, on the back of the stabilising economic outlook in Malaysia and the ongoing implementation of the first and second stimulus packages by the Government...The construction sector is expected to grow stronger with the implementation of the construction-related activities under the Tenth Malaysia Plan and the fiscal stimuli'.*

There are also some pessimistic view, such as interviewee F said, '*We can foresee a progress slightly dimmer than those glorious years back in the 90s and early 2000 but will continue to grow as the government continues to provide* *opportunities to sustain the economic growth in the country.*' Interviewee Q said, '*A prolonged global recession will impact the confidence of consumers in Asia, hence leading to a more sustained down market in the construction-industry'.* Interviewee M said, '*Malaysia's economic engine is slowing since the Asian financial crisis of 1997-1998*'. He further explained, '*Malaysia has a high degree of openness of the economy to world economy…Malaysia economy is highly dependent on external markets. The deterioration in external demand caused uncertainties over income outlook, job securities and weak consumer sentiment'.*

Other interviewees related Malaysia's current economic situation with the '*economic meltdown*', '*bursting of US housing bubble*' which led to the '*subprime crisis*', '*global financial crisis*', '*credit crunch*' and '*sovereign debt crisis*'. The respondent noted the '*large fiscal stimuli*', '*eased monetary policies worldwide*', '*quantitative easing*', '*financial support measures*' have been introduced by the governments around the world. Interviewee N said, '*economic recovery remained uneven and fragile in advanced countries due to high unemployment, less consumer spending, high sovereign debts levels'* and he observed, '*There is a better economic performance in emerging economies particularly China and India*'.

### 7.4.2 THE NATURE OF THE INDUSTRY

There are 67 free codes related to the nature of the industry. The ten most typical items described by the interviewees are:

1. *'fluctuating workload'*
2. *'almost impossible to have continuity of work'*
3. *'variation in demand and size of project'*
4. *'construction is easy to get in with low capital to start off'*
5. *'unfavourable site conditions'*
6. *'trouble-shoot in the field'*
7. *'long durations, involving multiple phases of work'*
8. *'works are done by subcontractors most of the time'*

9. *'affected by bad weather conditions especially during Monsoon season in East Coast'*
10. *'services are usually rendered first before payment is fully made'*

#### 7.4.3 CONSTRUCTION METHODS

There are altogether 19 coded items related with the construction methods. The following ten key attributes are typically referred by the interviewees:

1. *'Conventional construction is a common practice in Malaysia.'*
2. *'It requires many wet trades.'*
3. *'It is labour intensive.'*
4. *'The availability of abundant manual labour and cheap workers coming from neighbouring countries'*
5. *'The influx of foreign labour distresses the stability and growth of domestic economy and created social problems.'*
6. *'Most of the work is carried out by foreigners, the* locals are mainly doing *supervision job'*
7. *'Unsafe working conditions'*
8. *'Low standardisation of components'*
9. *'The take up of IBS [Industrialised Building System] was not as high as first anticipated.'*
10. *'High cost of investment and the inadequacy of market size* do not make *IBS popular'*.

Interviewee R explained that the low take up of IBS in Malaysia construction sector is because of *'low labour cost in Malaysia and the availability of manual labours especially the abundant and cheap workers coming from neighbouring countries…'* and *'small contractors are already familiar with the conventional system and for them the technology suit well with small scale projects and therefore not willing to switch to mechanised based system'* In addition, interviewee R observed that, *'there are cases, where building projects are awarded and constructed* *using IBS system but were contribute to the project delays and bad qualities. As a result, the industry is reluctant to embrace in IBS unless it is required by the clients.'*

Interviewee S said, *'small contractors lack financial backup and are not able to set up their own manufacturing plants as it involves very intensive capital investment.'* He elaborated, '*like it or not, we still need foreigners to work in the construction site. The locals are not interested. Otherwise, many projects will be delayed.'*

#### 7.4.4 CONTRACT ARRANGEMENT

There are altogether 53 coded items related with the contract arrangement. The traditional approach on design-bid-build is the most popular procurement strategy adopted. It is attractive to clients on its low risk and competitive tenders can be expected. The respondents used the phrase *'very competitive in terms of pricing', 'the profit margin is very low in construction'* and *'cut-throat pricing'* to describe the competitiveness of open tenders.

In answering the questions on how competitive is the construction sector. Interviewee N answered, *'…very competitive in terms of pricing…can't even expect 10 per cent margin for a contract worth one to two million ringgit*'. Interviewee J replied, *'for public project there are usually more than 70 tenderers for each G7 job. Semi government job is around 5 tenderers only. On the private development, there are 5-10 competitors'.* A consultant responded to the same question saying, *'It depends on the individual company policy, generally for budget more than 10 million it will be 5-6 tenderers and for budget more than 20 millions, it will be 8-10 tenders... For consultancy job, there are 3-4 competitors'.*

Interviewee L said, *'it will be competitive if go through the proper tender process. But normally there is a 'negotiation' process after the tender in the private sector.*'

Interview N recalled an experience in the 1980s recession, '*we tendered at cost...when I finished the costing of a 13 million ringgit project and as usual procedure the next step is to discuss with the MD* [Managing Director] *on the margin* *of mark-up…I was shocked when he told me just to submit what I have estimated. What shocked me further is when we were called to the tender interview, he further offered another half-a-million ringgit reduction of the tender sum on the spot'*. During execution of the project, the company manage to complete the project by *'re-negotiate with the subcontractors'* and *'sourcing for new subcontractors and suppliers'.* Another '*fortunate coincidence'* is '*the falls of materials price due to the recession set in subsequently'.*

It is common practice for clients and contractors to make specific alteration in the standard contract to suit their own special circumstances. Interviewee N quoted another example on this, *'we had been asked to accept a change on the payment clause where we will be paid thirty per cent of the certified amount on the progress payment certificate only. The balance would only be paid in ninety days' time. The client said that since we* [the contractor] *are getting credit terms from the building materials suppliers, so the arrangement is fair...'* Because of the *'downturn of economy'* the interviewee N said, *'we have no choice but to accept the terms'*.

After the 1985 recessions, there are more turnkey projects. Interviewee A said, '*There are more and more turnkey projects. The attitudes of the contractors have changed. Before that, the contractors 'bow' to the consultants, but after that they speak in different manners. Some of the contractors start to employ consultant on the turnkey project*.' Interviewee J said, '…*in private sector, 'relationship' is in priority, those close with owner will get the job*.'

### 7.4.5 PAYMENT CHAIN

There are altogether 38 coded items related with the payment chain, the typical themes of these include '*ability to collect progress payments from clients', 'pay-when-paid', 'conditional payment', 'delay payment' and 'non-payment'.*

Interviewee S said, '*construction projects are of long durations, involving multiple phases of construction works involves many parties from clients, consultants, contractors, suppliers, subcontractors, and site labours etc. Problems in payment at the higher end of the hierarchy will lead to a serious cash flow problem down the supply chain. If payment is not prompt, contractors will not able to pay his* *suppliers and subcontractors. This will have a (negative) chain effect because the construction industry involves many trades…'*

The ability to collect progress payments from clients is another common concern of the respondents. Interviewee K commented, '*Some contractors are forced to contra the progress payment due with the unsold properties from the client. Quite often most of these properties are shop houses, offices and residential units with unfavourable location. The contractor will made the same arrangement with their subcontractor or materials suppliers to settle their debts.'*

Interviewee N comments, '*upstream party closing its doors and leaving its suppliers and subcontractors over the other end with no payment and little practical option…CIDB has talking about CIPPA* [Construction Industry Payment and Adjudication Act] *since 2003, but until today, the Act is still not ready yet".*

A prevalent practice in Malaysia is the inclusion of '*pay-when-paid'* and other types of '*conditional payment*' terms for payment in construction contracts between the contracting parties. Interviewee S explained, '*with a pay-when-paid provision in a construction contract between say a main contractor and his subcontractor, the main contractor will only pay the subcontractor after the client has paid the main contractor. With a conditional payment provision in a construction contract between a developer and a main contractor, the developer will only pay the main contractor when a designated number of houses or other properties have been sold'.*

#### 7.4.6 REGULATORY POLICIES

There are altogether 35 coded items related with the regulatory policies. The typical issues about regulatory policies are:

1. *contractors registration*
2. *levy payment*
3. *green card registration*
4. *price controls on cement*
5. *price control on steel*

6. *no problem on the regulating laws, the problem is on the enforcement*

Overall the contractors do not find that the industry is over regulated. Indeed, Interviewee L felt that *'the present requirements such as to register with CIDB* [the acronym of Construction Industry Development Board], *levy payment and green card for construction workers and site supervisors are good for the industry development*.'

Contrarily, the Interviewee W described the present system the of contractor's registration as *'inefficient and ineffective methods and practices in contractor's registration and administration procedures.'* Another the respondent agreed that the construction cost as a consequence of complying regulatory requirements will be more expensive, especially in the public sector project. He explained, *'the 30% of value of each Government turnkey project contract need to give to the Bumiputera may affect the cost. Unless the Bumiputra contractors carry out the work by themselves, if they just playing the role as 'management contractor' whereby the works are sub-let to sub-contractors, it will caused the construction cost to increase.'*

The prices of cement and steel are control items until 2008. Interviewee N commented, '*although the prices of steel bars and cement are controlled, the reality on the ground shows that prices are uncontrollable. Artificial shortage remains and import controls do not allow more competitively priced materials to be sourced.'* Interviewee K said, *'price control has not succeeded in containing prices and ensuring demand. Rather, it has encouraged the activities of the grey market and artificially raised material prices...we are being forced to pay more than RM2,000 per tonne to keep up with construction schedule'.* Contractors were facing *steep price increases and acute shortage of steel bars and cement* and have been *unable to obtain the items at government-controlled prices*. Interviewee N cited a report in the newspaper claimed *'Local steel millers were requesting 'under-table' money of RM800 to RM1,000 per tonne on top of the RM2,225 to RM2,419, while actual transaction prices of cement were RM2 to RM3 above the RM10.95 ceiling price.'*

## 7.5 WHAT IS THE USUAL COURSE OF ACTION TAKEN BY THE INDUSTRIAL PARTICIPANTS WHEN THEY ARE ENCOUNTERED WITH MACROECONOMIC FLUCTUATIONS?

There are 220 free codes on strategies taken by the companies during the crisis. The codes are categorized to managing finance, managing people, managing market, managing organization and managing performance as shown in Table 7-4.

### 7.5.1 MANAGING FINANCE

Cost cutting during economic downturn is a strategic priority for majority of the companies. There are 57 free codes related with managing finance. These measures include curb expenses, consolidate operations, streamline capex programs and defer expansion plans and focus in managing cash flows. The following are some of the measures that the companies interviewed have taken during the economic downturn which have been organized to: cost reduction focused on staff overhead, cost reduction focused on other overhead, cost reduction focused on finance cost and cost reduction focused on improved efficiency.

a. ***Cost reduction focused on staff overhead***

- *'pay cut 6-10%'* (Interviewee A)
- *'reduction bonus and frozen of increment'* (Interviewee B)
- *'average about 12% pay cut'* (Interviewee C)
- *'staffs were asked to take pay-cuts'* ( Interviewee C)
- *'overall salary cut by 10-15%. But, it is only for a short while - a year – after that everybody get back the same level of salary before the pay-cut and the usual increment'* (Interviewee G)
- *'[pay cut] 8% for senior level (RM5,000 and above), 5% for middle level (RM2,000), no change for junior level (RM1,000 and less)'* (Interviewee K)
- *'allowances for entertainment and travelling were scaled down'* (Interviewee C)

b. ***Cost reduction focused on non-staff overhead***

- *'tightened expenditure, allowance and advertisement'* (Interviewee C)
- *'squeezing the price when awarding the contract'* ( Interviewee C)

- *‘minimise recruitment of new staff unless absolutely necessary’* (Interviewee C)
- *‘sorting out the daily activities to reduce unnecessary travelling’* (Interviewee D)
- *‘tightly control material usage to minimise wastage’* (Interviewee D)
- *‘adopt IT to cut down work’* (Interviewee D)

c. ***Cost reduction focused on finance cost***

- *‘I was lucky that my nature of spending unnecessary was low and has no borrowing.’* (Interviewee E)
- *‘control cost of borrowing’* (Interviewee E)
- *‘do not over borrow especially foreign currency where interest rate is high’* (Interviewee E)
- *‘capital cost containment’* (Interviewee T)
- *‘keeping development cost down’* (Interviewee T)
- *‘matching the financing of projects to their operating currencies’* (Interviewee T)
- *‘using local lenders and borrowing in a local currencies’* (Interviewee T)
- *‘build for less, so you can borrow less'* (Interviewee T)
- *‘I believe we should only borrow to finance our purchase or business as minimal as possible so that we can easily repay or serve our loan/borrowing’* (Interviewee E)
- *‘never over borrow and expose ourselves to high risks, it’s better to miss out then to lose out’* (Interviewee E)
- *‘ensuring sufficient financing facilities are readily available for all ongoing projects’* (Interviewee O)

d. ***Cost reduction focused on improve efficiency***

- *‘provide timely cost saving alternatives design and close cost monitoring for every project’(Interviewee G)*
- *‘incentive bonus for the profit making project and complete ahead of schedule’(Interviewee G)*
- *‘defer expansion plan’ (Interviewee G)*

- *‘accelerating the realisation of cash flows from ongoing projects’* (Interviewee O)
- *‘deferring or rescinding uncommitted projects which have long gestation periods’* (Interviewee O)

Interviewee C said, ‘w*e tightened expenditure, allowance and advertisement. Allowances for entertainment and travelling were scaled down. Staffs were asked to take pay-cuts...on average it is about 12%. We minimize recruitment of new staff unless absolutely necessary.*’

Interviewee G said, ‘*overall salary cut by 10-15%. But, it is only for a short while – a year – after that everybody get back the same level of salary before the pay-cut and the usual increment*’. Interviewee B said, *‘there is no retrenchment in our company, but there is reduction in bonus and frozen of increment.’*

Interviewee I emphasized ‘*keeping cash in hand* [hoarding working capital] *is crucial in meeting the economic downturns’*.

Interviewee N said ‘*cash flow is the main consideration for a small company. There is a little choice for small firm to source for the finance. The importance of cash flow will precede profitability when there is decision choice needs to be made.’* He cited an example, ‘*in one of our project, we have to use the site mix concrete instead of ready-mix concrete. It is because ready-mix concrete needs to be bought in cash term at the time, however, we only have credit facilities with our builder’s merchants in the supply of cement, sand and aggregate. It may affect our site productivity, but we have to manage with our ways*.’

An organization involved with subcontract business had enhanced their logistic management by coordinate and plan the travelling route of their company’s own vehicle in detail in order ‘*to reduce unnecessary trips’*. Besides they had also ‘*tightened material usage control to minimize wastage*’.

Interviewee E said they have been more cautious in expanding their business, he articulated, *‘we should only borrow to finance our purchase or business as minimal as possible so that we can easily repay or serve our loan/borrowing. Never* *over borrow and expose ourselves to high risks'.* As a result, the organisation has '*to downsize the development project due to insufficient loan facility from bank*'.

Interviewee T said, '*Keep products affordable to your customers'* and '*build for less, so you can borrow less*' are two of the practices among the company's strategies. He quote from a speech by his CEO, *'in the early nineties, we sought capital funding to build our first two power plants in Malaysia, we first designed a plant that was 40% less to build. Remember – after all, we're building engineers who understand construction from the ground up, know our market, and maintain subcontractors we can count on for reliability…Then we* adopted *'innovative financing' i.e. to look for local lenders to finance projects in ringgit. This is because the conventional thinking and conventional lending in world money markets is based on the premise that the Third World is risky business! In order to mitigate their risk, the common practice is to accelerate repayment of the capital by charging higher interest rates on Asian loans. These practices drove up cost considerably and reduce the profitability of projects…'*

#### 7.5.2 MANAGING ORGANIZATION

Downsizing of organization is most common during the economic downturn, it aimed to cut cost or improved efficiency. Twenty five (25) codes are relevant with managing organization.

Interviewee Q recalled situation in the 1997-1998, he said, '*Retrenchment has almost become a taboo among workers following the economic downturn. The Double Celebration – Chinese New Year and Hari Raya Aidilfitri celebrated together by the Chinese and Muslims communities in Malaysia seemed to be overshadowed by the fear of layoffs and pay cuts.'*

Interviewee C's company involved in reorganization; he said, *'...excess staff are either trimmed down or moved to other department which requires them. To make staff more productive and take on bigger roles (and take on the functions of retrenched staff), they were re-trained to acquire new skills, such as computing skills.'* In addition, they also '*minimise recruitment of new staff unless absolutely necessary*'.

Interviewee J's company also involved in temporary halt recruitment, he said, '*earlier we are short of staff. Now the management is not going to fill up the vacancy if there is any staff leaving*'.

L's company is involving in consultancy job, he answered, '*we don't have workforce redundancy. We have regional offices and partner companies overseas. When there is short of jobs, we can always help other regional offices or overseas partner companies in the jobs such as closing accounts. We can also second our staff to the other offices required them*'.

Company K is a construction arm and part of a larger group of companies. K said, '*We are small organization and there is enough work to keep us busy. Otherwise, we can second our staff to other company; however, we will lose good staff after the economic recovered*.'

Some of the managers have to dismiss people and to take the unpopular decisions during the recession. Interviewee N recalled the incident that he was told to implement the lay off employees. He was instructed by his superior to carry out the unpopular duty which he had not prepared at all.

The rule of thumb in exercising who should go during the retrenchment is '*last come first go'*. By following the norm may resulted with losing the more capable employee who join the company later. There are organizations choose not to follow the norm. For this reason, interviewee S said that his former employer has been challenged by an employee in the Industrial Court, the employee had claimed for unfair dismissal against the company.

On the other hand, not all the employees in the construction industry will have fewer jobs; in fact those in contract department will be busier during the recession. Interviewee G said, *'Contract department are busier in tendering, we attempt to access the international markets, collecting overseas market information, studying the political and risk factors of the nations.'*

Another interviewee involved in consultancy work said *'Indeed, we are more busy because of the client will opt to trim down their project budget, so we spent a lot of time to re-measure the quantities.'*

In summary the range of measures taken by the companies on redundancy employment during the economic downturn include:

- *'seconded staff to associate company'* (Interviewee K)
- *'there was minor retrenchment, mainly involved with lower level staff, i.e. supervisor and below. It did not involved key personnel.'* (Interviewee G)
- *'retrenchment mainly involved with lower and middle level staff i.e. supervisor and office executive'* (Interviewee D)
- *'the management is not going to fill up the vacancy if any staff is leaving'* (Interviewee J)
- *'retain only essential staffs'* (Interviewee C)
- *'to make staff more productive and take on bigger roles'* (Interviewee C)
- *'staff were re-trained to acquire new skills, such as computing'* (Interviewee C)
- *'excess staff are either trimmed down or moved to other department which requires them'* (Interviewee C)
- *'minimise recruitment of new staff unless absolutely necessary'* (Interviewee C)

#### 7.5.3 MANAGING PEOPLE

a. ***Human resource development***

Training is a key competitive weapon in a people-intensive, knowledge-based industry. Some firms maintained their training activities and increased the opportunities available to staff. Others were unwilling or unable to devote funds to training.

Interviewee O said his company has formalised the formation of an *'internal Quality Control and Training Unit. The unit has been given the mandate to improve the quality and depth of skills through hands-on and continuous training for key* *trades in structural works, mechanical and electrical installations, as well as architectural and interior finishes.'*

Company G invest one million ringgit a year to train the workforce. Interviewee G said, '*Enhancement of skills for an efficient workforce is a major priority in* [the company]. *At* [the company], *they are committed to provide their people with every opportunity for personal growth and professional development…'* [Our] *learning centre is a fully fledged team dedicated to training needs and continuous learning programmes for all levels of management and executive development. Through the Learning Centre the development initiatives are customised and conducted to meet the needs of the business model, organisational and management demands. In addition, the Construction Training Committee which is made up of experienced senior line managers has developed and facilitated a series of comprehensive technical training modules. These modules are aimed at all levels of engineers, supervisors and surveyors. Passing core modules is part of the requirements for promotion for technical staff. There is also a plant operator school in the company which provides skills, certification and statutory requirements training for both the company's staff and other workers in the construction industry. Courses offered by the school include: skill competency training, mobile, crawler and tower crane operation, excavator, backhoe loader, bulldozer, wheel loader, motor grader operation, hands-on maintenance of construction machinery, etc.*

Another example of organization with structure training programme is company L. The programme covers modules on measurement, quality assurance, contract, post contract administration and process, project management/value engineering/risk management. Besides what have been said, there are also training on leadership and public speaking. There is an assessment after the training. The trainees are required to write report on the benefits of the training.

Company J provides training on computer system/software, ISO training on Quality Audit. Normally the senior staff will train the more junior staff. ISO training will be conducted by the external trainer.

Company D said, '*I send them for trainings such as management skill training, computer skill training, safety training etc.*'

b. ***Contract employment***

There has been an increasing trend for companies to employ contingent workers to lower operating cost. Contingent workers are those who are employed for temporary periods by an organization. The employment period is normally same as the project duration.

Interviewee J said, *'all project staff employment, such as site supervisors, are on contract basic, this is applied to new staff especially'.* To answer the follow-up question why the company employ temporary staff, J replied, *'The advantages an organisation obtains from contract staff are because of the cyclical nature of construction work. It is very costly to terminate the employment if the company could not find the new contract in time for their continuous employment. In the long run it cost less to employ temporary staff because they received no indirect benefits and they can be let go easily when their services are no longer needed'.*

Interviewee G said, *'all the new employments are placed on two-year contract basis…those with right attitude and trustworthiness will be converted to permanent staff after proven performance.'*

Interviewee L said, '*we have it [contract employment] before year 1997. We used to have foreigners working with us for 2 years. They may not take good care of the project, except for those seconded from overseas office.'* On the reply to the further question on why there are differences in the performance of the permanent and contingent employees, he said, *'coordination and motivation problem may arise because temporary workers may have less incentive to perform at a high level, given that there is no prospect for promotion or job security…on the other hand, organizations must develop core competences, in their functions to gain a competitive advantage, and it is unlikely that temporary workers will help to develop such competences because they do not remain with the organization very long and are not committed to it.'*

Interviewee S said he had not employed temporary employees, he explained, *'those who work on projects part time could have trouble keeping up with technology. When you are working at a firm, you are always being introduced to new technology, either through your firm or other firms that you are working with… If you are a contract employee, you'll miss out a lot of that.'*

### 7.5.4 MANAGING MARKET

The common practices of the company in managing markets are diversified into construction related or non-construction related businesses. There are quite a number of companies have penetrated into the international construction market.

a. ***Diversification***

The construction firms are diversifying to different geographies and clients such as from focusing on private sector projects to public sector projects, moving towards to be developer as well as diversified to non-construction related business such as IT sector. The following are some of the quotes:

- *'diversifying in to other territories but still holding on to our strength on infrastructure and building works only.'* (Interviewee G)
- *'penetrate into the other new construction sectors and the property developments'* (Interviewee E)
- *'to diversify its earnings base across different geographies and clients, with a target of capitalising on its presence and on-the ground relationships in Malaysia and Vietnam'* (Interviewee O)
- *'the management has refocused its effort on bidding for public infrastructure construction projects'* (Interviewee O)
- *'more contractors are becoming developers'* (Interviewee J)
- *'we are now slowly moving towards to be a developer in the near future for a better prospect'* (Interviewee F)
- *'to participate directly in a prime property development project alongside its associate'* (Interviewee O)
- *'to concentrate on own development projects such as… to go for overseas projects...'* (Interviewee F)

- *‘expand into high technology and new development wherever we perceive opportunities’* (Interviewee T)
- *‘focus on its core strength of property and construction and nurturing promising business such as information technology’* (Interviewee O)

Interviewee G answered, ‘*we switched to a defensive strategy; we focussed on surviving the economic meltdown.’* This leads his company to take drastic measures *‘to curb expenses, consolidate operations, streamline capex programs and defer expansion plans. In addition, the company diversifying in to other territories but still holding on to our strength on infrastructure and building works only’.*

Interviewee O said his company, *‘seek to diversify our earning base across different geographies and clients including overseas ventures. We focus on continuous improvement and operational excellence to enhance our competitive edge. We participate directly in a prime property development project as well as participate actively in tenders of various ongoing public infrastructure projects… we have taken the opportunity during this ‘quiet’ period to re-assess and review our strategic plans and goals. Whilst construction and property development will continue to feature strongly as our core businesses, we also harnessing our experience and expertise in property development to offer innovative solutions for design-and-build construction contracts for potential public and private sector clients.’*

Interviewee F said, ‘*soon after the crisis, the management has understood that* [the company] *has to venture into a new market in order to sustain the growth of the companies… we are slowly building ourselves strongly to be a global player…as well as to be a developer in the near future for a better prospect.’* Interviewee F explained that his company able to survive through the recession is because they have secured ‘*recession free project i.e. concessionaire project on toll highway before the 1997-1998 Asian Economic Crisis that has actually immune ourselves even for another financial crisis like the 1997. Besides, the loan from the bank has actually tied up early before the crisis.’*

Interviewee E said, *‘our strategies are to penetrate into the other new construction sectors and the property developments’*. Interviewee E explained that they able to sustain during the 1980s recession was because *'the company at that time was successful in getting two good projects which last up to 1987 & 1988 the company did not expose to huge borrowings and do not have many property.'*

Interviewee A said, *'although jobs slow down, collection is slow. For us, overall is good. What affected is the private job. Our company is 51% owned by Bumiputra, we still have many government jobs, such as Putrajaya and KLIA.'*

Interviewee T said his company introduced the new procurement strategy i.e. turnkey concept in Malaysia during the economic downturn in 1980s, *'in the eighties, the Malaysian government introduced the privatisation concept, enabling the private sector to drive the engine of economic growth. For the first time, we could own and grow what we had built. In this new environment, motivated by new incentive, we introduced the turnkey concept in Malaysia…we designed, raised the capital for, and built hospitals, universities, residential proprieties, high-rise office buildings, industrial facilities and other infrastructure projects.'* He also highlighted the importance of developing personal relationships, *'In Asia, we put a high premium on relationship business. We like to find commonalities with our business partners to regard and be regarded as people much like you who may enjoy similar interests…we like to see your face before your contract.'*

Maintaining a good relationship with the authority is another strategic practice mentioned by one of the interviewee. He described a situation where his company were successful in getting a letter of award on a major public infrastructure project from the earlier administrative but was told to put on hold of the project when there is a change of new administrative. The company was farsighted and did not react irrationally by putting a big claim against the authority even though they have sunk cost of more that millions from paying for the design and others committed costs. Finally, the project was revived recently after a lapse of few years.

b. ***Overseas expansion***

Six of the 21 companies interviewed have ventured to overseas market. According to the interviewee E, their company have made its mark in several major international joint venture projects involving infrastructure investments in Latin

America, India, Vietnam and China since 1996. They ventured into overseas market '*to insulate from the cyclical downturn of the construction industry by adding foreign jobs in the work portfolio*.'

'*To reduce the effects of the unfavourable domestic market factor then'*, Interviewee G said, '*we have to set up bases in foreign countries such as India, Thailand, Taiwan and Gulf States in the Middle East*.'

Interviewee R explained, *'involvement in many of Malaysia's mega projects has nurtured the capabilities and expertise of Malaysian contractors. Testimony of their expertise is reflected in their ability to build world renowned landmarks such as the Putraja e-Government Administrative Centre, Cyberjaya-Malaysia's first smart city, the world's tallest Petronas Twin Towers…Whether through conventional and other innovative approaches including privatisation, Build, Operate and transfer (BOT) and deferred payment methods, our fast track contractors are reputed to have the capabilities to complete time-critical project ahead of schedule. Clear examples are the Sepang International Circuit for Malaysia's first Formula One racing, and the Bukit Jalil National Sport Complex for the Commonwealth Games.'*

Not all would share the same measure of success as the global construction scene has its share of challenges and pitfalls to consider. Working in unfamiliar geographical markets overseas will often bring challenges in terms of culture and market practices.

#### 7.5.5 MANAGING PERFORMANCE

When the recession took hold, planning was abandoned in favour of short-term answers, focus on internal efficiency and solving immediate financial difficulties and other problems. For example, the interviewee C said, *'In 1996, we had indeed foreseen that there will be a slump in the near future and the management had been asked to implement cost cutting measures. But the 1997-1998 Asian Financial Crisis came too suddenly. Although we have seven projects on hand and half of them on the mid-way of development, but because of the sudden hit by the crisis, sales were affected and we have to put some projects on hold.'*

Interviewee G said, *'One of the great strength apart from machinery ownership is our in-house design team and the budgeting team. They provide timely cost saving alternatives design and close cost monitoring for every project.'*

Interviewee L illustrated their company will conduct regular meeting to review progress. The meeting is part of their QA system. The management will review the minutes after internal QA audit. QA audit are carried out consistently at 4 months interval. They will amend and review the procedures where necessary at every 4 months.

Interviewee N also answered that their company is *'holding weekly meetings to ensure all parties are on the same page and that schedules are met.'*

Interviewee E said, *'their company will placed greater efforts in strengthening the internal control system of its overseas operations.'*

None of the interviewees has a designated programme for productivity improvement.

## 7.6 WHY SUCH COURSE OF ACTION IS CHOSEN?

### 7.6.1 MANAGING FINANCE

The companies have tightened financial control during the economic downturn. An explanation quoted by interviewee G is *'the company switched to a defensive strategy which means that efforts were focused on surviving the economic meltdown.*' Interviewee H said, *'freezing of loan to the developers, affecting construction – during the crisis, most of the bank has freeze the facility for commercial loan causing lots of project left abandoned due to not being able to secure the loan.'*

Company O is *'to accelerate the realisation of cash flows from ongoing projects'* is the main concern of the company. Interviewee O said, *'the ease to collect progress payments from clients becomes a central concern of us.'* Interviewee N echoed and elaborated, *'upstream party closing its doors and leaving its downstream parties with no payment and little practical recourse…once project are completed,* *the work will becomes a fixture to the ground disabling the party to recover non-payment by removing any part of the completed work.'* Company T suggested *'keeping development cost down'* in order to '*minimise borrowing*'. Interviewee E commented, *'never borrow and expose ourselves to high risk…I believe we should only borrow to finance our purchase or business as minimal as possible so that we can easily repay or serve our loan.'*

### 7.6.2 MANAGING ORGANIZATION

According to the interviewee F, '*companies downsize or restructure or even reinvest their core business to suit the environment or business needs*.' Interviewee J explained that they have to downsize their company *'due to the shrinkage of the workload and to the urgent need to cut costs.'*

The company C have *'grown too tall and bureaucratic and their operating costs have become much too high.'* They take the opportunity *'to get rid of the least satisfactory managers as well as job elimination.'*

Interviewee Q said, *'downsizing can be seen as an opportunity to strengthen the management to achieve greater organizational efficiency and to fill gaps which had developed.'*

### 7.6.3 MANAGING PEOPLE

a. ***Human resource development***

The employers generally don't have any idea whether they are getting any business value from training. Beyond teaching new employees the specific of their jobs, most companies train staff in areas such as leadership, communications, performance management, or lean operations. But they typically measure training's impact by conducting surveys of attendees or counting how many employees completed the courses rather than by assessing whether those employees learned anything that improved business performance.

From one perspective, it does seem sensible not to invest in training since it is more likely to benefit the individual's career rather than the firm. Without investment in training and management development, knowledge based assets of the firm will not be enhanced and so the firm will lose a source of competitive advantage. If construction is about competing on knowledge based assets rather than just price, the time to continue investing in the protection of that asset is during a recession so as to be able to compete more effectively in buoyant times. The counter argument is that the increased mobility of both middle and senior managers as a prevalent employment pattern does not seem sensible to train the employee.

b. ***Contract employment***

Intensified competition and the financial crisis have encouraged a trend towards a leaner, more fluctuating workforce. Some respondents expect a growing proportion of workers to be contract-based rather than permanently employed. A flexible workforce will make it easier to scale up or down as business need dictate 'just-in-time' resources. Interviewee J explained the advantages obtained from contract staff are *'the cyclical nature of construction work. It is very costly to terminate the employment if the company could not find the new contract in time for their continuous employment. In the long run it cost less to employ temporary staff because they received no indirect benefits and they can be let go easily when their services are no longer needed.'*

Interviewee E enumerates the reasons to maintain contract employment for project staff as '*saving cost of employment, flexibility in meeting changing workloads and able to reduce responsibilities under the employment law.*'

#### 7.6.4 MANAGING MARKET

a. ***Diversification***

The purpose of diversification reasoned out by the interviewees include for better prospect, to diversify earning base, to sustain the growth, to reduce the impact of macroeconomic changes, to capitalise their strength in the industry, to suit the environment and business needs and to cushion impact of any sectors doing badly. The following are the examples of answers to the question on why they chose to diversify:

- *‘we are now slowly moving towards to be a developer in the near future for a better prospect.’* (Interviewee F)
- *‘…to diversify its earnings base across different geographies and clients, with a target of capitalising on its presence and on-the ground relationships in Malaysia and Vietnam.’* (Interviewee O)
- *‘…to venture into a new market in order to sustain the growth of the companies.’* (Interviewee E)
- *‘In order to reduce the impact of macroeconomic changes, we are diversifying into other territories but still holding on to our strength on infrastructure and building works only.’ (Interviewee G)*
- *‘…to capitalise on our strengths in the construction and property industries.’ (Interviewee O)*
- *‘…built or acquire recurring income business so that it will cushion the impact if anyone of the industries sector is doing badly.’ (Interviewee E)*

Company E took its first step into property development out of necessity during the recession in the mid-1980s. There were fewer construction opportunities then but the Government provided land for companies to build mass low and medium cost houses under privatisation programmes. Leveraging on its construction skills, several such projects were successfully undertaken by the group, setting the foundation for the properties division. Its property development has now become a major part of the group's activities. Since then, the company has made impressive inroads into the development of massive mixed-use developments, satellite townships, large-scale condominium projects and industrial and office parks.

Company E has taken the opportunity to transform its internal building material operations, such as quarrying and ready-mixed concrete, into a core activity when demand grew significantly outside the group.

The company also venture into plantations as a source of steady income to cushion the cyclical nature of its core construction business. It helped bolster the Group during the economic downturn in the Asian financial crisis in 1997.

b. ***Overseas expansion***

The involvement in many of Malaysia's mega projects has nurtured the capabilities and expertise of Malaysian contractors to export the construction services. It is not only enabling these contractors to brought additional revenue for the Malaysian economy, it also help them *'to insulate from the cyclical downturn of the construction industry'* (Interviewee E). Interviewee G concurs with the comments, he replied the reason for their companies to venture overseas market is to *'to reduce the effects of the unfavourable domestic market factor.'* Interviewee R said Malaysian contractors expand to overseas market especially in the Middle East is *'to take the advantage of the boom in the construction scene of the region'.* He also commented, *'fulfilling foreign market demands does not being with it the multiplier effect to the economy as domestic demand does, although contribution to the construction industry performance may still be accrued.'*

#### 7.6.5 MANAGING PERFORMANCE

Construction activities always required site managements to make many ad hoc decisions, often without reference to more senior management. They need a powerful position to adapt and modify the company's policies and production level. As a result, diet management is now increasingly required to combine high levels of both technical and managerial competence. However, interviewee G commented, *'some of the Project Managers in charge of project whom I met are lack of comprehensive knowledge of the industry. They may be good in one specific area, but are not all rounded…The earlier batch of supervisors do not have skills required for the job, therefore causes poor workmanships and lots of technical issue left unsolved.'*

The use of subcontracting as an operating core strategy resulted the role of the main contractor moved towards managing organizational and contractual risk, coordinating and controlling boundaries and interfaces between different organizations on site within the supply chain. The use of subcontracting meant that the production process has become fragmented in terms of managerial control, including the intimate and detailed knowledge of production methods and labour employment.

## 7.7 WHAT ARE THE IMPACTS OF SUCH COURSE OF ACTION?

Interviewee A agreed that there is overall improvement on the productivity of the construction industry after the 1980s recession, he said, *'during those days, for example, Samudra Hotel, now known as Holiday City Centre, the construction of superstructure takes 36 months. After completion of Dayabumi, similar projects will need 18-24 months to complete only.'*

Interviewee C replied, '*generally it helped in the short term but on the long run, staffs were demoralized. Before the cost-cutting measures, our organization was over-staffed, and people tended to be complacent. After tightening up, things improved. Excess staff disappeared and it became a lean organization*.' He added, '*People are more sensitive and alert to changes. Things can come and hit anytime. Information becomes very important to gauge any change in circumstances*.'

The labour productivity is affected by the influx of immigrant workers from the neighbouring countries in the 1990s. Interviewee H explained, *'After the crisis* [in 1980s], *skill workers, supervision staffs, consultants have left the industry for better jobs; therefore today we are short of manpower and have to depend on foreigners…most of the skill worker i.e. tiler, marble layer, plumber and etc. have been replaced by foreigner due to high cost to engage locals...Amid the economic boom in the years before the economic crisis, the labour market had become employees' market where job-hopping and staff-pinching had given employer a tough time in recruiting quality staff. On the other hand, quite a number of professionals had taken the opportunity to transform their fields of interest into professions related to the booming share market.'*

Interviewee S also commented the opening of the floodgates for cheap foreign labour in the past has caused the industry to maintain the competitiveness based on the low-wage system. *'If Malaysia had not allowed the massive influx, local contractors would have been force to innovate, automate to boost productivity to maintain their competitiveness.'*

## 7.8 SUMMARY

The key aspects and issues underlying productivity of construction sector highlighted by the interviewees include economic environment, the nature of the industry, construction methods, contract arrangement, payment chain and regulatory policies. The development plans and stimulus packages of the government are considered as contributing positive effect to the industry. The external threats to the industry are bursting of US housing bubble, subprime crisis, global financial crisis, credit crunch, sovereign debt crisis, large fiscal stimuli, and high unemployment in advanced economies.

The workload fluctuation resulting from volatile demand of construction had lead to the state of almost impossible to have continuity of work in the industry. In order to over comes the demand fluctuation of the individual company, subcontracting becomes a common practice in the industry. However, the consequences of subcontracting are the risks of quality, occupational safety health and lack of long-term training of the industry. In addition, there was abundance of cheap foreign labours, and the resulting effect was labour intensive construction methods commonly adopted in the industry. Construction is always associated with long durations and multiple phases of work along with trouble-shooting in the field. The services are usually rendered first before payment is fully made; the resulting effects were delayed payment, under payment or non-payment of those on the downstream of payment chain. The regulatory policies available are not only to regulate the industry but also to meet the social objectives requirements which bring about distorted competition.

The usual course of action taken by the industrial participants when they are encountered with economic changes are tightened financial control, curb expenses, downsizing or re-organization, retrenchment, diversification and venture into overseas market. The reasons quoted by the participants for taking these actions are to survive the economic downturn, to improve the cash flow, to insulate from the cyclical downturn of the construction industry, and to have better control of the supply chain. The contract employments have been adopted by some companies to recruit the new employee after the economic downturn, especially for the site supervisory and management staff. This is to avoid the obligation of redundancies payment when the economic slump in future.

The effects of these actions will be analysed in the Chapter 8.

# Chapter 8: Discussion

## 8.1 INTRODUCTION

This chapter triangulates the data from the two phases of the study to facilitate the interpretation and discussion of the Quantitative Data Result and Qualitative Data Result. It highlights trends and patterns and comments on their significance in the context of the literature reviewed in Chapter 2 through 4. The main conclusions drawn from this triangulation process will be presented in the next chapter. The seven sections set up in this chapter are organized to address the five research questions. Section 8.2 reviews how the productivity of construction sector is affected by macroeconomic fluctuations; Section 8.3 addresses the key aspects and issues underlying productivity of construction sector; Section 8.4 focus on the usual course of action taken by the industrial participants when they are encountered with macroeconomic fluctuations; Section 8.5 deals with why such course of action is chosen; Section 8.6 attends to the impacts of such course of action and Section 8.7 summarize this chapter.

## 8.2 HOW THE PRODUCTIVITY OF CONSTRUCTION SECTOR IS AFFECTED BY MACROECONOMIC FLUCTUATIONS?

The output of construction is large and therefore it is a significant part of the economy. Fluctuation in construction output is endemic in the industry. In part it is caused by fluctuations in the economy as a whole and in part by the nature of the construction product. The construction business cycle is more pronounced than the rest of economy. The upswings are steeper and the troughs deeper than in the economy as a whole (Section 4.5.1). The perception of the magnitude of fluctuations in the construction industry by the persons and organisations working in it is often greater than the overall statistics of output would seem to justify.

### 8.2.1 FLUCTUATIONS OF CONSTRUCTION

Section 6.2 have identified a 32-year building cycle from 1975 to 2006, which is superimposed with three shorter construction business cycles in 1975-1987, 1987-1999 and 1999-2006. The three construction business cycles exhibit different periodicity. Figure 6.1 depicts the fluctuation of construction business cycle is more pronounced than the general business cycle, i.e. the upswings are steeper, and the troughs are deeper.

Table 8-1
Comparison of economic and construction business cycle

| **Economic cycles** | | **Construction business cycle** | |
|---|---|---|---|
| **Periods** | **Length (years)** | **Periods** | **Length (years)** |
| 1975-1986 | 11 | 1875-1987 | 12 |
| 1986-1998 | 12 | 1987-1999 | 12 |
| 1998-2009 | 11 | 1999-2006 | 7 |

Most economists see the general business cycle as influenced by random as well as predictable events (Section 4.5.1). Construction involves long term investment and long term risks; it will be the first to be suspended at the first sign of an economic downturn, and the last to be revived during an economic upturn. Although government frequently intervene construction investments in order to regulate the economy, it is unlikely this will lead to perfectly synchronized in economic and construction fluctuations. The comparisons of lengths of construction business cycles and economic cycles are presented in Table 8-1. In addition, the general business cycle which is represented by GDP is the sum of its component industrial part, it will appear to fluctuate less than any one of its parts.

#### 8.2.2 ECONOMIC DEVELOPMENT AND CONSTRUCTION LABOUR PRODUCTIVITY

The time series of Figure 6.3 seems bear no relation to one another before mid of 1980s. However, there is a radical change at end of 1980s. The two Oil Shocks in 1970s (Section 6.2) and the change of the Malaysian economy from the emphasis of agriculture in pre-1970s to the manufacturing sector has led to change in the structure of labour employment. There is 22.3% increase in the construction employment from 160,000 in 1975 to 206,000 in 1976; however, the construction value added is only increased by 8.3% (from RM3.2 billion in 1975 to RM3.5 billion in 1976). The resulting effects were consecutively 19.8% and 15.3% declines in the CLP in 1975 and 1976 respectively. From the end of 1980s to end of 1990s, Malaysia economy is driven by the massive development of infrastructure projects. The curve of CLP is following closely with the curve of GDP per capita until outburst of Asian Economic Crisis in 1997. When Malaysia entered into the new millennium, most of the large infrastructure projects had already completed. The construction projects undertaken in 2000s are mainly housing development. In general, The CLPs recorded in 2000s are generally lower than those achieved in 1990s; the latter are dominated mainly by capital-intensified civil engineering projects. These finding is in align with the RBC theorists' assumption that the economy is being continuously buffeted by the productivity shocks (Section 4.5.1).

In addition, RBC theorists' prediction that employment will move procyclically by and large are supported by the empirical data, 30 out of 40 years data (75 per cent) shown in Figure 6.2 concurred with this. Besides, Figure 8.1 indicates that the construction employment is strongly correlated ($R^2$ = 0.92) with the GDP per capita.

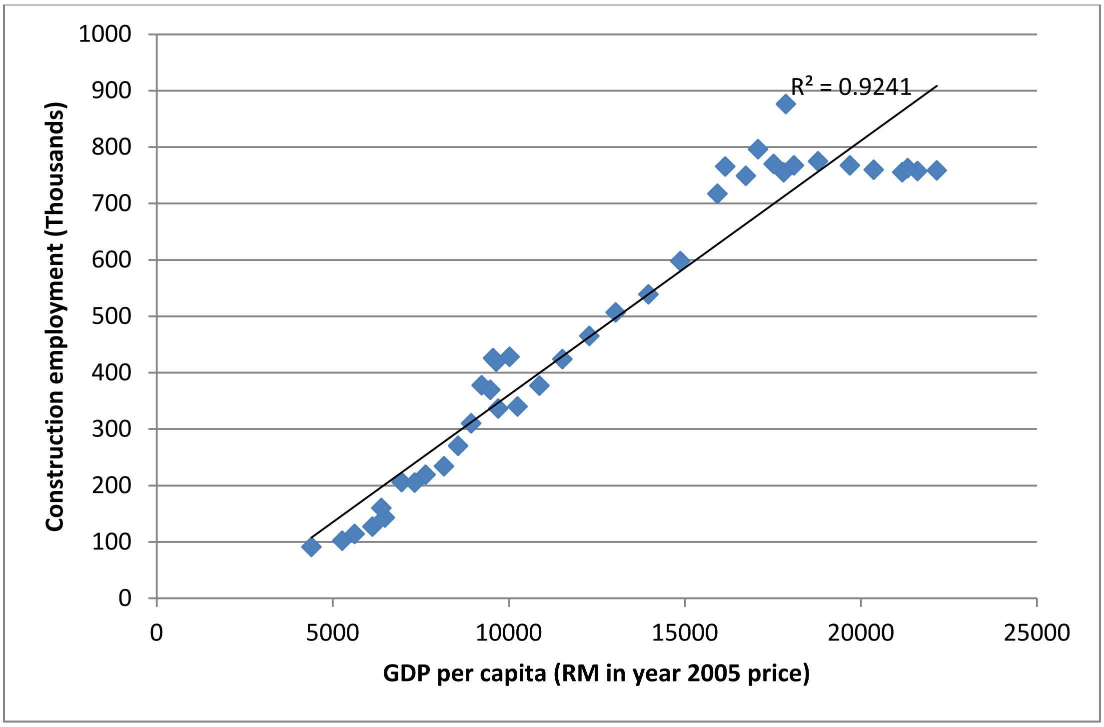


Figure 8.1. Correlation of construction employment and GDP per capita (1970-2009)

Thirdly, the RBC theorists predicted that the real wages will be higher during booms than during recessions (procyclical real wages). Nevertheless, it cannot be verified in this study. The available data on construction employee wages are in years 1996, 1998, 2000, 2002, 2004, 2005 and 2007 (Table 6-4). The average construction employment wage increased by 5.0 per cent in 1996/1998 and 5.7 per cent in 2000/2002 despite there were recessions in years 1998 and 2001 (Table 6-4).

Fourthly, the average labour productivity is procyclical; that is the output per worker is higher during the booms than during recessions. It is supported by 30 out of 40 years data (75 per cent) shown in Figure 6.3. This is consistent with the RBC economists' assumption that booms are periods of beneficial productivity shocks, which tend to raise labour productivity, whereas recessions are the result of adverse productivity shocks, which tend to reduce labour productivity. The RBC economists point out that without productivity shocks whilst allowing the production function to remain stable over time; the average labour productivity would not be procyclical. This is concurred by the stagnant performance of construction productivity in 2000s. With no productivity shocks, the expansion of employment that occurs during the booms would tend to reduce average labour productivity because of the principle of diminishing marginal productivity of labour. Similarly, without productivity shocks, recessions would be periods of relatively higher labour productivity, instead of lower productivity as observed.

Indeed Construction labour productivity (CLP) is a ratio of construction value added and construction employment; whereas GDP per capita is a ratio of GDP and population. Hence, the correlations between CLP and GDP per capita will vary with any changes in GDP, population, construction activity or construction employment. The hypothesis that the positive correlation between CLP and GDP per capita in the longer 1975-2006 building cycle is driven by construction activity is confirmed in Section 6.3. In the shorter 1987-1999 construction business cycle, both of the hypotheses that correlations between CLP and GDP per capita are driven by construction activities and employment are confirmed. Nevertheless, the correlation between CLP and GDP per capita in the 1999-2006 construction business cycles is driven by GDP and population.

Table 8-2
Average annual growth rates of GDP, construction, construction employment, GDP per capita and construction labour productivity (1970-2009)

| Year | GDP | Population | GDP per Capita | Construction | Construction Employment | Construction Labour Productivity |
|---|---|---|---|---|---|---|
| 1975-2006 | 6.40 | 2.47 | 3.84 | 5.31 | 5.74 | -0.34 |
| 1975-1987 | 5.84 | 2.55 | 3.21 | 4.61 | 7.40 | -2.22 |
| 1987-1999 | 7.37 | 2.68 | 4.57 | 7.14 | 5.97 | 0.80 |
| 1999-2006 | 5.58 | 2.04 | 3.47 | 0.12 | -0.16 | 0.27 |

Table 8-2 which is computed from the data in Table 6-1 shows that the average annual growth of construction activity of the 1975-2006 building cycle (5.31%) is less than the average annual growth of construction employment (5.78%), consequently the average annual growth of construction labour productivity decline (-0.34%). The average annual growth of construction activity of the 1987-1999 construction business cycle (7.14%) is higher than the average annual growth of construction employment (5.97%), as a result the average annual growth of construction labour productivity increase (0.80%). The average annual growth of GDP per capita of the 1999-2006 building cycle (3.47%) is less than the previous cycle (4.57%), thus the average annual growth of construction labour productivity decelerating from 0.80% in 1987-1999 to 0.27% in 1999-2006.

Between 1987 and 1999, the value added in construction and employment in construction sector grows 2.5 and 2.3 times respectively. The average annual growth value-added in construction and employment in construction expands 7.14% and 5.97% respectively for the period (Table 8-2). Section 2.2.2 has brought to light that this is the period where privatisation is a vital part of the overall strategy in the country's economic development and the construction sector accounted for 22.5% of total project privatized. Section 2.4 reveals that as the buoyant activities of the construction sector continued to expand in implementation of large infrastructure and civil engineering projects as well as continued expansion in residential and non-residential construction, labour shortage had become more acute. To avoid disruption to the economic growth process, the government allowed foreign workers to be employed in the construction sector. For example, there were 725,200 registered foreign workers in 1996, out of which 29% were employed in construction.

The average annual growth rate of GDP in total economy and population grow 5.58% and 2.04% respectively between 1999 and 2006. However, the average annual value added in construction only grows marginally at 0.12% and the employment in construction contracts 0.16% (Table 8-2). It is because most of the major infrastructure projects have completed during this period and subsequently Malaysian government have launched Amnesty Programme in 2004 to reduce the number of illegal foreign workers as explained in Section 2.4.

The positive correlation coefficients of CLP and GDP per capita of 1975-2006 building cycle and 1987-1999 and 1999-2006 construction business cycles are consistent with the RBC economists' assumption discussed in Section 4.5.1, stipulating that the average labour productivity is procyclical, denoting output per worker is higher during booms than during recessions.

The frequency and size of changes in the level of activity in the construction sector has a number of implications on how the sector function was discussed in Section 4.4.1. Two of the most important factors are the effects on skill formation and capitalisation or investment. As the output of the sector changes, the demand of labour force varies at the same time. When employment increases, unskilled or poorly skilled workers are attracted temporarily to the industry causing the overall skills level and productivity drop. Since the periods of employment are normally of short duration, there is no time and no incentive to engage in formal training. Skills development is consequently almost exclusively 'on the job' training; very specific and fairly superficial. In response to the demand for flexibility in output, the use of capital in the sector is relatively low compare with manufacturing sector. The impact of unstable demand in the construction sector resulted in wide variation of cash flow; which cannot provide a required steady cash flow for an adequate return on investment.

### 8.2.3 COMPARISON OF CONSTRUCTION SUB-SECTORS

The Construction Industry Surveys/Census over the period from 1996 to 2007 show that the construction labour productivity is peaked at 2004. This is partly attributed to the reduction of construction employment as a result of the measure to control the influx of illegal foreign workers under the Amnesty Programme in 2004 (Section 2.4). Although the labour saving devices such as construction methods using Industrialised Building System (IBS) and through greater automation and mechanisation were introduced (Section 4.5.2), there is no significant change in the capital intensity recorded. There is a declining trend of added value content, which reflected high cost of bought in services or materials, for example, Section 4.5.2 recorded prices of steel bars were revised upwards three times in 2006 by a total of 45% and the price of cement was revised at end-2006.

Table 6-8 concludes that civil engineering construction is more productive than the residential and non-residential construction in labour usage. But it is less competitive in capital productivity than the residential and non-residential construction sub-sectors. Subsequently, the added value per labour cost in the civil engineering construction is higher than the residential construction. Civil engineering subsector is most capital intensified subsectors as shown in Table 6.6 and this is aligned with Ive and Gruneberg's comment that machine-for-labour substitution has been a more important process in civil engineering (Section 4.4.2). There is only 7.8% increased in the capital intensity of civil engineering subsector between 1996 and 2007, consequently, the capital productivity is shrunk by 38.1% (Table 6.8). It implied that the idling of capital asset has increased.

Table 6-9 shows that among the four subsectors, the residential subsector encounters the most severe contraction of added value content at 27.9%. However, it expands fastest in output per employee (48.1%) and value added per employee (6.8%). The labour competitiveness improved by 18.7% which is slower than the 20.4% growth of labour cost and consequently the average value added per labour cost declines 11.2%. The improvement of labour productivity is attributed to the growing rate of capital investment at 31.1% although declines of capital productivity (32.8%) results. Residential subsector has been encouraged to adopt IBS (Section 4.5.2), for examples, the government had pledge to construct 100,000 units of affordable houses using IBS in 2005 Budget; all new government building projects were required to have at least 50% of IBS content was announced in 2004 and the exemption of construction levy on contractors that have used IBS in 50% of the building components was announced in 2007. Nevertheless, the construction sector can further improve in its productivity performance by embarking through more efficient utilisation of assets and enhancing the capability of their management system.

Special trade works subsector is the second most capital intensified subsector after the civil engineering subsector. Table 6-6 shows that the capital intensity of special trade work subsector is approximately 1.6 times of residential or non-residential subsector, but the capital productivity is only 0.7 times of the two sub-sectors. In addition, Table 6-9 shows that despite the capital intensity of the subsector had grown by 53.7% but the capital productivity is declined by 44.6%. The special trade subsector consist a large variety of trades ranging from labour intensive activity such as painting and decorating (RM6,775 per employee) to capital intensive activities such as renting of construction equipment (RM77,649 per employee) (Appendix 4). In addition it also includes trades like ‘heating, ventilation, air-conditioning and refrigeration work’ which forms the bulk of the contract sum. The sector recorded with highest output per employee (RM107,206 per employee) among the subsectors but only increase the added value content by 29.6%, the second lowest among the sub-sectors (Appendix 4). The increase technical sophistication demand of construction product and the construction process will continuously drive the demand of highly specialised nature of much of the work. One of the groupings including in the special trade works is ‘renting of construction or demolition equipment with operator’. The existence of a plant hire system allows the contractor to pay for machinery only when he needs it and allows the machinery itself to be hired out for different projects, kept in more continual used and therefore more likely to make a return on its capital cost.

The differences in value added per employee among the sizes of the establishment are not statistically significant. However, the differences of total output per employee among the establishment sizes are statistically significant (Table 6-14). Section 6.4.2 found that the larger establishments are able to achieve higher added value with same unit of labour cost compare with the smaller size establishments. In the large-size establishment, unit labour cost is the most competitive; consequently, the added value per labour cost is the highest in the large-sized establishment. This is attributed to the lowest average return of the individual employees, greatest capital deepening and most efficient in utilization of capital. Large establishment is big enough to obtain the technical and managerial economies of scale (Section 4.3.3). It is quoted in Section 4.4.2, Gruneberg and Ive (2000) advocated that capital intensive in itself favours those firms able to command larger amounts of capital. The relative success of a firm in one time period is positively correlated with relative success in the next time period, and so on because large ownership units are often in a position to take advantage of financial economies of scale. These parent companies are usually able to raise additional capital, beyond their retained profits, more cheaply than smaller ones; either by borrowing or by issuing new share capital above-average growth makes a firm larger than its rivals.

## 8.3 WHAT ARE THE KEY ASPECTS AND ISSUES UNDERLYING PRODUCTIVITY OF CONSTRUCTION SECTOR?

The key aspects and issues underlying productivity of construction sectors include the following six clusters: the economic environment within that the construction sector is operating, the construction methods involved in the sector's production system, contract arrangement of the sector's procurement practices, the position in the payment chain of the sector's supply chain and regulatory policies to competition and enterprise of the sector.

### 8.3.1 ECONOMIC ENVIRONMENT

The economic environmental factors impinge on the demand of construction industry highlighted by the interviewees in the Section 7.4.1 are grouped into internal and external economic factors. The internal factors include, the developmental plans such as the Ninth Malaysian Plan, Tenth Malaysia Plan, the five growth corridors – Iskandar Malaysia, Northern Corridor Economic Region, East Coast Economic Region, Sarawak Corridor of Renewable Energy and Sabah Development Corridor, government pump priming exercises and fiscal stimulus and the lately announced Economic Transformation Programme (ETP). These government initiatives generate waves of construction demand. However the positive effects of the government initiatives are impinged by adversarial external factors include: deterioration in external demand, bursting of US housing bubble, subprime crisis, global financial crisis, credit crunch, sovereign debt crisis, large fiscal stimuli and high unemployment in advanced economies.

At the time of writing, the World Bank (2011) reported that the world economy is moved from a post-crisis bounce-back phase of the recovery to slower but still solid growth. Global GDP is estimated to have increased 3.9 percent in 2010, and will slow to 3.3% in 2011 before reaching 3.0% in 2012 (World Bank 2011). In Malaysia, the value-added of the construction sector have strengthened by 6.3% during the first half of 2010 (Ministry of Finance 2010).

### 8.3.2 THE NATURE OF THE INDUSTRY

The construction industry predominates in the economy; it represents one of the most complex and dynamic industrial environment. The issue of *'fluctuating workload'* highlighted by the interviewees in Section 7.4.2 relies on the support of highly '*fragmented*' industrial participants who sporadic involved throughout the course of the project (Section 4.3.2b). Fragmentation should be accepted as characteristics of the industry that have developed over time as it adapts to successfully meet the challenges of its turbulent business environment (Section 4.3.2b). Thus, the debate shall shifts from questioning the industry's 'lamentable' performance owing to its project-based characteristics, and towards the view that it is appropriately differentiated but not well integrated as advocated by Lee and Barrett (2008) .

### 8.3.3 CONSTRUCTION METHOD

Construction is done in the way it has always been done in Malaysia. Cost and budget constraints along with availability of cheap foreign labour have encouraged the construction industry to favour labour-intensive construction methods over the use of more expansive technology. The low take up of IBS in Malaysia construction sector is because of low labour cost in Malaysia and the availability of abundant and cheap workers coming from neighbouring countries (Section 7.4.3). On the other hand, IBS involves very intensive capital investment; the small contractors are already familiar with the conventional system and the conventional technology suit well with small scale projects therefore they are not willing to switch to mechanised based system.

Malaysian government has drawn up a new roadmap to promote and intensify IBS (Section 4.5.2). Incentives for IBS adopters were outlined in the 2005 budget as support for the success of IBS in Malaysia. These include exemption of the construction levy as an incentive on contractors that used at least 50% IBS components in construction of new residential project. In addition, Government had enforced the use of 70% IBS component in all government's new building construction since 2008. However, higher construction cost, high capital investment, difficulties in achieving economies of scale, inability to freeze design early and complex interfacing are the most significant barriers restricting the use of IBS were concluded in the CIDB (2010) recent study.

Despite with the problem identified by the CIDB study, the recent construction labour productivity had shown a continuous growth at average annual rate of 2.3% between 2005 and 2009 (Table 6-1 and Figure 6.5). However, the construction employment during this period had shrunk with average rate of -0.1% (Table 6-1 and Figure 6.5). This will only be possible if there is improvement in the construction process such as simplification of building design for greater standardisation, mechanisation of constructional work and much more use of factory produced units and assemblies.

Construction is essentially a process of preparing a site, bringing in materials and components, forming materials into elements such as frames, walls and roofs, assembling readymade components, installing services and then finishing ready for occupation. The construction process itself apparently does not have changed very much. However, there is increase proportion of components made away from the site, modern sophisticated manufacturing technology in the production of materials and modern components, use of prefabrication and the application of mechanisation to site work have all been going for a long time in construction and may not be evident on the building site. The total output per employee growth at 18.1% while added value per employee declined 8.5% (Table 6-9) reflected there is an increasing the use of bought in off-site manufactured components (Section 3.4.2). The output-based productivity measures provide a more complete picture of the production process, which include intra-industry flows of intermediate products (Section 3.4.1).

It appears that construction was technologically backward compared with most of the manufacturing process. Indeed, some of the innovation is hidden (Section 4.4.3b). Although the basic types of machinery have been changed little, the list of main forms of mechanisation used commonly on sites such as tower cranes, mobile cranes, fork lift trucks, concrete mixers, pumps and a range of digging machine of every scale apparently does not change much; there have been constant improvements in their quality and capacity. The range of products on the market is so great that if a job on site can be assisted by the mechanical means there is likely to be a machine ideally suited for the purpose. In addition, the equipment used on site today is very versatile and some of it is technically quite advanced. The CASE-type digging machine can be used on many different jobs, such as digging trenches, shovel earth, lift and carry heavy objects, knock things down and put things up. Its versatility makes this sort of machinery cost effective because the amount of idle time is obviously reduced.

The use of purpose-designed power tools for virtually every job-drills, saw, sanders, staplers, and hand-guided hydraulic tools, mixers and sprayers on building on sites is now so common. These will reduce the demand of labour hour on site. There is also now a growing adoption of IT equipment for a range of functions, especially in the information communications system.

The new technology is no good enough if it is simply used to reinforce outdated and wasteful processes. The problems on site have often been not the shortage of technology but the planning of its use. In addition to the traditional R&D activity that concentrates on producing new material or improved materials, business-level innovation that matter in construction shall include general organisational development activity. It generates radically new or incrementally improved supply chain arrangements, human resource management strategies, businesses or working practices (Section 4.4.3b).

Standardisation is another productivity improvement strategy. The current focus of IBS approach in Malaysia is mainly on prefabrication in order to achieve productivity improvement (Section 4.4.3d and Section 7.4.3). In fact, prefabrication and standardisation are not the same, although they are usually part of the same process. Prefabrication can take place without standardisation and standardisation does not necessarily require prefabrication components; nevertheless, there are whole range of activities and procedures which can be standardised in order to improve the productivity of construction process; for example, delivery, storage, documentation, communications and design. Moving as much of the process as possible off the site is one of the alternatives. Innovation in construction is highly non-linear: it derives from evolving working practices, project collaborations and problem-solving (Section 4.4.3b).

### 8.3.4 CONTRACT ARRANGEMENT

The traditional approach on design-bid-build is the most popular procurement strategy adopted in the construction sector. It is attractive to clients on its low risk and competitive tenders can be expected. The construction industry is considered competitive in the small- and medium-sized contracts as experienced by the interviewees (Section 7.4.4). It is common to receive more than 50 bidders for a small- or medium-sized project in the public sector. On the other hand, not all projects let to the contractors were won through competitive tendering, especially for the private sector. Often contracts were negotiated with firms known to the client or design team. Tenders were called through general advertisements in the trade and local press; other times only a small group of contractors were invited to tender. Contracts could be awarded to a single selected contractor without competition particularly if they had worked for same client before. Whether Malaysian were being well served had been questioned (Section 2.2.2) when the government awarded contracts without competitive bidding or sold assets without seeking the best offer.

Contractors' prices are far from stable. In demand slumps duration, profit mark-up can fall towards zero per cent or even put at negative mark-ups as experienced by interviewee N in the Section 7.4.4. In this desperate condition, the 'successful' contractor will instil added pressure on subcontractors and labour by reducing their charges and wages in order to regain own profit margin. The labour subcontractors' wages fluctuate massively and quickly in response to market conditions. Contractors do not really carry expensive spare capacity. This is consistent with the literature considered in Section 4.5.1 that in demand boom, construction firms tend to raise their prices even before their costs begin to increase, in order to take advantage of a sellers' market and to widen their profit mark-ups. Thus constructions businesses profit margins will tend to move proc-cyclically, i.e. widen during cyclical expansions and narrow during contractions.

Subcontracting is unavoidable in the construction industry as fluctuating work load is one of its characteristics (Section 7.4.4). It is a fundamental part of the whole building process (Section 4.3.2). The firms often form a loosely organized set of subcontractors who work from time to time for a main contractor. They tend to develop long-term relationships and rarely based on price competition.

Subcontracting makes it easier to accommodate such cyclical demand on skills; the tradesmen themselves may keep themselves being employed constantly by subcontracting work from the several different main contractors. Productivity gains from specialization may be available, if workers are becoming increasingly proficient in their niche tasks. There are scale economies on the production and the installation of individual components across the industry as a whole. Conversely, the subcontracting system has also been a major part of the fragmentation of the industry as a principal cause of inefficiency and adversarial effects; it has been creating management problems on the apportionment of responsibility for health and safety, training and the undermining of the apprenticeship system, levels of supervision on work sites. Sub-contracting requires considerable co-operation between site management and sub-contractors but contractual responsibilities are a continual source of divisiveness and also profitability. In addition, the failure of subcontractors to perform to required standards or even business failure of the subcontracting firm itself can cause major disruption to building programme.

#### 8.3.5 PAYMENT CHAIN

A main issue affecting the construction industry highlighted by the interviewees are the problem of late, under and non-payment (Section 7.4.5). Partly because of the complexity of construction work and partly because of financing issues, there are bound to be disputes relating to non-payment. Remedies such as suspension of work and direct payment are difficult to be properly and lawfully exercised unless there are expressed provisions in the contract and the disputes are resolved by an independent third party. As a result, cash flow of contractors will be affected and this will inevitably affect the progress of construction. Consequently, innocent third-parties, such as the purchasers, are often the victims of delayed or abandoned projects. This can severely affect the implementation of construction projects and thus the provision of the nation’s infrastructure and built environment.

Parties in the construction industry have no other effective remedy to recover non-payment. Once projects are completed, the infrastructure becomes a fixture to the ground disabling any party to recover non-payment by removing any part of the completed work. All these mean that the contracting party at the receiving end (the party doing the work and who is to be paid) and who has no privity of contract with or choice of the party up the chain of contract could be abused.

The proposed Construction Industry Payment and Adjudication Act (CIPPA) initiated by CIDB and working together with the construction industry players since 2003 had finally completed the preliminary draft bill in 2009. The construction industry has been waiting for far too long since CIPAA was mooted (Section 7.4.5). The Act should be seen as vital to protect the interest of the primary players in the construction industry and more so when the contractual bargaining powers of the primary players are often not equal. There are already similar acts in Britain, Australia, New Zealand and Singapore. These include: Building and Construction Industry Security of Payment Act 2002 (Victoria, Australia), Construction Contracts Act 2002 (New Zealand); and Building and Construction Industry Security of Payment Act 2004 (Singapore). All these countries recognise that timely payments are vital to the very survival and continuity of business of the construction industry. Clients are under contractual obligation to pay contractors, within the stipulated period, for services rendered and issuance of certificates of payment.

### 8.3.6 REGULATORY POLICIES

The interviewees also expressed anxieties about the regulatory policies which directly or indirectly affect the well-being of the industry (Section 7.4.6). Regulation is perceived as a key determinant of competitiveness, impacting on a number of drivers of productivity, particularly enterprise and competition. Regulation can limit activity, increase costs and stifle innovation in the sector. It is leading to increased compliance costs and less efficient worksites. It is important to ensure that the regulatory system is as efficient and effective as possible by removing any burdens that are unnecessary in the delivery of economic or social objectives.

#### a. *Contractor registration*

Overall the interviewees do not find that the industry is over regulated. There are two extreme views on the present registration system, on one end they felt that the present requirements such as to register with CIDB, levy payment and green card for construction workers and site supervisors are good for the industry development. On the other end, the present systems of contractor's registration and administration procedures are being described as inefficient and ineffective methods and practices (Section 7.4.6). There are two registration centres for contractors – CIDB (the acronym of Construction Industry Development Board) and PKK (the acronym of the abbreviated Malay name: *Pusat Khidmat Kontraktor*, in English this is: Contractor Services Centre) (Section 4.5.2). CIDB registration is a mandatory for contractors wanting to enter into any construction contract with either the public or private sector clients. PKK registration however required for contractors wanting to participate in government contracts. CIDB had recommended reviewing its current registration requirements for both its license and PKK license.

In addition, the prices paid on public project are perceived to be more expensive than those in the private sector. Restriction of competition and regulatory requirements are alleged to the more expensive procurement in the public sector (Section 7.4.6).

b. ***Price control***

Another example of regulatory policies affecting the well-being of the industry is the price ceilings imposed to cement and steel bars under Price Control Acts before 2008. As a result of price control, the local millers averting supply to export markets, creating an artificial shortage locally, encouraged the activities of the grey market and artificially raised material prices. Local builders have been forced to purchase above the ceiling price and difficulties in tender bidding. The industry was exposed to higher risk of project delays and failures (Section 7.4.6).

The price control gives firms a monopoly or oligopoly over the supply of price-controlled items (Section 4.5.2). Artificially low prices had discouraged producers from supplying more of the material, artificial barriers to the supply would emerge and prices would still not be real.

## 8.4 WHAT IS THE USUAL COURSE OF ACTION TAKEN BY THE INDUSTRIAL PARTICIPANTS WHEN THEY ARE ENCOUNTERED WITH MACROECONOMIC FLUCTUATIONS?

Companies switched to a defensive strategy during the economic downturn and the focus is on surviving the economic downturns were identified in Section 7.5. This leads the company to take drastic measures to curb expenses, consolidate operations, streamline capital expansion programs and defer expansion plans. Furthermore, some companies are diversifying into other territories but still holding on to the strength on construction; some companies started to venture into overseas market.

### 8.4.1 MANAGING FINANCE

Section 7.5.1 found that strengthen financial control is the first move by most of the company during the economic contraction which involved stricter cash flow monitoring and better budget planning and use of funds. Costs are reduced or controlled by downsizing, reorganisation of departments, control over capital expenditure, salary freezes or even salary cuts, no bonuses, reduction perks, etc. The common approaches adopted can be categorise to cost reduction focused on staff overhead, cost reduction focused on non-staff overhead, cost reduction on finance cost and cost reduction focused on improve efficiency. The approaches of cost cutting measures adopted by most of the companies interviewed so far are meeting the target by across-the–board cuts (Section 7.5.1) that don't differentiate between those that add value or destroy it. Most of the time, these measures are treated as one-off exercise.

Section 2.2.2 recollected the 1997-1998 Asian Financial Crisis have found that the poor assessment and management of financial risk led Malaysian construction firms borrow large amounts of international capital in 1990s. Much of the borrowing was short-term, denominated in foreign currency, and unhedged. Sluggish growth in the advanced economies, in particular Europe and Japan, made investments in fast-growing Asian countries relatively attractive and thus led to the build-up of foreign capital inflows. Over time, these inflows tended to be used to finance poorer-quality investment. The resulting inefficiency was higher lending rates than those reflected by the official intervention rate. These higher lending rates led to debt serving problems in the corporate sector and threatened the stability of the financial system.

Company T explicitly link cost reduction initiatives to long-term strategic business objectives who emphasize matching the financing of projects to their operating currencies and keeping development costs down so that less borrowing is required (Section 7.5.1). Adopting protective measures borne from lessons learned decades ago, from ensuring a healthy cash reserve and matching the financing of projects to their operating currencies and to ensuring that the organisation is not bound by a herd mentality and the myopia of short-term performance, had shielded the companies from the worst of the Asian financial crisis in 1997, and these defences continued to hold ten years later during the global financial crisis in 2007/2008 (Section 7.5.1).

### 8.4.2 MANAGING ORGANIZATION

Retrenchment during a downturn is often necessary to ensure a company's current profitability and future competitiveness. Section 2.4 quoted report in Bank Negara Report 2000 that

> 'Retrenchments of workers were rampant, and in 1999 the number settled to 37,357. With reference to contractors' notification at CIDB, 115 projects worth RM2,457.47 million were either suspended or abandoned in 1998. Despite better economic climate of the country, the number rose to 149 projects in 1999, worth RM2,307.37 million. This is a 6.2% increase in terms of value and 29.6% in terms of number.'(Section 2.4)

Nevertheless, the employer may wish to avoid it by all means as it causes loss of public confidence in the company. It not only lowers morale amongst remaining employees, but also makes cash flow difficult as funds must be set aside for payment of termination benefits. Before retrenching staff, an employer will usually consider other alternatives such as cost cutting, job freeze, early recruitment, tight control upon overheads, reduced working hours and lower wages. The layoffs scenario also has negative impacts on employees who have secured jobs as nobody knows exactly how many more will be laid off in months to come. The reduction in the labour force brought about by the recession, together with the long-term reduction in training by the industry means that, if and when there is an upturn in work, there is unlikely to be sufficient trained manpower.

Those affected are mainly involved in the site operations according to the interviews (Section 7.5.2). The contract departments of most of the construction organizations were relatively busier compare with those working on the site. Most of the time, they were involving in the re-measurement work or contractual claims due to the increased contract dispute and down scale of projects. They need to participate in more tenders because the tender success rates are declined as result of the vicious cycle of more bidders and less jobs available. To counter the effect of lesser jobs available in the domestic market, some of the larger company are started to participate in the international tenders. The larger company such as G was conducting market studies on the impact due to the change in the macroeconomic factors, to look for business opportunities especially collecting overseas market information, to study the political and risk factors of the nations and attempt to access the international markets in 1997-1998 Asian Economic Crisis.

Similarly, the feedback of the interview with the consultancy firms concluded that they (Quantity Surveying firms) feel busier during the economic downturn because of the more re-measurement job required due to the changes such as downsizing of the project instructed by the client (Section 7.5.2).

#### 8.4.3 MANAGING PEOPLE

a. ***Human resource development***

In general, the companies interviewed had provided various training programme to the management and supervisory employees in the industry (Section 7.6.3). This could be attributes to employers are mandatory to contribute Human Resource Development Levy described in Section 4.5.2. However, there are very little operative training was undertaken by contractors. It is viewed as uneconomic to do so. Nevertheless, companies such as G and L has maintained structured training programme including (a) Learning Centre to develop training programmes to meet the needs of the business model, organisational and management demands; (b) the Construction Training Committee which is made up of experienced senior line managers to develop and facilitate a series of comprehensive technical training modules aimed at all levels of engineers, supervisors and surveyors; and (c) plant operator school in the company which provides skills, certification and statutory requirements training for both the company’s staff and other workers in the construction industry. Courses offered by the school include: skill competency training, mobile, crawler and tower crane operation, excavator, backhoe loader, bulldozer, wheel loader, motor grader operation, hands-on maintenance of construction machinery, etc. Some companies included passing core modules as part of the requirements for promotion for technical staff (Section 7.5.3).

b. ***Contract employment***

Section 7.5.3 testified during the recession, the firms are minimizing recruitment of new staff unless absolutely necessary. After the crisis, companies are much more likely to use contract employees, especially for those position involved site operation, staff were employed for the duration of projects only. A small amount of the contract staff with proven performance will be offered with permanent employment. At least, company G and J are two companies interviewed confirmed that this was their companies' practice. Interviewee G also emphasized that the criteria in selecting who would be placed under permanent employment were those with right attitude and trustworthiness.

#### 8.4.4 MANAGING MARKET

a. ***Diversification***

In the construction industry, not only do firms produce different products within the contracting operation, but they also go outside the contracting business into property development, materials and other activities. Section 7.5.4 demonstrated that some of the diversifications are based with a link of experience between construction and a new venture such as property development, urban toll concessions, ports, highway and stormwater tunnel, water supplies, power plants, quarrying, cement manufacturing, ready mixed concrete production, precast concrete products, hospitality and leisure. Others are differentiating their services and offering services which are non-construction related business such as plantation, IT and wireless broadband network. In order to obtain major infrastructure work, most contractors invest in projects and often operate the facilities which they have developed. These new businesses provide an income flow independent of the construction business cycle.

b. ***Overseas expansion***

In responding to the falling workload in the domestic market, a number of contractors had been undertaking more contracting work abroad (Section 7.5.4). Four companies confirmed that they have penetrated to the global markets. The earliest ventured abroad was in 1996. The types of projects involved were tollway, highway, airport, township development, water supply scheme, power generation, hydropower project. The geographical markets that they had reached are Argentina, Qatar, India, China, Vietnam, Laos, Thailand, Indonesia and Singapore.

Section 2.4 had explained that following the completion of many privatized projects in years 2004-2005 as well as lower Government spending on new large infrastructure, the civil engineering sub-sector remained weak. The excess capacity in this sub-sector encouraged many construction companies to venture abroad. Among the successfully secured contracts were in road building, housing, power generation and airport project in the regional and Middle Eastern nations. In particular, India continued to be the major destination for Malaysian contractors given its huge spending on infrastructure development.

#### 8.4.5 MANAGING PERFORMANCE

There is no designated programme to improve the productivity of the company according to this investigation. The productivity improvement initiatives are embedded in the usual performance management of the companies. The common methods adopted are the routine management meeting to review the performance and those procedures and practices required under the Quality Assurance programme.

## 8.5 WHY SUCH COURSE OF ACTION IS CHOSEN?

Turbulent economic conditions have concentrated the collective minds of many executives on pure survival. The objectives of companies during the recession emphasized more to generate sufficient liquidity and cash flow to ensure short-term survival than to make a profit to ensure long-term survival and growth. The way to improve liquidity and cash flow is basically to reduce costs or to increase prices. In the recession with low and negative market growth the contractors had to concentrate on reducing costs that implied concentration on financial matters such as reducing borrowing, improving financial control and limiting losses. The time span of objectives in many cases became weeks or months rather than years.

Delivering good short-term results are important to the management to build confidence in its ability to realize longer-term strategies. However, companies must also act today to ensure that they can convert their growth prospects, capabilities, relationships, and assets into future cash flows.

### 8.5.1 MANAGING FINANCE

The roles for the finance function in a corporation ranges from at one end focuses primarily on reporting and compliance, with most of its time devoted to transaction management in financial accounting; at the opposite extreme, finance serves as an integral part of management team to support the creation of value by identifying opportunities and providing critical information and analysis to make superior operating and strategic decisions. The lesson learned from the Company T is increasing the finance purview into strategy and risk management could help companies manage themselves better through crisis (Section 7.6.1).

The predominant motivations for cost reduction of any kind are to reduce expenditure in line with lower construction contract in hand, to free up cash and reduce need for short-term external funding and to increase performance. However, the cost cutting is quite often not sustainable. The cost reduction programme born in economic downturns, quite often as growth revives, the successes of cutting cost during the downturn will erode with time. Figure 8.2 illustartes this phenomenon. The value added per staff cost and unit labour cost of companies G and E. E's unit labour cost had been reduced from 0.092 in 1992 to 0.039 in 2004. Similarly, G's unit labour cost had been reduced from 0.039 in 2000 to 0.023 in 2004. In 2009, both of the unit labour cost increased to 0.069 and 0.029 in company E and G respectively.

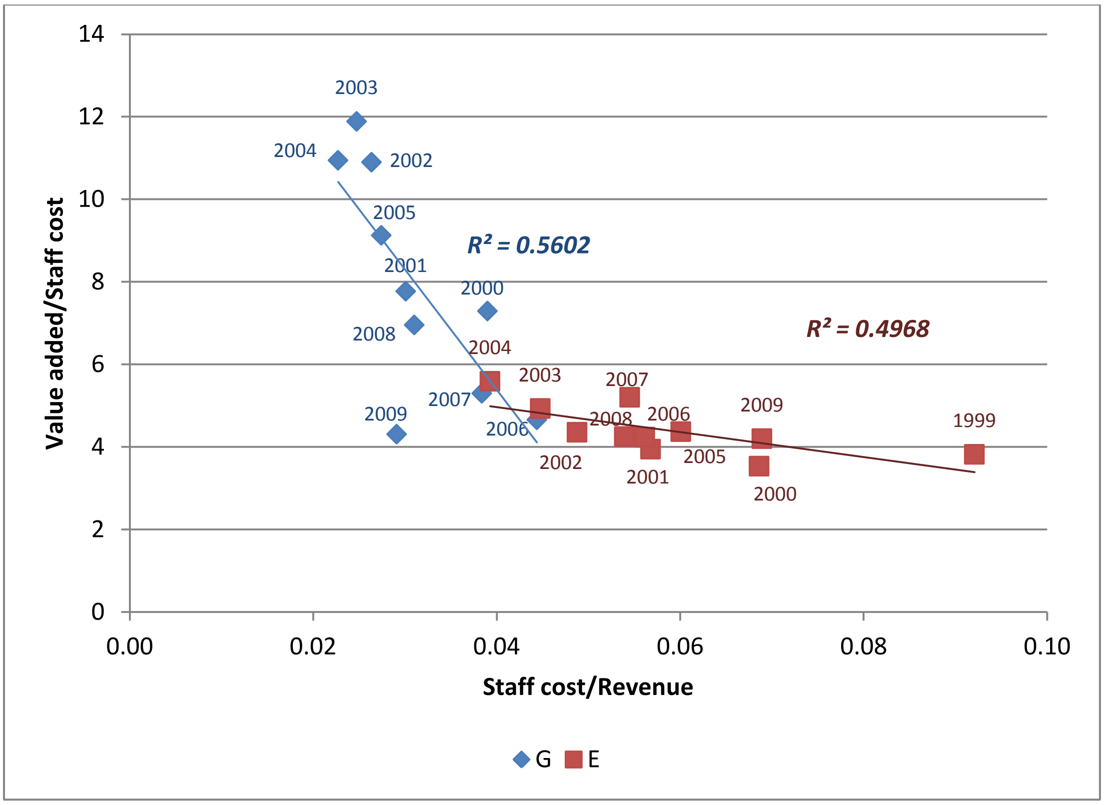


Figure 8.2. Value added per staff cost and unit staff cost of company G and E

The flaws of common practices in the cost reduction programme were focusing on overhead cost rather than deepen insights into the operating cost to set useful reduction targets. The across-the-board cuts where reduction targets were set so that each business unit does 'its fair share'- which initiatives in one area of a business often have unintended negative consequences for the company as a whole (Agrawal, Nottebohm et al. 2010). Any failure to sustain a cost-cutting program can weaken a company's resolve to deal with difficult issues and undermine management's credibility. The net result was fewer people doing more work in the same old way, leading to a vicious spiral of declining morale, quality, and productivity. The cconsequences of such flawed decisions are starving high-performing units of the resources needed, delaying critical investments, undermining revenue generation, damaging to long-term value creation, dampening morale by disrupting daily work rhythms when head counts are cut.

The trend lines of Company E and G in *Figure 8.2* indicate that the staff cost per revenue is more elastic in Company E than G. The change of staff cost per revenue when the value added per staff cost varies is more sensitive in Company E than G. One of the possible explanations is the difference in the investment portfolio of both companies. Company G is construction-dominant company, almost 70% of the company G's revenue is through construction contract. On the other hand, construction contracting is contributing only 45% to Company E's revenue between 1999 and 2009; the rests of revenue are driven from their investments in manufacturing and trading (31%), property development (20%) and infrastructure concessions (4%). It implies that the value added per staff cost is more sticky in diversified company than the construction-dominant company.

#### 8.5.2 MANAGING ORGANIZATION

During the recession there was a need to undertake substantial cuts in the staff numbers. The interviewees justified the need to cut costs on the heavy reductions in workload (Section 7.6.2). Staffing cuts were both deep and wide across range of activities and types of employee. However, the surge of downsizing and other forms of cost cutting may have little or nothing to do with sustained enhancements in productivity. In fact, there is no empirical evidence supports the interpretation of the downsizing as a necessary step in a process of reviving productivity.

In Table 8-3, return on capital employed (ROCE) is used as the proxy for measuring the company performance on the effect of unit staff cost. The hypothesis of downsizing will improve the company's performance is confirmed if there is significant negative correlation between the two variables i.e. the higher the unit staff cost, the lower the ROCE and vice versa. The result indicates that only four out of the eight companies agree with the hypothesis. The four companies are U, Q, O and C. Company U, which is a property developer in domestic market has the highest negative correlation coefficient between ROCE and unit staff cost. Company Q, which is mainly involved with local construction contract ranks behind Company U. Company C, which had carried out downsizing in 1997-1998 Asian Finance Crisis and had continued to made payment on Voluntary Separation Scheme between 2006 and 2010 amounting to 8.3% of the staff cost during the period but the average ROCE between 2001-2010 of company is continuing decline by 4.5%. On the other hand, Company T which started as construction firm and now with diversified investments which covers manufacturing, utility, hospitality and leisure has a strong positive correlation coefficient between ROCE and unit staff cost. This implied that an increase in unit staff cost is required in order to generate higher ROCE in company T.

Table 8-3
Correlations coefficient ($r$) between ROCE and unit staff cost

| Company | C | E | G | O | Q | T | U | V |
|---|---|---|---|---|---|---|---|---|
| Correlation coefficient | -0.39 | 0.05 | 0.26 | -0.53 | -0.74 | 0.72 | -0.96 | -0.29 |

In summary, the above results do no supports the interpretation of the downsizing as a necessary step in a process of reviving productivity. Downsizing is destructive because it eliminates an organisation's memory and sense of values, and destroys trusts, especially when downsizing is taken as across-the-board cost-cutting and headcount reduction. The loss of experienced workers is damaging to the future capabilities of organizations. Downsizing can lead to increase workloads, time pressures and job complexity for those remaining. Organizations may be trading off short-term gains from cost savings for long-terms losses.

Although clearly disadvantages are associated with excessive downsizing, it remains true that many organizations became too tall and bloated because they failed to control growth of their hierarchies and design their organizational structures appropriately in the past. In such cases, downsizing can be used as a strategic transformation to restructure their organizations, to change the organisation's culture and the way it does business.

#### 8.5.3 MANAGING PEOPLE

a. ***Human resource development***

The reduction in labour force brought about by the recession, together with the long-term reduction in training by the industry means that, if and when there is an upturn in work, there is unlikely to be sufficient trained manpower. The mobility of labour force as testified in Section 7.5.3 is reducing the long-term advantages to a firm of investment in training. It appears that expenditure on training is likely to benefit the individual in enhancing his career prospects rather than the company which finance it according to the interviewees.

Development the human resource capabilities of the construction sector are necessary in order to enhance the productivity. The current practice of employing unskilled labour has restrained productivity growth in the sector. The industry needs to promote and enforce the use of skilled labour. It would increase the likelihood that new technologies and methods will be adopted and this would strengthen the industry's competitive position (Section 4.4.3).

b. ***Contract employment***

After the 1997-1998 Asian Financial Crisis, vacancies tend to be filled with staff employed on contracts employment. This has changed the employment patterns. The contract staffs were seen as less costly and more flexible; the avoidance of redundancy payments and other costs means that short-term flexible employment is cheaper (Section 7.6.3). There is concern that this type of employment pattern did not provide staff able to blend in with the company culture. As the workforce becomes increasingly contract-based, it will increase the complexity of management's role, such as it needs to resolve cultural friction between full-time and contract workers.

There will be a cultural divide between the contract workers and core staff. Core staff will undergo a more rigorous hiring process than previously, but be rewarded with stable employment, regular promotions and better employee welfare and benefits. The essential technologies of construction are embodied in the people employed and residing in project teams at different levels in the firm's structure. Construction relies extensively on project team working and problem solving.

On the other hand, the workforce has changed; the younger generation of worker is more impatient for exciting work, challenges and new opportunities. They are not necessarily looking for lifetime employment.

#### 8.5.4 MANAGING MARKET

a. ***Diversification***

Contracting has a high positive cash flow and contracting companies were very anxious to enhance their asset base and penetrate into areas that provided income generation capabilities that are independent of the construction business cycle. Some of the contracting companies diversified into construction-related businesses and in some cases into business with little connection with construction. In this study, the businesses that have been diversified and mentioned by the interviewee include property development, building materials production and trading, infrastructure concessions, utilities, hospitality and leisure, etc (Section 7.5.4).

Many firms have diversified to such an extent that contracting is only a small percentage of their overall business. Some construction firms have diversified into construction related industries, whilst others have diversified outside construction related activities. There are also those firms where contracting remains a significant part of their turnover and some firms viewed traditionally as construction firms are progressively diluting their investment in contracting divisions.

Table 8-4
Sources of revenue of eight selected companies in 2009

| Company | Construction contracting | Property Development | Construction product manufacture and trading | Infrastructure concessions & Utilities | Others |
|---|---|---|---|---|---|
| O | 93% | - | 6 | - | 1% |
| Q | 100% | - | - | - | - |
| G | 76% | 15% | 5% | 3% | 1% |
| E | 34% | 23% | 21% | 8% | 14% |
| T | 3% | 1% | 23% | 61% | 12% |
| V | 83% | 9% | - | - | 9% |
| U | 20% | 72% | 2% | - | 6% |
| C | 61% | 33% | - | - | 6% |

Table 8-4 shows the current distribution of sources of revenue of eight companies in this study. Construction has been Company E's core business since its formation. Synergies for growth were forged as the company sought to diversify into other sectors related to its core construction business. Leveraging on the vast experience and expertise in construction, Company E expanded into property development and management as a natural progression. Since then, the properties division has made impressive inroads into the development of massive mixed-use developments, satellite townships, large-scale condominium projects, industrial and office parks and corporate headquarters of major local and international corporations in key growth areas throughout the country. The Company E's industry division which set up initially to support in-house needs have grown its operations into scalable core activities to focus on demand outside the Group.

Company T started with construction business in 1950s. Today, it adopted backward vertical integration to own businesses in construction material production and trading. It also involved with forward vertical integration to own and manage property development, hotels and resorts, REITs etc. The vertical integration allows the company to use or enhance its core competence in value creation, especially in controlling reliability of supplies and enable the resource to focus on more competitive activities instead of price negotiation and sourcing for competitive supplies.

*Figure 8.3* compares the results of ROCE of four selected companies. It indicates that diversified Companies E and T fluctuated less in the ROCE compare to the construction-dominant Companies C and G. However the relatively more focused Company G, is able to maintain the record of highest ROCE among the five companies.

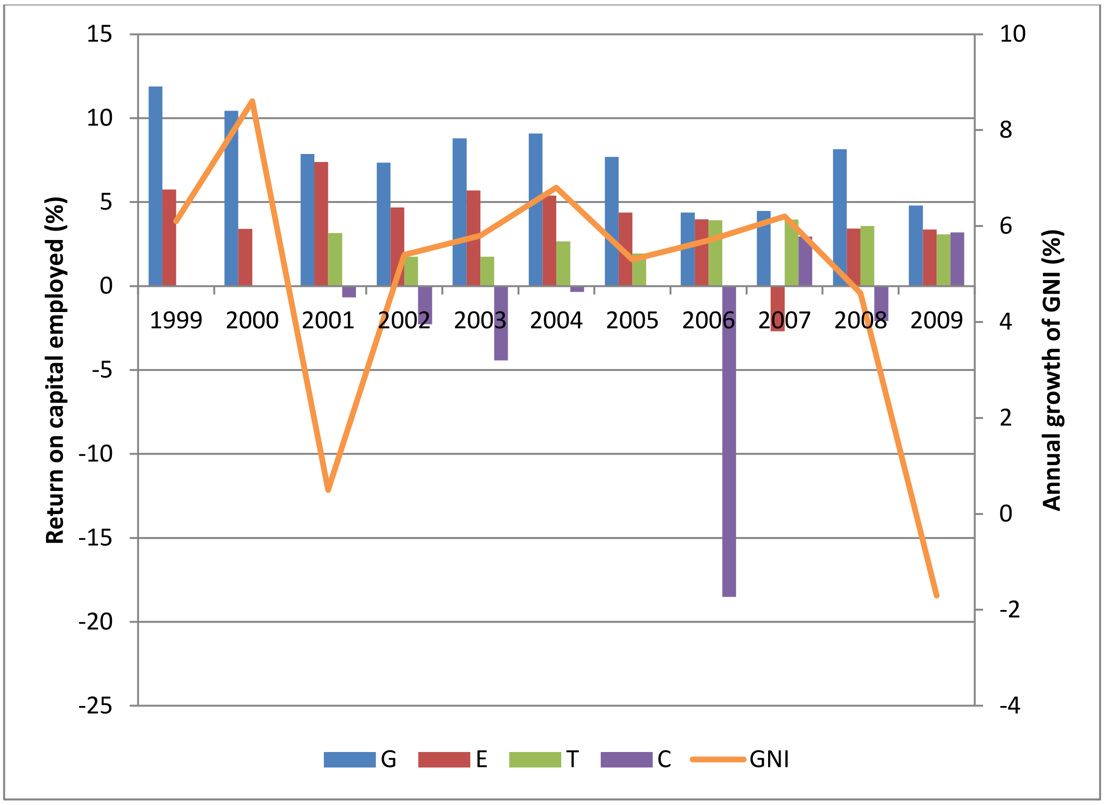


Figure 8.3. Annual growth of GNI and ROCE of selected companies

One of the reasons for the firms expanding into the businesses of their suppliers or customers in the construction industry is uncertainty in the availability of supplies especially during the periodic booms in the industry. A firm which controls its own source of supply is more likely to be able to meet delivery schedules, avoids the transaction costs of purchasing and price negotiation. This kind of vertical integration is most likely to be beneficial if the material concerned forms a major part to a project and the transport costs are high.

Tan (2004) drew attention to the risk of diversification into the construction related business (Section 2.4):

> During the boom times corporations were built up. The core business of the conglomerates tends to be centred on construction-related businesses, such as property development and manufacturing of building materials. This puts the entire corporation at risk during the recession, when the recession occurred, many of these companies were not able to survive since all of the related businesses would be affected (Tan 2004).

Horizontal integration may simply consist of merging with another firm in the same business in which case there may be economies of scale in purchasing or it may be possible to share certain resources. A firm may link with a firm which has no connection with the original business. The reason for this action is normally a desire to spread risk, overcoming fluctuations in workload and to make better use of resources since contracting is not a capital intensive activity. The diversified companies can exploit negative correlations among the business cycles of different investments towards more attractive projects or regions.

b. ***Overseas expansion***

While there may well be a global downturn, international prospects for Malaysian construction firms are becoming increasingly important. Malaysian contractors have been venture into the overseas market since 1986. The focus of overseas project has mainly been in infrastructure works – such as building and road/highway projects – which are areas of export specialty for Malaysian contractors. Involvement in many of Malaysia’s mega projects in the 1990s has nurtured the capabilities and expertise of Malaysian contractors. Table 8-5 shows the project value for domestic construction and overseas construction. The table shows that the average value of overseas market is 17% of project value awarded in domestic markets from 2001 to the third quarter of 2010. Many of the large firms began to seek overseas opportunities during the 1990s due to the decline in demand for domestic construction work. These firms specifically began to explore opportunities in location such as the Middle East where industrial, commercial and infrastructure expansions were brought about by a dramatic increase in wealth due to soaring oil prices. As it was highlighted in Section 2.4, between 2004 and 2006 there is a sharp increase of projects undertaken by Malaysian contractors in global market.

Globalisation has created numerous opportunities as well as challenges for the local construction industry. Due to the slowdown in the construction sector, some contractors have begun to tap into overseas markets, particularly India, Indochina and the Middle East. It allows the Malaysian construction industry to reduce the effects of domestic market conditions, especially in year 2006 as shown in *Figure 8.4*, the total project value undertaken by Malaysian contractor in the global market is equal to 46% of total project value undertaken by the industry.

Table 8-5
Total value undertaken by Malaysian contractors in global market by year of project awarded

| Year | ASEAN | India | Middle East | Africa | Others | Total | Total value of project awarded | % of Global market/ Local market |
|---|---|---|---|---|---|---|---|---|
| 2001 | 176 | 2,213 | - | 18 | 36 | 2,443 | 51,424 | 4.75 |
| 2002 | 9 | 3,335 | 709 | - | 2,133 | 6,186 | 48,313 | 12.80 |
| 2003 | 234 | 659 | 629 | 174 | 4,041 | 5,737 | 49,560 | 11.58 |
| 2004 | 168 | 202 | 514 | 2,007 | 100 | 2,990 | 52,694 | 5.67 |
| 2005 | 424 | 1,971 | 9,299 | 975 | 649 | 13,318 | 54,761 | 24.32 |
| 2006 | 2,180 | 969 | 22,622 | 839 | 1,399 | 28,009 | 60,927 | 45.97 |
| 2007 | 2,553 | 4,653 | 11,753 | - | 738 | 19,697 | 94,417 | 20.86 |
| 2008 | 1,474 | 900 | 5,610 | 1,029 | 452 | 9,464 | 85.649 | 11.05 |
| 2009 | 887 | 784 | 12,470 | - | 80 | 14,221 | 72,863 | 19.52 |
| 2010* | 888 | 162 | | - | 7 | 1,058 | 38,058 | 2.78 |

* The figures for 2010 are up to Q3 only.

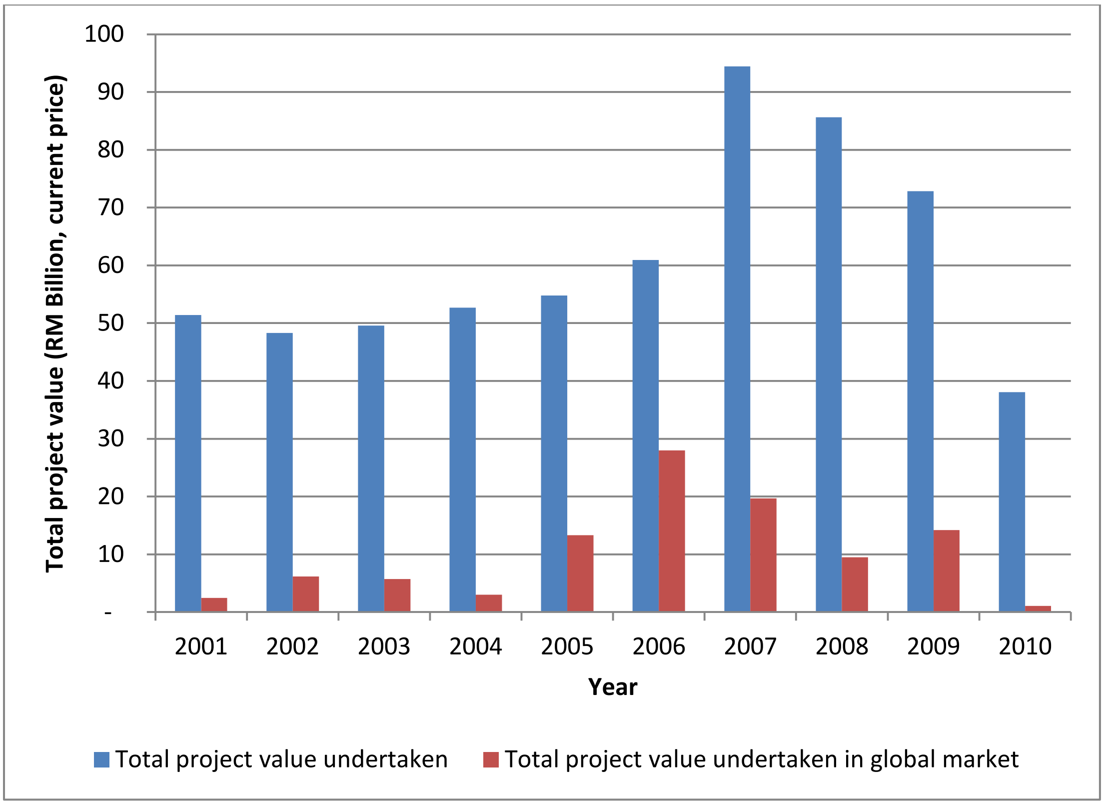


Figure 8.4. Project value undertaken by Malaysian contractors in domestic and global markets (2001-2010Q3)

The economic and social impact of the domestic and export construction markets are clearly different. In the local market all the activities undertaken in a project contribute to the economy whether they are considered as part of the construction output or as output of the service or manufacturing sectors. In the case with projects in foreign construction markets, the project proposal is unlikely will be viable if it entails the import of materials and labour from the home country, It is expected that the host Government will not favour such a proposal. In the national level, the returns from overseas project are not economically attractive compared to domestic projects. However, there are few ways to improve the attractiveness of projects in the foreign markets, for example widening and deepening the local contribution to the project by developing innovative materials, systems or technology that can improve the productivity of a project.  These will be attractive to project clients and Malaysian contractor will be able to provider justification and recommendation to the use of such material, systems or technology.

### 8.5.5 MANAGING PERFORMANCE

Most of the tactics on planning and control undertaken by the companies involved in this investigation are short-term measures. There is lack of long-term strategic consideration (Section 7.5.5). It caused cyclical challenges and resulting with companies traditionally chosen to rely on operating-performance tactics when times are hard and only during good times to undertake more fundamental performance-improvement initiatives. Companies used to improve operating performance by squeezing more profit out of existing capabilities. The attempt to boost their earnings by cutting discretionary spending so much that potentially productive long-term investments is compromised. Eliminating the least productive capacity, cutting corporate overhead, shedding marginal operations and businesses are necessary to eliminate waste built up during the boom of the late 1990s. But merely acting to secure increased returns from existing capabilities will yield diminishing returns and eventually become counterproductive.

## 8.6 WHAT ARE THE IMPACTS OF SUCH COURSE OF ACTION?

The published annual accounts of eight selected companies are reviewed in order to study the impacts of the course of action taken. The earliest year that the financial data could be obtained for all the eight companies is 2004, hence it is chosen as the benchmark year for the following analysis.

Figure 8.5 and Figure 8.6 depict relationship of the value added and unit staff cost of eight businesses in 2004 and 2010 respectively. The vertical axis shows the value added whereas the horizontal axis shows unit staff cost. The circles represent businesses, their size proportionate to share of construction contract in the total revenue of the company. The larger size of the bubble symbolizes construction-dominant business, the smaller size of the bubble symbolizes construction-related business. The top two quadrants are regarded as beneficial, and particularly the top left quadrant because it represents high value added and low unit staff cost. The bottom quadrants are regarded as less desirable. The bottom right quadrant is most undesirable because it represents low value added and high unit staff cost. There are four companies, G, U, E and T in the desirable top left quadrant in 2004. However, in 2010, all the four companies have moved away from of the top left quadrants. Company T has moved to bottom right quadrant which means value added of the company decreased; nevertheless, the unit labour cost has increased. The value added of Companies G, U and E decreased. Unit staff cost of Companies G and U remains competitive. Company E is in the undesirable high unit staff cost quadrant. There is an increase in the share of construction contract in total revenue for Companies G, U and T. The share of construction contract in total revenue declines in Company E.

Company Q moved from undesirable lower quadrants in 2004 to desirable upper quadrants in 2010. It shows an improvement in the profitability of the company. The unit staff cost improves marginally in 2010. Company C remains in the lower quadrant, nevertheless it shows visually that it has attained higher level of value added with almost unchanged unit staff cost.

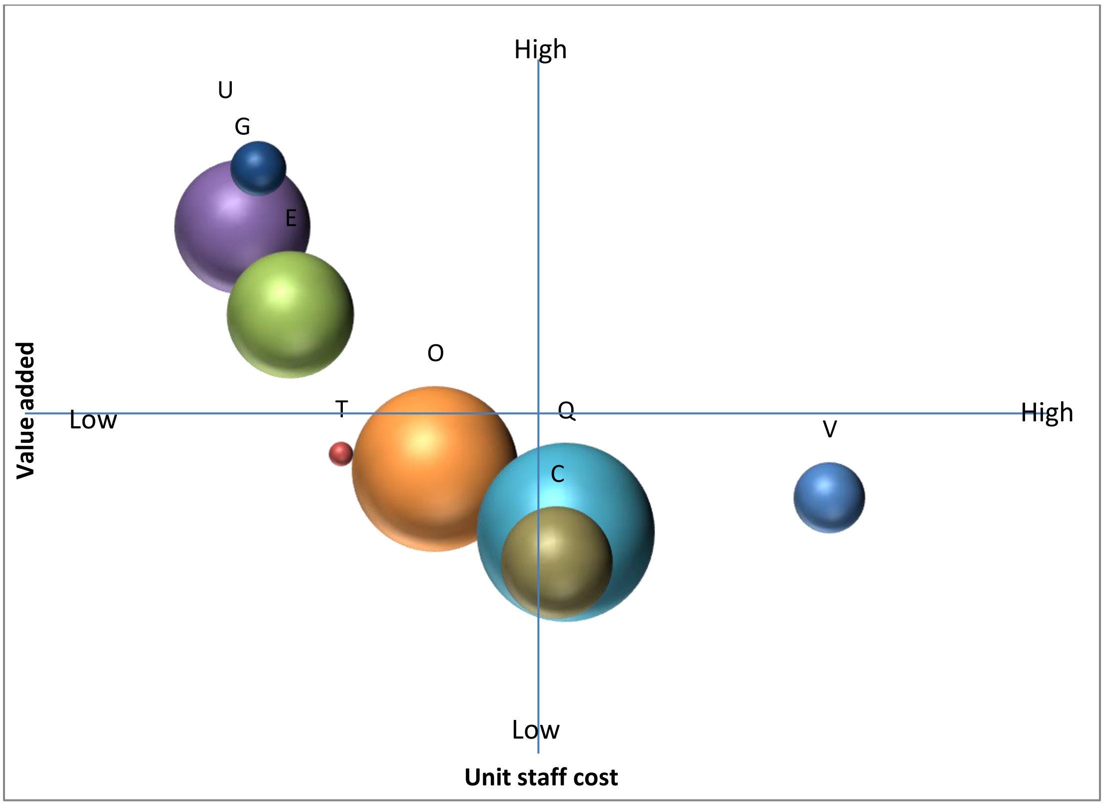


Figure 8.5 Value added and unit staff cost matrix (2004)

The result shows that construction-dominant Company Q has achieved improvement in the value added with no significant change in the unit staff cost in 2010 compare with 2004. It also indicates the possible cyclical nature of the value added in a construction-dominant business. However the value added of diversified business such as T is more stable but the unit staff cost is not as competitive as Company Q.

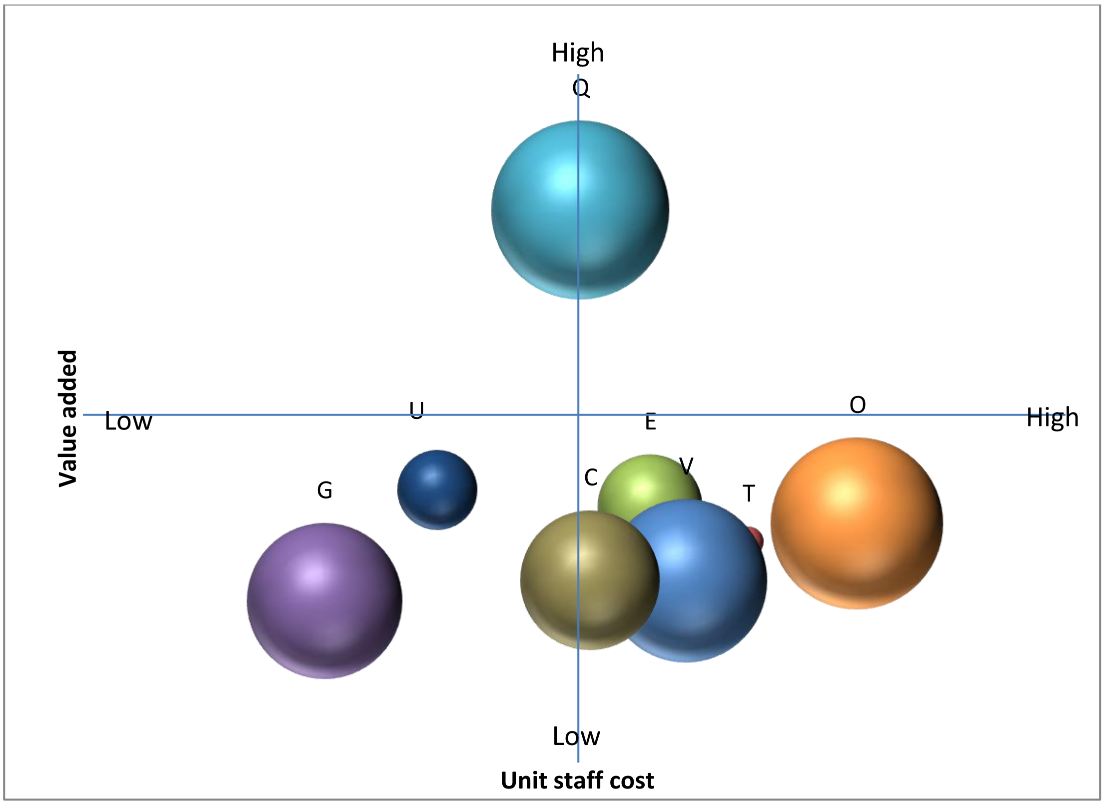


Figure 8.6. Value added and unit staff cost matrix (2010)

The bubble charts of Figure 8.7 and Figure 8.8 show the similar result of the previous section. However, the horizontal axis is replaced by the unit capital cost. Among the eight companies, there is only Company Q, able to migrate from the undesirable lower right quadrants in 2004 to the desirable upper left quadrants in 2010. It reflects improvement in the competitiveness of unit capital cost and increase in value-added of Company Q. On the other hand, Company U and E have moved from the desirable top left quadrant in 2004 to the most undesirable right lower quadrant in 2010. It indicates decline in the value added and increase in unit capital cost of Company U and E.

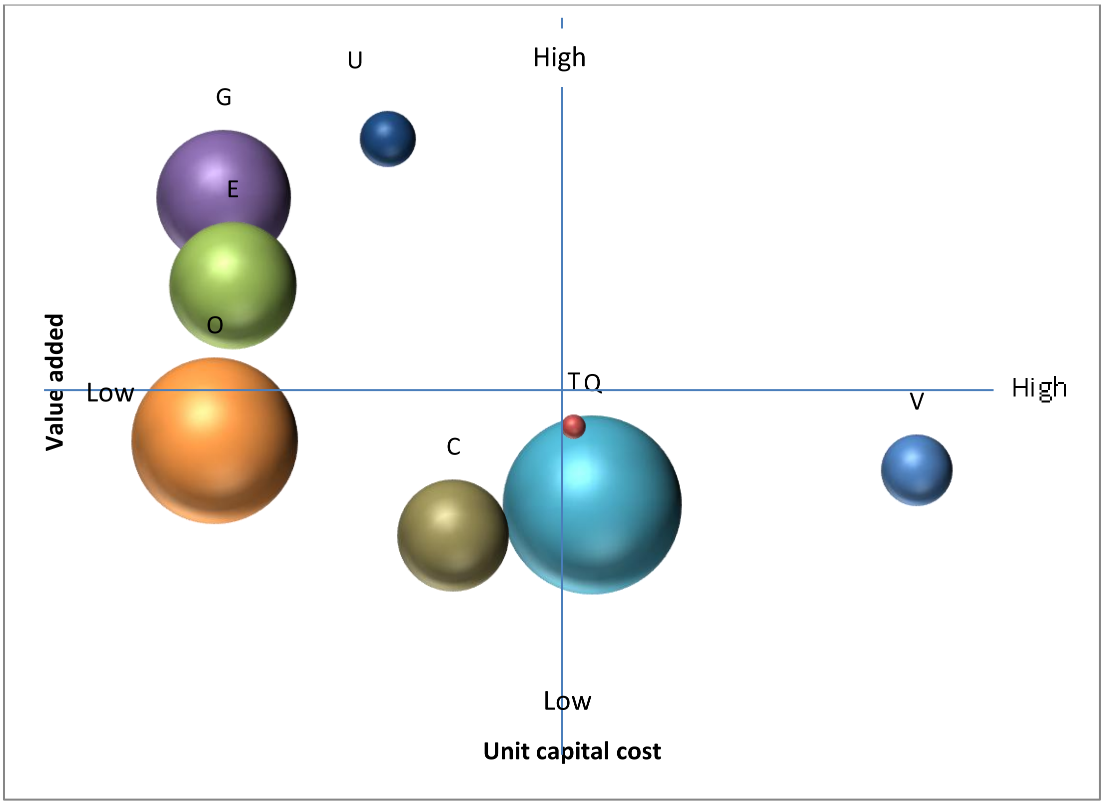


Figure 8.7. Value added and unit capital cost (2004)

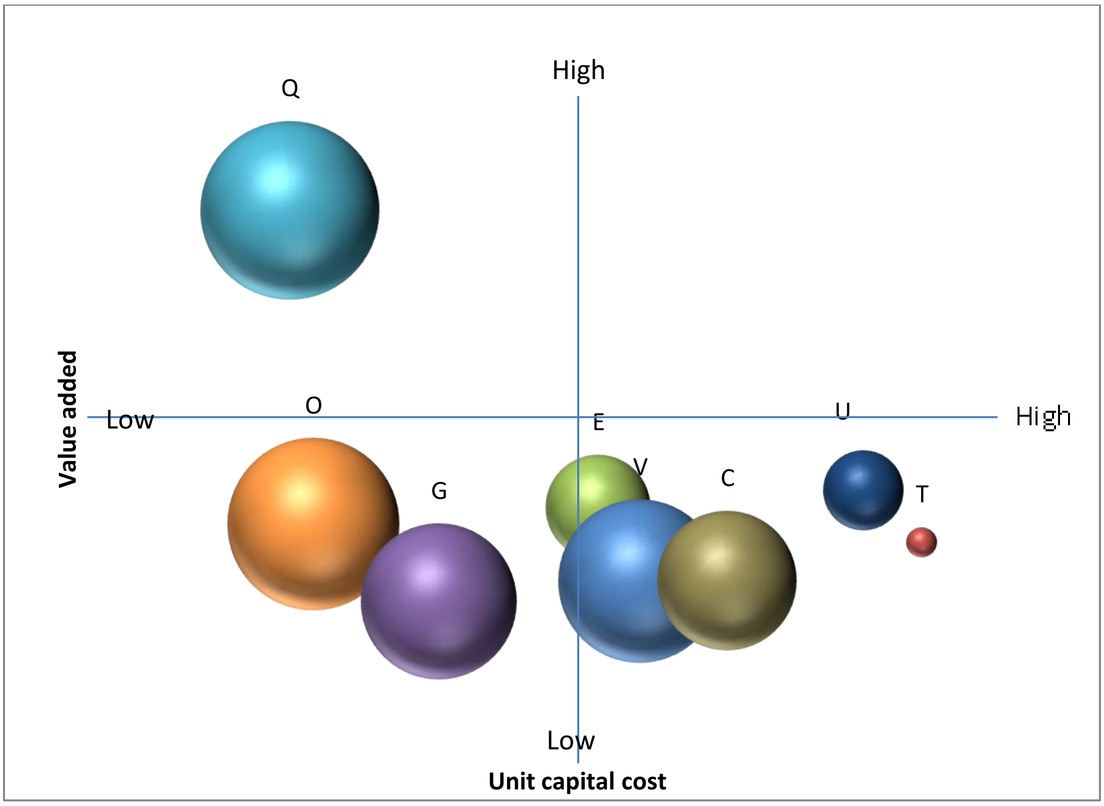


Figure 8.8. Value added and unit capital cost (2010)

In general, the result indicates that most of the companies have not performed better in 2010 with exception of Company Q. Company Q has a larger share of construction contract in the total turnover which has increased from 56% in 2004 to 76% in 2010; it operates in the domestic market and with the smallest turnover among the eight companies. Company T, which indeed is a company with largest turnover but smallest in the share of construction contract has relatively stable value added but the unit capital cost increased.

The results of the combination effect of unit capital cost and unit staff cost in value-added are shown in the Figure 8.9 and Figure 8.10. The unit capital cost and unit staff cost can be seem as proxies of capital productivity and labour productivity respectively. The vertical axis shows the unit capital cost. The horizontal axis shows the unit staff cost. The circles represent businesses, their size proportionate to value added of the business. The larger size of the bubble symbolizes higher value added, the smaller size of the bubble symbolizes lower value added. The most desirable quadrant will be the lower left quadrant which means the most competitive in both of the unit labour cost and unit capital cost.

Figure 8.9 shows that there are four Company U, O, G and E in the desirable lower left quadrant in 2004. However, Figure 8.10 shows that none of the four Company remains in the quadrant by 2010. The shrunk bubble of Company U and G have moved to the left upper quadrant which implied the Company decreased in value added with high unit capital cost and low unit staff cost. Company O shifts to the low unit capital cost/high unit staff cost quadrant in 2010. Company E relocates to the most undesirable high unit capital cost/high unit staff cost quadrant in 2010. The value added for all the three Company O, Q and C has increased. The value added of Company Q had significantly growth from 2004 to 2010 with marginally improve in the unit capital cost.

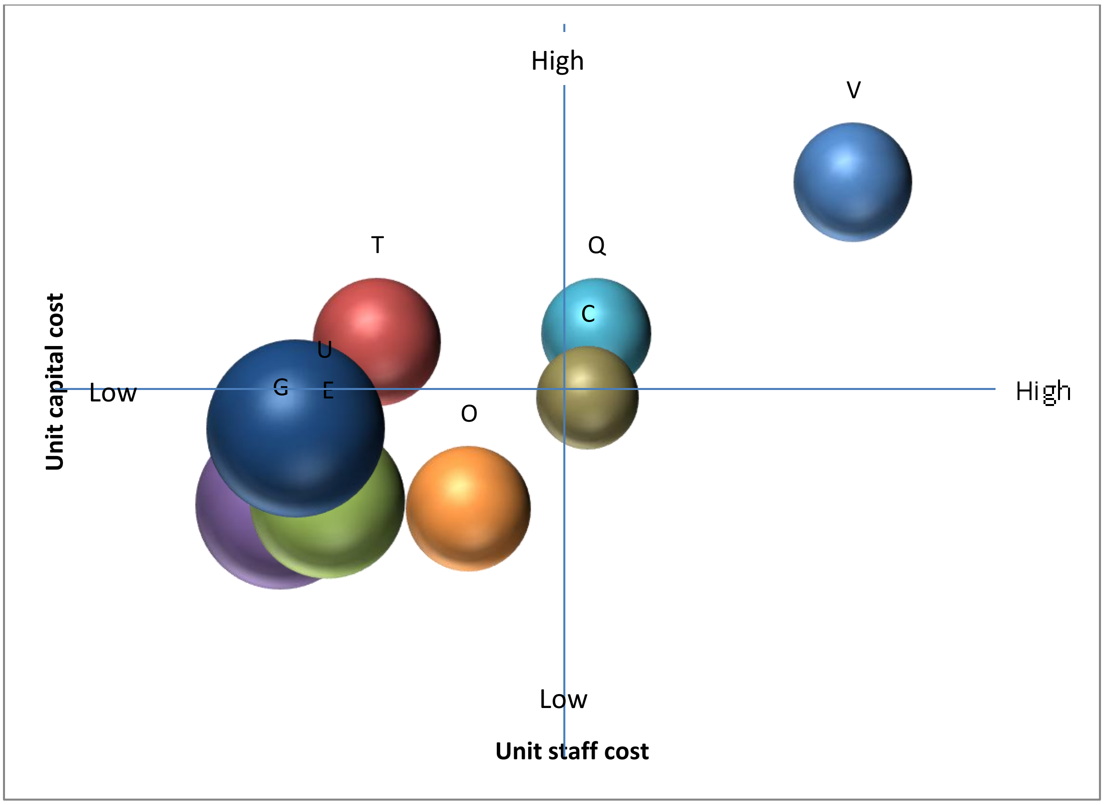


Figure 8.9 Unit capital cost and unit staff cost matrix (2004)

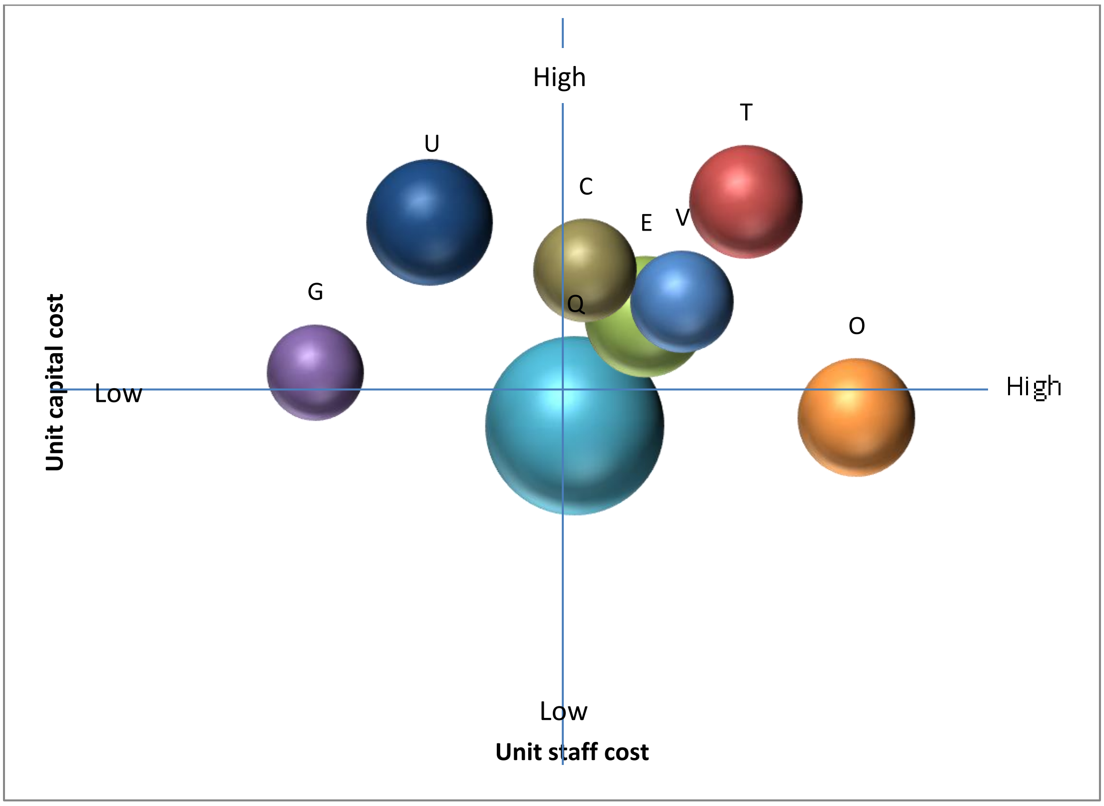


Figure 8.10. Unit capital cost and unit staff cost matrix (2010)

Company U, G and Q are relatively focused companies among the eight companies. Company U is property-dominant, however, Company G and Q is construction-dominant. Company G undertake domestic as well as overseas contracts, Company Q is only involve with local contract. In addition, Company G is one of the top five capitalisation construction counters listed in the Kuala Lumpur Stock Exchange (KLSE). Company U and Q are listed companies in KLSE too, but they belongs to the middle-sized groupings.

The result shows that productivity is not correlates with size of firm. A relatively smaller organisation such as Q appears to be more productive than the large organisation. Gruneberg and Ive (2000) attributed sources of higher productivity in the large firm sector to owning and investing in larger amounts of plant and equipment or other fixed capital per worker; larger firms achieve lower porosity of the working day, higher work intensity, or greater non-capital-embodied efficiency; larger firms pay higher wages per worker and implied bargains available with larger firm to persuade workers work above average intensity and in return will received above average wages. The capital intensity of large (0.22) and medium company (0.20) as shown in the Table 6-14 is consistent with Gruneberg's proposition. However, average unit labour cost in the middle-sized company (RM17,654) is higher than the large-sized company (RM11,522). It is inconsistent with Gruneberg's proposition. It can be explained by the fact that ownership and use of fixed capital is different. The existence of plant hires industries in Malaysia enables the middle-sized firms hire or lease fixed capital equipment. In addition, the free-enterprise spirit and no-nonsense approach to do business is inherent in smaller-sized firms. The skills of the employee employed are tending to be multi-skilled which are comparable with the advantages of lower porosity of the working day that large firm possess.

Diversified companies must wrestle with complicated management issues. They have to balance the interest of different businesses and attempt to meet dozens of skills. On the other hand, focused companies are relatively simple organizations: they can work on a handful of skills that will deliver on clear objectives (Jenna and Leslie 2000).

To stay focus, the company becomes specialize and generates enormous scale effects. Companies can take even greater advantage of specialization by ceding more control over decisions about the content of products to networks of participants (suppliers, customers, or both) who interact with one another. The orthodox neo-classical marginal cost model requires that each firm eventually encounters diminishing returns. The law of diminishing returns assumes at least one input remains the same as other variable inputs are then increased, eventually returns from successive unit of inputs decline. Grunberg have proposed management resource rather than fixed capital equipment as the fixed input in this respect because the existence of plant hire and building materials industries with adequate spare capacity to accommodate any growth in planned contractor output in the short run, and of a casual labour market with significant numbers of skilled workers under- or un-employed, so that the construction firm can readily increase its use of all other inputs besides management (Gruneberg and Ive 2000). This explained why relatively smaller and focused firm, such as Company Q is more productive than the others.

## 8.7 SUMMARY

The productivity of the construction sector is subjected to the economic environment and the ways the industry operate which include construction method, contract arrangement, payment chain, regulatory policies, competition and subcontracting.

The 1970-2009 time series on value added of construction sector shows that the 32-year building cycle of 1975-2006 is superimposed with three shorter construction business cycles in 1975-1987, 1987-1999 and 1999-2006. The frequency and size of changes in the level of activity in the construction sector affected the skill formation and capitalisation or investment of the sector.

The Construction Industry Surveys/Census over the period from 1996 to 2007 show that the average growth rate of total output per employee expanded and the added value per employee contracted because of the high cost of bought-in materials and services and inefficient usage of purchases. The construction labour productivity is peaked at 2004. The residential subsector shows with the best result in the various productivity indicators among the sub-sectors.

The unit labour cost is most competitive in the large-sized establishment. The average return of the individual employees is lowest in the large-sized establishment. Consequently, the added value per labour cost is highest. The large-sized establishment has the greatest capital deepening and most efficient in utilization of capital.

The fluctuations of construction demand have caused companies switched to a defensive strategy during the economic downturn; the focus is to ensure short-term survival than to make a profit for the long-term survival and growth. This leads the company to take drastic measures to curb expenses, downsizing, employ contract employment, diversification and venture overseas market. However, there is no empirical evidence supports downsizing as a necessary step in a process of reviving productivity.

In general, the result shows that productivity is not correlates with size of firm. A relatively smaller and focused firm such as Q appears more productive than the larger and diversified organisation. Diversified company such as T is able to generate more stable value-added per capital employed but neither the unit capital cost nor unit staff cost is more competitive than Company Q.

# Chapter 9: Conclusions

## 9.1 INTRODUCTION

In the preceding chapters the relationships between the economic fluctuations and construction sector have been investigated. The core research problem and research questions are defined in Chapter 1. An overview of Malaysian economic development and the construction sector is outlined in Chapter 2. The productivity issues and productivity measurement are highlighted in Chapter 3. The specific productivity issues of construction sector and its determinants are reviewed in Chapter 4. The research approach and its justification are outlined and explained in Chapter 5. The effects of the economic fluctuations on the construction productivity are analysed in Chapter 6. The usual course of actions taken by the industrial participants when encountered with macroeconomic fluctuations and the reasons underlying such course of action have been explored and the impacts of such course of action has been analysed in Chapter 7. Chapter 8 attempted to triangulate the official statistics analysed in Chapter 6 and results of interviews with the industrial practitioners examined in Chapter 7 in the context of literature reviewed.

In this chapter, the findings deduced and inferences drawn from the research questions formulated in Chapter 1 are summarised in Sections 9.2. The conclusion to the research problem is presented in Section 9.3. Sections 9.4 highlighted the implications of this investigation to the body of knowledge. The recommendations for policy and practice improvement are included in Section 9.5. The limitation of this research and recommendation for future research are covered in Section 9.7 and Section 9.6 respectively.

## 9.2 THE RESEARCH QUESTIONS

Five research questions have been formulated in Section 1.3. The next section will recapitulate findings of the first research question, i.e. how the productivity of construction sectors is affected by the macroeconomic fluctuations. The conclusions of other research questions which include: identify the key aspects and issues underlying productivity of construction sector, the usual course of action taken by the industrial participants when encountered with macroeconomic fluctuations, the reasons for the actions taken and its implications, are summarised in the subsequent sections.

### 9.2.1 HOW THE PRODUCTIVITY OF CONSTRUCTION SECTOR IS AFFECTED BY THE MACROECONOMIC FLUCTUATIONS?

The implications of cyclical factors on the construction productivity have been reviewed in Section 4.5.1. The empirical analysis on the statistical data of Malaysia between 1970 and 2009 in Section 6.2 has confirmed the procyclical nature of construction productivity. Section 6.3 and Section 8.2.1 show that the fluctuations of construction activities drive the changes of construction productivity in the 1975-2006 building cycle and the 1987-1999 construction business cycle. The influx of foreign workers is another factor caused the rise and fall in the construction productivity. However, the oscillation of construction productivity in 1999-2006 construction business cycle are driven by changes of GDP and population. The fluctuation in the construction has corresponding impacts on perceptions of job security, which in terms can impact on the surety of employment and career paths, and ultimately the desirability of the sector as a long term career (Section 4.5.1). Uncertainty over employment and career opportunities is likely to create disincentive for employees to further develop their skills. The downturn could results in a permanent loss of skills to the sector and it will create capacity constraints and continuing low productivity in the sector.

The survey/census data between 1996 and 2007 shows continuous decline of value added content of the construction sector, it reflects inefficiency production process and high cost of bought in materials and services of the sector (Section 6.4 and Section 8.2.2). The civil engineering construction is more productive than the residential and non residential construction in labour productivity. However, it had not utilising the capital as effective as the residential and non residential construction. The special trade construction had not efficiently used its fixed assets (Section 6.4.1 and Section 8.2.3). The labour cost is more competitive in the relatively larger size establishment. The large-sized establishment is more efficient in utilisation of capital than the smaller establishments and there is greater capital deepening in the larger establishment than the smaller one (Section 6.4.2).

### 9.2.2 WHAT ARE THE KEY ASPECTS AND ISSUES UNDERLYING PRODUCTIVITY OF CONSTRUCTION SECTOR?

In addition to the factors depict in Figure 4.2 of Section 4.8 from the literatures reviewed, Section 7.4.5 and Section 7.4.6 found that issues on payment chain and price control of construction materials such as cement and steel are the concerns of the industry respectively. Non-payment or delay of payment will destabilise the supply chains. It is not only delaying completion of the projects but also adversely affecting the productivity of the construction sector.

The price ceilings imposed to cement and steel bars under Price Control Acts had not succeeded in containing prices and ensuring demand and resulting effects were artificial shortage locally, activities of the grey market and artificially raised material prices. Local builders have been forced to purchase the control materials above the ceiling price. Similarly, the delayed in the progress of project have impinged the productivity of the construction sector.

Malaysia must urgently reform its regulatory framework to make it proportionate and up-to date with global developments and to reduce business costs and complexity, while enhancing the country's productivity and international competitiveness.

The 'context' and 'intervening conditions' of theoretical model show in Figure 9.1 extended the determinants of productivity found in the Figure 4.2 and integrated it with Figure 4.3 to provide a more comprehensive theoretical model that links economic fluctuation and the productivity of construction sector. It summarises the key aspects and issues underlying productivity of construction sector.

### 9.2.3 WHAT IS THE USUAL COURSE OF ACTION TAKEN BY THE INDUSTRIAL PARTICIPANTS WHEN THEY ARE ENCOUNTERED WITH MACROECONOMIC FLUCTUATIONS?

Companies switched to a defensive strategy during the economic downturn; the focus is on surviving the economic meltdown. This leads the company to take drastic measures to tightened financial control, consolidate operations, downsizing and defer expansion plans. The 'across the board cost cutting' cost reduction measures are usually not tied with the long term strategic objectives of the organization. There are firms re-organizing the departments and retrenched the redundant employees. The contract employments have increased after the economic recovered. Some companies adopted vertical integration strategy to have better control of the supply chain. There are companies diversifying into different geographical region or different client segments. The larger contractors penetrated into the overseas market. On the other hand, there are firms diversified to such an extent that contracting becomes only a small percentage of their overall business (Section 7.5 and Section 8.3).

#### 9.2.4 WHY SUCH COURSE OF ACTION IS CHOSEN?

The objectives of companies during the recession emphasized more to generate sufficient liquidity and cash flow in ensuring short-term survival than to make a profit in ensuring long-term survival and growth. In the recession with low and negative market growth, the ways to improve liquidity and cash flow are basically to reduce costs, reducing borrowing, improving financial control and limiting losses. The time horizon of objectives in many cases became weeks or months rather than years (Section 8.5). The measures taken such as downsizing and engaging contract employments are aimed to contain cost. Diversification of businesses and penetrate into the overseas market are aimed to mitigate the fluctuation of domestic construction demand.

#### 9.2.5 WHAT ARE THE IMPACTS OF SUCH COURSE OF ACTION?

The short-term oriented approaches adopted by companies have not overcome the issues faced by the sector. The shortage of skill labour and lack of capital investment remains as the issues unresolved of the construction sector. The continuous dependence on cheap labour has put Malaysia in the middle income trap (Section 7.7), as it would not encourage local construction sector to mechanise. In addition, the short-term cost-cutting measures are always not sticky.

The analysis based on the financial data of selected companies shows that productivity is not correlating with size of firm. A relatively smaller and focused firm appears to be more productive than the larger and diversified organisation. Diversified company generate more stable return, however, both of the unit capital cost and unit staff cost is not as competitive as a relatively focused company (Section 8.6).

## 9.3 THE RESEARCH PROBLEMS

The research problem formulated in Section 1.3 is *how the productivity of construction sector is being influenced in the course of economic fluctuations in Malaysia?*

The conclusions drawn from the quantitative and qualitative analysis and the determinants of productivity identified in Figure 4.2 and Figure 4.3 are recapitulated in Figure 9.1. The visual model is evolving from Strauss and Corbin's framework (1990). It consist of causal conditions of the core phenomenon, i.e. fluctuations in construction demand, the contextual and intervening conditions that enumerated the broad and specific situational factors respectively, the strategies taken in response to the core phenomenon, and the consequences i.e. outcomes from using the strategies.

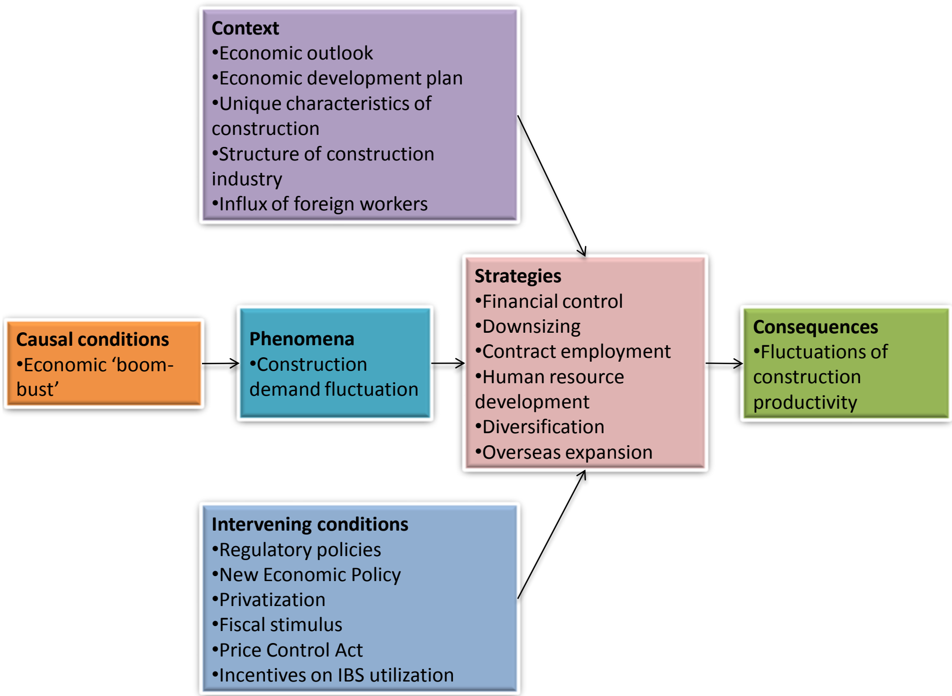


Figure 9.1. Theoretical model of economic development and construction productivity

Fluctuations in construction output are endemic in the industry. In part they are caused by the boom and slump of the economy as a whole and in part by the nature of the construction product. Malaysian construction sector has experienced four construction business cycles since independent. Fluctuation in construction demand resulting from the unavoidable business boom and slump. The major contextual conditions which have caused change in supply and demand of construction include the energy crisis of the 1970s, the 1980-1982 global recession, the 1997-1998 Asian financial crisis and the 2007-2008 Global Financial Crunch. These broad contextual conditions act together with the narrow intervening conditions such as the fiscal and monetary measures undertaken by the government influenced the companies within the construction sector to adopt specific strategies. The intervening conditions include New Economic Policy in the 1970s, Privatisation introduced in the 1980s, fiscal stimulus undertook by the government during the economic downturns, the various national development plan, legislation and regulations introduced to the industry. The range of specific strategies undertaken by individual firm to mitigate the under- and over capacity resulting from these external environments include tightening financial control, downsizing or restructure of the organization, diversification into the construction related or non-related businesses, expansion into the global market. The efficiencies and effectiveness of the strategies adopted by the individual firm will cause improvement or declines of the construction productivity. The results of this investigation show that the strategies adopted by the individual firm may return with beneficial result for those taking the appropriate actions not only to his own organization but to the construction sector as a whole. In addition, the policies and practice adopted by the governing agencies and the industrial participants needed to be reviewed in view of the stagnate performance of the productivity for the last forty years.

## 9.4 IMPLICATIONS OF RESEARCH

This research has made the following contributions to the body of knowledge in construction economics and identified a number of results which have implications on the strategies choice and decision making of the practising manager.

### 9.4.1 DELINEATE BUILDING CYCLE (1975-2006) AND CONSTRUCTION BUSINESS CYCLES (1975-1987, 1987-1999 AND 1999-2006)

Building cycles and construction business cycles are known to exist in Malaysia; however there is no empirical study to identify when such cycles exactly happened and the causes of such cycles arise. This research delineate the 32-year building cycle between 1975 and 2006 in Malaysia. The building cycle is superimposed with three shorter construction business cycles in 1975-1987, 1987-1999 and 1999-2006 (see Section 6.2). It can be construed that the length of building cycle is longer which will span around 30 years; the building cycle will be overlaid with shorter construction business cycles last around 10 years. Business cycles are known to exist but predicting when and how big the winning and losing years are beyond the most passionate analyst; some broad understanding of their behaviour and changes in them will give some indication of likely future event. The same could be said of construction market variability themselves; forecasts can be made, but the future is still fundamentally uncertain. Lagging indicators were used to track construction industry trends for 1970-2009 to attempt identification of the root causes of improvement or decline. Information related to root causes in turn can be used to develop industry-wide strategies for improvement of policies, procedures, practices and research. This research found that there is significant correlation between the construction productivity and the economic fluctuations within the period of building cycle (1975-2006) and strong correlations within the construction business cycles in 1987-1999 and 1999-2006. Overall, the fluctuations of construction activities drive the changes of construction productivity in the 1975-2006 building cycle. The influx of foreign workers and fluctuations of construction activities drive the changes of construction productivity of the construction business cycle in 1987-1999 and the variations of GDP and population caused the rises and falls of construction productivity construction of business cycle in 1999-2006.

#### 9.4.2 APPLY RBC THEORY TO THE CONSTRUCTION SECTOR

The second implication of this study is confirming that the real business cycle (RBC) theory which explains supply shocks or productivity shocks to the total economy applies to the construction sector too. Despite the fact that construction sector is only part of the of economy and it contributes only 2 to 5 per cent of the value added in GDP in Malaysia, the procyclical nature productivity advocates by the RBC economists has been found (Section 6.3). The construction sector produces all the facilities needed for the production of goods and services, starting from those needed by other producers and ending with those needed by the ultimate consumers; it serves as a hub of economic activity, and its labour-intensive nature makes it particularly attractive as a means of creating employment in developing countries. It is also a major consumer of products from the primary sector, such as quarrying and forestry, as well as a wide range of materials and components from the domestic manufacturing sector. Both in boom and bust, the construction sector remains an important part of an economy and it contributes to economic stabilization. As a result, construction also emerges to have a fairly direct relationship with national output – when construction is down, the economy will also be down; when it is up, so too will be the economy. Besides, Government plays an important role as a purchaser of construction, in the area of infrastructure especially at the earlier stages of development. The great flexibility of the construction industry activity in adjusting to different framework conditions makes it as a major contributor to the process of economic growth and development.

In addition, the procyclical nature of construction labour productivity is consistent with the RBC economists' assumption that the booms are periods of beneficial productivity shocks, which tend to raise labour productivity, whereas recessions are the result of adverse productivity shocks, which tend to reduce labour productivity. This is especially obvious between early 1980s and late 1990s. Furthermore, the stagnated construction labour productivity in 2000s is consistent with the RBC economists' prediction that without productivity shocks average labour productivity will not be procyclical. The expansion of construction employment that occurs during the booms between 1987 and 1997 resulted in subsequent contraction of productivity between 1997 and 2000. It is consistent with the principle of diminishing marginal productivity of labour when there is no productivity shock.

### 9.4.3 SYNCHRONIZE PUBLIC AGENCIES' CONSTRUCTION INVESTMENT

Through triangulate the data from the two phases of the study, it is confirmed that the sector being often beset with cycles of skill shortages or surpluses resulting from changes in the frequency and size of the level of activity in the construction. It is difficult in business planning of the sector. There is a need to better manage the 'boom-bust' nature of the construction business cycle in order for the skill development and retention, reduce waste and to provide greater confidence to industry participants in the skill investment. The construction business cycle can be better managed if there is greater understanding and confidence about the forward needs of major clients. Government agencies being the largest group of clients of the construction sector shall work closely to minimise, as far as possible, excessive troughs in the sector. A lesson learned from the past is a more coordinated approach among the public agencies in launching the sheer dimension of mega-projects in the

1990s would have enhanced the capability and capacity of the industry rather than resource constraints and cost pressures to the sector.

### 9.4.4 CONSTRUCTION PRODUCTIVITY DECLINE DESPITE ADOPTING OF IBS IN CONSTRUCTION

The value added content of the construction sector continues to decline between 1996 and 2007, except in 1998 and 2005 (Table 6-4). It reflects inefficiency production process and high cost of bought in materials and services of the sector (Section 6.4 and Section 8.2.3). Although much effort has been put in IBS, but there is lack of integration at the designs stage; most of the IBS component manufacturers are currently deployed only after the designs stage. There is a need for redesign and additional costs to be incurred resulting from lack of integration among relevant players at the design stage if IBS is adopted. This implies that there is poor knowledge in the industry on the new construction technology and improvement of construction process. IBS requires a different approach to construction, hence, familiarity with the IBS concept and its benefits is vital to its success (CIDB 2007). The problems on site are often not being the shortage of the right technology but the planning of its use.

### 9.4.5 SHORT-TERM DOWNSIZING DO NOT SUSTAIN PRODUCTIVITY ENHANCEMENT

The fluctuations of construction demand have prompted companies switched to a defensive strategy during the economic downturn; the focus is to ensure short-term survival than to make a profit for the long-term survival and growth. In fact, there is no empirical evidence supports the interpretation of the downsizing as a necessary step in a process of reviving productivity. The wave of downsizing has had any sustainable impact on productivity. Companies have reduced their workforces in the name of productivity, but with the loss of so many key supervisors and knowledge workers, they have inflicted on their future capabilities. The real damage of short-term survival is expected to surface later when accounting reports begin to show declining operating results. The cost reduction programme born in economic downturns quite often erodes with time, as growth revives. The surge of downsizing and other forms of cost cutting may have little or nothing to do with sustained enhancements in productivity. The quick headcount reductions often come at a price of missing the opportunities that crises can create to improve business systems or to strengthen parts of an organization with long-term consequences. Actually, downsizing involves a reinvention of the organization, it shall become part of an organization's continuous improvement scheme and assumes a long-term perspective instead of short-term cost cutting. On the other hand, organizations always need some level of 'surplus' managers who have the time and energy to improve current operating methods and search the environment to find new opportunities for growth and expansion. Downsized organizations lack the creative middle managers who perform this vital task, and this may hurt them in future.

#### 9.4.6 DIFFICULT TO DEVELOP CORE COMPETENCE WITH CONTRACT EMPLOYMENT

There are increasing trend on companies relying on contract employees to meet the need for more flexible staffing. Those employees employed on contract basic have been marginalising in terms of career paths, training and fringe benefits. The increased mobility of these employees means reduce the long-term advantages to a firm of investment in training. The expenditure on training is likely to be interpreted by the companies as to benefit the individual in enhancing their career prospect rather than the company which finances it. The resulting effect is difficulty in developing core competences in the company. It will deter gaining a competitive advantage because of motivation and coordination problems. Although in short-term it is possible to increase the productivity owing to the lesser porosity of works when contract employees are employed only when needed. However, in the long-term the undertrained workforce will cause the productivity to decline.

#### 9.4.7 FOCUSED COMPANIES ARE MORE PRODUCTIVE THAN THE DIVERSIFIED COMPANIES

Many companies have adopted diversification as the strategy in order to spread risk, overcoming workload fluctuation, controlling essential supplies and ensuring markets. Some of the contracting companies diversified into construction-related businesses and in some cases into business with little connection with construction. There are firms where contracting remains a significant part of their turnover. There are some firms viewed traditionally being construction firms are progressively diluting their investment in contracting divisions to such an extent that contracting is only a small percentage of their overall business. This study found that the company remains focused in construction business performed better in productivity than the diversified companies. The diversified companies must grapple with complicated management issues. They have to balance the interests of different businesses and attempt to master dozens of skills. However, focused companies are relatively simple organizations; they can sharpen a handful of skills that will deliver on clear objectives. Nevertheless, diversified companies demonstrated less productivity fluctuations.

Another strategy adopted to reduce the effects of domestic market conditions or the slowdown in the construction sector is to tap into overseas markets. The companies with extra capacity especially in the project management are expanding into the global construction market. However, the economic and social impact of the domestic and export construction markets are markedly different. Being a foreign contractor, one is normally exporting the project management services only. Penetrating into the global market is mainly utilising the overcapacity on the management resource expanded during the boom time only. The returns from overseas project are not economically attractive compared to domestic projects in the eyes of the nation.

### 9.4.8 RENT SEEKING IS HINDERING PRODUCTIVITY IMPROVEMENT

The sluggish performance of the construction productivity partly is due to the nature of the industry, partly is affected by the broader environment that within which the industry is operating. The Government-led economic model of the past highlighted in Section 2.2, was characterised by an interventionist approach which includes the establishment of strategic industries, centralisation of decision-making and wide ranging affirmative action policies. The preferential pricing and quotas have led to rent-seeking, market distortions or perversion of the objectives, propagated and embedded distributive and entitlement culture as concluded in the New Economic Model by National Economic Advisory Council (NEAC). The consequences of these policies and practices highlighted by the Report are market inefficiencies and misalignments and led to policy inflexibility. In addition, rent-seekers are engaged in unproductive activities and can add sizeably to the cost of doing business; they are not really creating wealth, or adding to economic growth. Indeed, they are closely associated with the growth of bribery and corruption in the economy.

## 9.5 POLICY AND PRACTICE RECOMMENDATIONS

In order for unleashing the productivity growth of the construction sector, the measures for improvement not only shall be based on maintaining macroeconomic stability to ensure certainty for the long-term investment decisions but also the microeconomic reforms to tackle market failures around the productivity drivers.

### 9.5.1 SUPPORTING SMES

The construction industry has exclusive characteristics related to its structure, production process, physical characteristics and composition. These characteristics explained methods of production, organisation, price determination, payment methods, financial decision and control, and an industrial structure unlike what usually met in other sectors. Some degree of fragmentation is required to allow the industry to remain flexible as it is prone to the fluctuations of the business cycle. In view of this, the positive role SMEs play in the construction sector has to be recognised. SMEs are playing an important role in the construction sector and have the potential to be a powerful engine of growth and innovation. The potential of SMEs has to be unlocked, redundancy and inefficiency has to be reduced, the impact of policies towards SMEs has to be tracked and assessed e.g. reducing the disproportionate regulatory requirement costs borne by SMEs, employees that subcontracted from the large contractors could be given hand-on training by the large companies to upgrade their knowledge and skills to enable them to meet the specific requirements and standards. Similar training programme to build capacity and capabilities of SMEs could be delivered by government too.

### 9.5.2 ENCOURAGING COMPETITION IN THE SECTOR

Malaysia was ranked 16th overall in terms of competitiveness among 59 economies compared with 10th place last year in the World Competitiveness Yearbook 2011 Report (WCY2011) released by the Switzerland-based Institute for Management Development (IMD) recently. Greater competition needs to be promoted in the domestic market to attract and sustain a high level of private investment and strengthen the business environment to become more transparent and vibrant, whereby businesses compete on quality, value and innovation. Undistorted competition is a central driver for productivity and growth in the economy, and is critical to encourage efficiency, innovation and flexibility in the economy.

Intense competition could drive greater integration of the supply chain in the industry and produce improvements in construction process. The Competition Commission Act 2010 which was passed by Parliament in May 2010 and gazetted on 10 June 2010 has come into force on 1 January 2011 while the Competition Act 2010 which was passed by Parliament and gazetted together with The Competition Commission Act 2010 will come into force on 1 January 2012. The Competition Law will be introduced to govern all firms including government-linked companies (GLCs) against anti-competitive practices such as price fixing or discrimination, excessive or predatory pricing, limiting or controlling of production and market access to maximise profit, imposing unfair trading items and bid rigging. These laws are acknowledged to be on par with comparable laws in other jurisdictions; however, the primary challenge in implementing the Competition Act lies in striking the right balance between achieving the country’s social objectives and allowing healthy competition to flourish in the domestic market. This requires addressing subsidy and social protection policies as well as GLC operations. The GLCs are said to make up 40% of the domestic economic activity, they may benefits in term of contract and so forth by being government-linked (Arulampalam 2011). The Government can signal its strong commitment to competition by not interferes in any decisions made by the Commission and ensures the composition of Commission members represent not only the interests of the Government, but those of the private sector and consumers. Government should set an example by ensuring competition in Government procurement and provision of goods and services to promote growth of the industry. Selective import substitution policies and wealth redistribution policies which conflict with the competition policy should be reassessed with a view to remove or address market distortions. Besides, further liberalisation may be needed in keeping with the ASEAN Framework Agreement on Services (AFAS), World Trade Organisation (WTO) and free trade arrangements (FTAs) timeline and equity parameters.

### 9.5.3 ENHANCING REGULATORY ENVIRONMENT

Malaysia's Business efficiency was ranked 14th compared with fourth last year while government efficiency was at 17th position from ninth position according to the World Competitiveness Yearbook 2011 Report (WCY2011). The business efficiency gap in 2011 is -3 according to the Report. The government could significantly reduce complexity of the regulations by initiating a comprehensive regulatory reform agenda to make it up-to-date with global development; many international jurisdictions are aggressively adjusting their regulatory environment and streamlining processes for working with business to attract new investment. For example, to standardise and integrate administrative practices and procedures of regulatory and licensing requirements at various levels of government which are overlapping and increases compliances costs. It must be clear which regulator will take the lead in unavoidable cases of regulatory jurisdiction overlap so that businesses do not have to deal with multiple regulators. The present contractor's registration scheme of CIDB and PKK can be harmonised and standardised. The licensing conditions imposed by sector regulators, will also need to be streamlined to ensure that they do not prohibit entry of new market players. It will also ensure a leaner civil service to trim Government expenditure in order reduce the country's budget deficit pressure which stands at 5.4% of GDP in 2011.

### 9.5.4 REVISING FOREIGN LABOUR POLICY

The abundance of cheap low-skilled labour had delayed investments in mechanisation and innovation. The nation's prevailing dependence on low-skilled foreign workers cannot be done away with overnight. More incentives should be introduced to spur the construction sector to become less labour-intensive and to upgrade their workforce or hire skilled foreign labour. At the moment the foreign workers in the construction sector are charged with annual levy of RM1,200. It is suggested that a multi-tiered levy system can be used to encourage the employers move towards a high-skilled workforce. For example, the monthly levy for skilled worker in Singapore is S$160 which is much lower than the levy of unskilled worker at S$470 per month. Other practice in Singapore include quota for hiring foreign workers; the dependency ratio of construction sector is one local full-time worker to 7 foreign workers. In addition, the levy could be proportionated to the ratio of foreign to total workers and the rate to increase over time.

### 9.5.5 RETAINING AND UPSKILLING THE WORKFORCE

There is need to ensure that enough capacity and skills are retained in the sector as well as need to upgrade and re-skill the existing workforce. Delivery of training directly by companies operating in the industry will ensure that the training content best matches the needs of the industry. The industry shall be encourage to establish accredited in-house training programmes and to extend these programmes beyond their employees to produce qualified skilled workers who are employable across the industry. Actions to expand group training and employment schemes for apprentices. Ensuring on-going training is available because of increasing complexity and change in the industry – new construction techniques and materials, changes in design and regulatory environment. The training programme shall support the career pathways that transition people into management and leadership roles. The training programmes shall be made available to SMEs through trade associations such as Master Builders Association and government agencies such as CIDB.

### 9.5.6 PROMOTING INTEROPERABLE TECHNOLOGY APPLICATIONS

Encouraging the use of interoperable information technologies for Building Information Modeling (BIM) that supports sustainable design, clash detection, construction planning, and fabrication will enable better prediction of the outcome of a building before it is built. On top of that, it fosters collaborative partnerships among owners, designers, contractors and other involving parties in the early project phase. BIM is able to automatically update the relevant changes and restore documentation, generating coordinated processes and reliable records as the design evolves along the way. A change in anywhere shall be a change in everywhere. Interoperable information technologies supports a common set of real-time, accurate data accessible by all involved parties to improve communication, expedite better informed decisions, reducing errors and omissions caused by conflicting information, gain insight into manufacturing viability and early construction material takeoffs. The outcomes of these capabilities are integration of what are now fragmented processes, reducing design and engineering conflicts and fix the problems in the ‘virtual’ phase before significant resources have been invested in physical structures and the subsequent need to rework.

### 9.5.7 IMPROVING JOB SITE EFFICIENCY

There is still considerable room for companies to employ traditional best practice operational improvement. The principles of lean operations are not applied as broadly as they should. The examples of possible lean practices to improve job site efficiency are lean inventory management, pooled purchasing to reduce time spent on purchasing processes, data-driven project management, electronic record keeping, scientifically planning which include internet-based scheduling and optimal resources levellings.

Greater use of automated equipment at the job sites offers an opportunity to work more efficiently with fewer people. However, the segmentation of planning, design and procurement and construction processes is hindering the widespread use of automated equipment. The productivity improvement could be realized through collaboration, up-front planning that involved different players in the whole supply-chain to effective use of automated equipment at the early stage of development. Industry should improve project and job-site management through the effective use of technologies. The technologies will be able improve job-site efficiency and field execution, expedite problem resolution and enable projects to continue progress significantly when they are organized and used correctly. This requires well-trained, educated workers who can work collaboratively and communicate effectively and who possess technical knowledge.

In addition, there is an absence of a mechanism which allows for and encourages knowledge sharing among its diverse stakeholders. It is necessary to set up a user friendly portal systematically collecting and disseminating timely, accurate, comprehensive, and relevant information for method or practice to meet the requirements of all the stakeholders in the industry. The SMEs rather than operating with suboptimal support can move towards broader access to advanced computing capabilities by subscribing to shared computer applications that can form data accessible to the entire organisation and allow enterprise-wide optimisation of the technology infrastructure.

### 9.5.8 TRACKING THE PRODUCTIVITY OF THE CONSTRUCTION INDUSTRY

Performance measures are enablers of innovation and of corrective action. It will help the companies to understand how processes or practices led to success or failure, improvements or inefficiencies, and how to use that knowledge to improve products, processes, and the outcomes of active projects. Accurate industry data also provides insights into the industry growth for investors, economic development groups and other construction industry stakeholders. There is inadequate information available for detail analysis. At the moment, the industry-level measure can be computed from the present statistics collected by the DOS; however, detail statistics are not available annually. In addition, there is lack of project-level and task-level measures. The productivity is better to be expressed in physical units (in quantities) instead of monetary units, however due to the unavailability of data, it make it almost impossible to have industrial-wide study on productivity based on physical units. The published official data by CIDB and Department of Statistic contain only monetary value of output. In fact, the present FORM CIDB L1/96 which required contractor to submit before the commencement of work already included information on physical size of the work. However these data have not been analysed and published. Indeed this information can be processed as useful industrial benchmarks for project-level measures.

In addition, the numbers of staff employed is not mandatory reported in the company's annual report at the moment. The resulting outcome is the lack of meaningful comparison of productivity between companies. If it has been included in the report it will enable value produced per head count be extracted to facilitate production of more informative reports.

### 9.5.9 DEVELOP INNOVATIVE MATERIALS, SYSTEM OR TECHNOLOGY FOR PENETRATION TO GLOBAL MARKET

Many of the Malaysian contractors have commenced to venture abroad during the economic downturn of the country. Penetrating into the global market is mainly utilising the overcapacity on the management resource expanded during the boom time. The returns from overseas project are not economically attractive compared to domestic projects in the eyes of the nation. On top of that, there are threats such as financial risks, high credibility stakes, significantly different cultural background, fewer shared cultural and commercial assumptions. At times, there may be contractual requirements to make a given percentage of the costs sourced locally. The differences in local working patterns may affect productivity varies significantly. Nevertheless the attractiveness can be improved if Malaysian contractors can widen and deepen the local contribution to the project by developing innovative materials, systems or technology. This will not only improve the productivity of a project but also enable justification and recommendation to the use of such material, systems or technology to the project.

## 9.6 LIMITATION

There is lack of data to study the productivity at the macro-level. The data available from the Economic Reports are limited to the value-added and number of employment of the industry at the national level for the period between 1970 and 2009. Although there are few additional variables available from the industrial survey and census for meso-level of studies, such as capital employed, wages paid and sub-sectorial input and output data, however these data are limited to the period of 1996-2007 and all the data for the years within the periods are available. Similarly, the time spans of company data available for this study are varies. Some of the published financial data spanning up to ten years, however, the data for most of the countries are only available from 2004 onwards. Consequently, meaningful comparison can only be made between 2004 and 2009. Figure 9.2 summarises the sources of data included in this study.

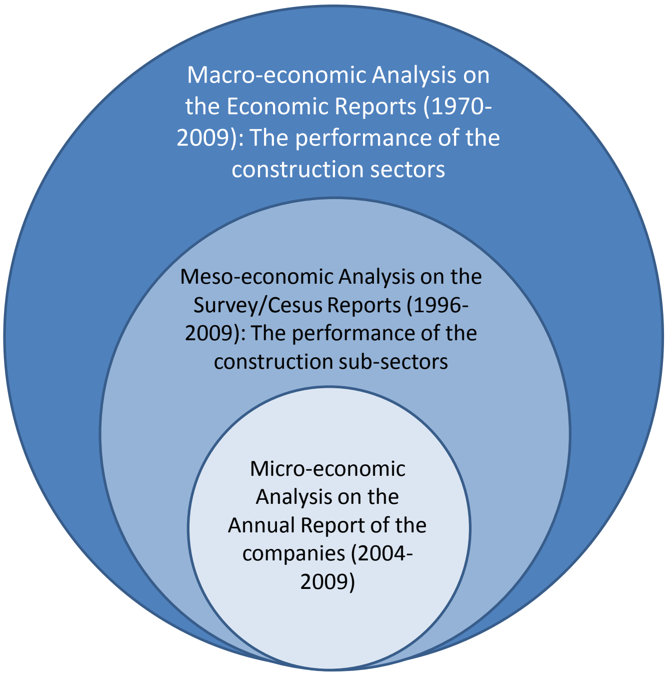


Figure 9.2. The data included in this study

In addition, it is well known fact that profitability and productivity are two different things; productivity is better to be expressed in physical units (in quantities) instead of monetary units. However, for the inter-organizational comparison and inter-sub-sectorial comparison, to express the productivity in monetary units will be the only choice. In order to mitigate the effects of profitability focused, the data on 'value-added' had been adopted in this study whenever possible instead of 'return on capital employed'.

This study attempted to extract all possible information from the available data so that a reasonable comparison could be made in order to draw rationale conclusion. However, the economy that we have today is different to that of the 1970s in terms of inter-relationships, magnitude, control, sophistication of the financial sector and the degree of governmental involvement in economic policy. Much uncertainty surrounds the construction sector and the future of the industry depends on hard-to-predict factors such as the fluctuations of economic, the actions of the governments, and the volatility of global market.

## 9.7 RECOMMENDATION FOR FUTURE WORKS

The intent of this concurrent mixed methods study is to uncover how the productivity of construction sector is influenced in the course of economic fluctuations in Malaysia. The statistical data of government reports had been used to measure the relationship between economic growth and construction labour productivity. At the same time, the key aspects and issues underlying productivity of the construction sector and the usual course of action taken when encountered with macroeconomic fluctuations were explored using the qualitative interviews with experienced industrial practitioners in Peninsular Malaysia. The intent in qualitative research is not to generalize the information but to elucidate the particular, the specific (Creswell 2007). In order to address the 'generalizability' issues of this research and for further research by the construction management analysts, the future work arising from this study may include:

1. quantitative evaluation evolving from the theoretical model developed in Figure 9.1;
2. detailed analysis of the implications of individual strategies adopted when confronting with macroeconomic changes;
3. evaluate the impacts of the domestic construction industry when Malaysian contractors penetrating global markets; and
4. develop a forecasting model to predict the construction demand.

So as to understand the implications of contextual factors of the industry operation, such as economical and political factors, the regulatory policies and the strategic undertaken by the individual organization, there is a need to have more micro-level of data for further studies.

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# Appendices

## APPENDIX 1: INTERVIEW GUIDE ON 'ECONOMIC DEVELOPMENT AND PRODUCTIVITY OF MALAYSIAN CONSTRUCTION SCETOR'

**SECTION A:**

**1. Outlook of the Malaysian Economy and the Construction Industry**

(a) What do you think would be the outlook for the Malaysian economy over the next five years?

(b) How will it affect the construction industry?

**2. 2008-2009 Global Financial Crisis**

(a) Does the recent financial crisis affect your company?

(b) What are the courses of actions you have taken to counter/mitigate its effects?

(c) Could you explain your reasons of doing so?

(d) What are their consequences/results?

**3. 1997-1998 Asian Economic Crisis**

(a) Does the 1997-1998 Asian Economic Crisis affect your company?

(b) What are the courses of actions you have taken to counter/mitigate its effects?

(c) Could you explain your reasons of doing so?

(d) What are their consequences/results?

**4. 1984-1986 Recessions**

(a) Does the 1984-1986 recessions affect your company?

(b) What are the courses of actions you have taken to counter/mitigate its effects?

(c) Could you explain your reasons of doing so?

(d) What are their consequences/results?

**5. Productivity of construction industry**

(a) In your opinion, do the changes of the economic situations affect the productivity of the industry?

(b) Besides that, do you have any suggestion for further improvement of the productivity of the construction industry?

**6. Managing Productivity**

(a) Does your company have any special programmes/practices in managing productivity?

**SECTION B: ABOUT YOURSELF**

| | | |
|---|---|---|
| 1. | Name: | |
| 2. | Profession: | |
| 3. | Job Title: | |
| 4. | Years with current job title: | |
| 5. | Years with the company: | |
| 6. | Name of company: | |
| 7. | Years of establishment: | |
| 8. | Number of employees: | |
| 9. | Annual turnover: | |
| 10. | Nature of business: | |

# APPENDIX 2: PARTICIPANT INFORMATION AND CONSENT FORM

## QUT PARTICIPANT INFORMATION for QUT RESEARCH PROJECT

### The Productivity of Construction Sector and Malaysian Economic Development


| Research Team Contacts | |
|---|---|
| Name & Position: Chia Fah Choy (Chief Investigator) | Name & Position: Prof Martin Skitmore (Principal Supervisor) |
| Phone: (6016) 908 1639 | Phone: (617) 31381059 |
| Email: chiafc@utar.edu.my ; fc,chia@student.qut.edu.au | Email: rm.skitmore@qut.edu.au |


**Description**

This project is being undertaken as part of PhD project for Chia Fah Choy. This project is funded by QIDS.

The purpose of this project is to explore the relationship of productivity of construction sector and Malaysian economic development.

The research team requests your assistance because of your input will be important to provide us with an understanding of the industry and key strategies for future development of the construction sector.

**Participation**

Your participation in this project is voluntary. If you do agree to participate, you can withdraw from participation at any time during the project without comment or penalty. Your decision to participate will in no way impact upon your current or future relationship with QUT.

Your participation will involve an interview for approximately 30-60 minutes at your office.

**Expected benefits**

It is expected that this project will not benefit you. However, it may benefit the construction sector on the best practices of managing productivity.

**Risks**

There are no risks beyond normal day-to-day living associated with your participation in this project.

**Confidentiality**

All comments and responses are anonymous and will be treated confidentially. The names of individual persons are not required in any of the responses.

The transcription of the interview content will be e-mailed to you for verification prior to final inclusion. The audio recordings (if there is) will be destroyed after the contents have been transcribed.

**Consent to Participate**

We would like to ask you to sign a written consent form (enclosed) to confirm your agreement to participate.

**Questions / further information about the project**

Please contact the researcher team members named above to have any questions answered or if you require further information about the project.

**Concerns / complaints regarding the conduct of the project**

QUT is committed to researcher integrity and the ethical conduct of research projects. However, if you do have any concerns or complaints about the ethical conduct of the project you may contact the QUT Research Ethics Officer on +61 7 3138 2091 or ethicscontact@qut.edu.au. The Research Ethics Officer is not connected with the research project and can facilitate a resolution to your concern in an impartial manner.

# CONSENT FORM for QUT RESEARCH PROJECT

## The Productivity of Construction Sector and Malaysian Economic Development

**Statement of consent**

By signing below, you are indicating that you:

- have read and understood the information document regarding this project
- have had any questions answered to your satisfaction
- understand that if you have any additional questions you can contact the research team
- understand that you are free to withdraw at any time, without comment or penalty
- understand that you can contact the Research Ethics Officer on +61 7 3138 2091 or ethicscontact@qut.edu.au if you have concerns about the ethical conduct of the project
- agree to participate in the project
- understand that the project will include audio and/or video recording

**Name** ______________________________

**Signature** ______________________________

**Date** ________ / ________ / ________

# APPENDIX 3: DEFINITIONS OF SMALL AND MEDIUM ENTERPRISES (SME)

The basic of classification of firm size differs from one country to another. Their definitions are also different. Before the formation of National Small and Medium Enterprise Development Council (NSDC), there was no standard definition of Small and Medium Enterprises (SMEs) in Malaysia. Different agencies defined SMEs based on their own criteria, usually benchmarking against annual sales turnover, number of full time employees and/or shareholders funds. For example, the Small and Medium Industries Development Corporation (SMIDEC) defined SMEs as enterprises with annual sales turnover not exceeding RM25 million and full-time employees not exceeding 150. For Central Bank of Malaysia, SMEs were defined as enterprises with shareholders funds of less than RM10 million. The absence of a standard definition prevented the collection and compilation of SME data for assessment of development needs and business performance across the economic sector. The NSDC's definition still has not included the construction industry in its definition. In views of subcontracting, especially labour only subcontracting is the common practice in Malaysian construction industry and the nature of activities of the sector are mainly involving site assembly work, therefore the definition of services sector is adopted for the present study (Table 9-1).

Table 9-1
SME definition in terms of full-time employees

| Size | Primary agriculture | Manufacturing (including agro-based) & Manufacturing related services | Services Sectors (including ICT) |
|---|---|---|---|
| Micro | Less than 5 employees | Less than 5 employees | Less than 5 employees |
| Small | Between 5 & 19 employees | Between 5 & 50 employees | Between 5 & 19 employees |
| Medium | Between 20 & 50 employees | Between 51 & 150 employees | Between 20 & 50 employees |
| SME | Not exceeding 50 employees | Not exceeding 150 employees | Not exceeding 50 employees |

Source: The Central Bank of Malaysia, Small and Medium Enterprises (SME) Annual Report 2007

Table 9-2
SME definition in terms of annual sales turnover

| Size | Primary agriculture | Manufacturing (including agro-based) & Manufacturing related services | Services Sectors (including ICT) |
|---|---|---|---|
| Micro | Less than RM200,000 | Less than RM250,000 | Less than RM200,000 |
| Small | Between RM200,000 and less than 1 million | Between RM250,000 and less than 10 million | Between RM200,000 and less than 1 million |
| Medium | Between RM 1 million and RM 5 million | Between RM 10 million and RM 25 million | Between RM 1 million and RM 5 million |

Source: The Central Bank of Malaysia, Small and Medium Enterprises (SME) Annual Report 2007

# APPENDIX 4: PRODUCTIVITY INDICATORS OF CONSTRUCTION INDUSTRY BY SUB-SECTORS, 2007

| Group and industry description | Added value per employee | Total output per employee | Capital productivity | Capital intensity | Added value per labour cost | Labour cost per employee | Unit labour cost | Added value content |
|---|---|---|---|---|---|---|---|---|
| **Residential buildings** | **29338** | **100211** | **2.68** | **10949** | **1.34** | **21824** | **0.2178** | **29.2765** |
| **Non-residential buildings** | **27925** | **94115** | **3.37** | **8295** | **1.35** | **20624** | **0.2191** | **29.6708** |
| **Civil Engineering** | **32265** | **106236** | **1.73** | **18690** | **1.45** | **22180** | **0.2088** | **30.3712** |
| Demolition or wrecking of buildings and other structures and its clearing work | 36976 | 103349 | 5.03 | 7355 | 1.39 | 26513 | 0.2565 | 35.7780 |
| Land preparation work | 38703 | 109104 | 1.86 | 20771 | 1.71 | 22615 | 0.2073 | 35.4735 |
| Preparation of mineral properties and sites except oil and gas sites | 38591 | 90702 | 1.24 | 31197 | 2.04 | 18914 | 0.2085 | 42.5469 |
| Land reclamation work | 83651 | 278723 | 1.46 | 57337 | 2.74 | 30488 | 0.1094 | 30.0121 |
| Other site preparations | 42657 | 161032 | 0.62 | 68625 | 1.51 | 28281 | 0.1756 | 26.4900 |
| Construction of roads, bridges, tunnels, viaducts, highways, elevated highways, railways, airfields, harbours, etc | 28423 | 96045 | 2.11 | 13447 | 1.38 | 20633 | 0.2148 | 29.5939 |
| Construction of dams, irrigation system, drainage and sewage system, pipe lines, etc | 36892 | 116385 | 1.06 | 34716 | 1.57 | 23435 | 0.2014 | 31.6985 |
| Communication and power lines | 30853 | 97782 | 1.96 | 15741 | 1.43 | 21537 | 0.2203 | 31.5532 |
| Sport facilities including stadium, golf courses, etc | 29924 | 87205 | 3.79 | 7896 | 1.53 | 19614 | 0.2249 | 34.3146 |
| Other civil engineering | 33633 | 113629 | 2.14 | 15699 | 1.44 | 23400 | 0.2059 | 29.5988 |
| **Special trade work** | **31752** | **107206** | **1.79** | **17690** | **1.41** | **22465** | **0.2095** | **29.6181** |
| Plumbing, sewerage and sanitary installation work | 28979 | 81642 | 0.40 | 73271 | 1.50 | 19301 | 0.2364 | 35.4950 |
| Electrical wiring and fitting work | 30903 | 105030 | 2.75 | 11222 | 1.44 | 21400 | 0.2038 | 29.4229 |
| Fencing and railing construction work | 31431 | 115780 | 2.13 | 14763 | 1.28 | 24500 | 0.2116 | 27.1474 |
| Lift and escalator construction | 38086 | 112346 | 16.32 | 2333 | 1.50 | 25425 | 0.2263 | 33.9002 |
| Gas fitting construction | 31643 | 106020 | 2.94 | 10750 | 1.42 | 22319 | 0.2105 | 29.8461 |

## APPENDIX 4: PRODUCTIVITY INDICATORS OF CONSTRUCTION INDUSTRY BY SUB-SECTORS, 2007 (Contd.)

| Group and industry description | Added value per employee | Total output per employee | Capital productivity | Capital intensity | Added value per labour cost | Labour cost per employee | Unit labour cost | Added value content |
|---|---|---|---|---|---|---|---|---|
| Fire protection, security alarm and telecommunication systems installation | 36558 | 130198 | 2.35 | 15562 | 1.46 | 25037 | 0.1923 | 28.0786 |
| Heating, ventilation, air-conditioning and refrigeration work | 36741 | 132940 | 2.19 | 16802 | 1.62 | 22622 | 0.1702 | 27.6371 |
| Other building installation work | 28947 | 116096 | 1.77 | 16328 | 1.20 | 24202 | 0.2085 | 24.9337 |
| Building completion works | 32192 | 93515 | 2.76 | 11678 | 1.39 | 23226 | 0.2484 | 34.4246 |
| Painting and decorating | 23315 | 56893 | 3.44 | 6775 | 1.36 | 17184 | 0.3020 | 40.9813 |
| Floor sanding, finish carpentry, acoustical work and cleaning of the exterior, etc | 24716 | 82928 | 2.55 | 9684 | 1.30 | 19049 | 0.2297 | 29.8039 |
| Other building completion works | 30991 | 101132 | 3.03 | 10242 | 1.39 | 22362 | 0.2211 | 30.6442 |
| Renting of construction or demolition equipment with operator | 46950 | 114658 | 0.60 | 77649 | 1.83 | 25642 | 0.2236 | 40.9481 |

Source: Computed for this research from Report on Survey of Construction Industries 2008.