DYNAMISM AND SUSTAINABILITY THROUGH IBS

A COST-BENEFIT ANALYSIS FOR THE INDUSTRIALISED BUILDING SYSTEM INDUSTRY IN MALAYSIA

CIDB TECHNICAL REPORT
PUBLICATION NO: 1117

CIDB MALAYSIA
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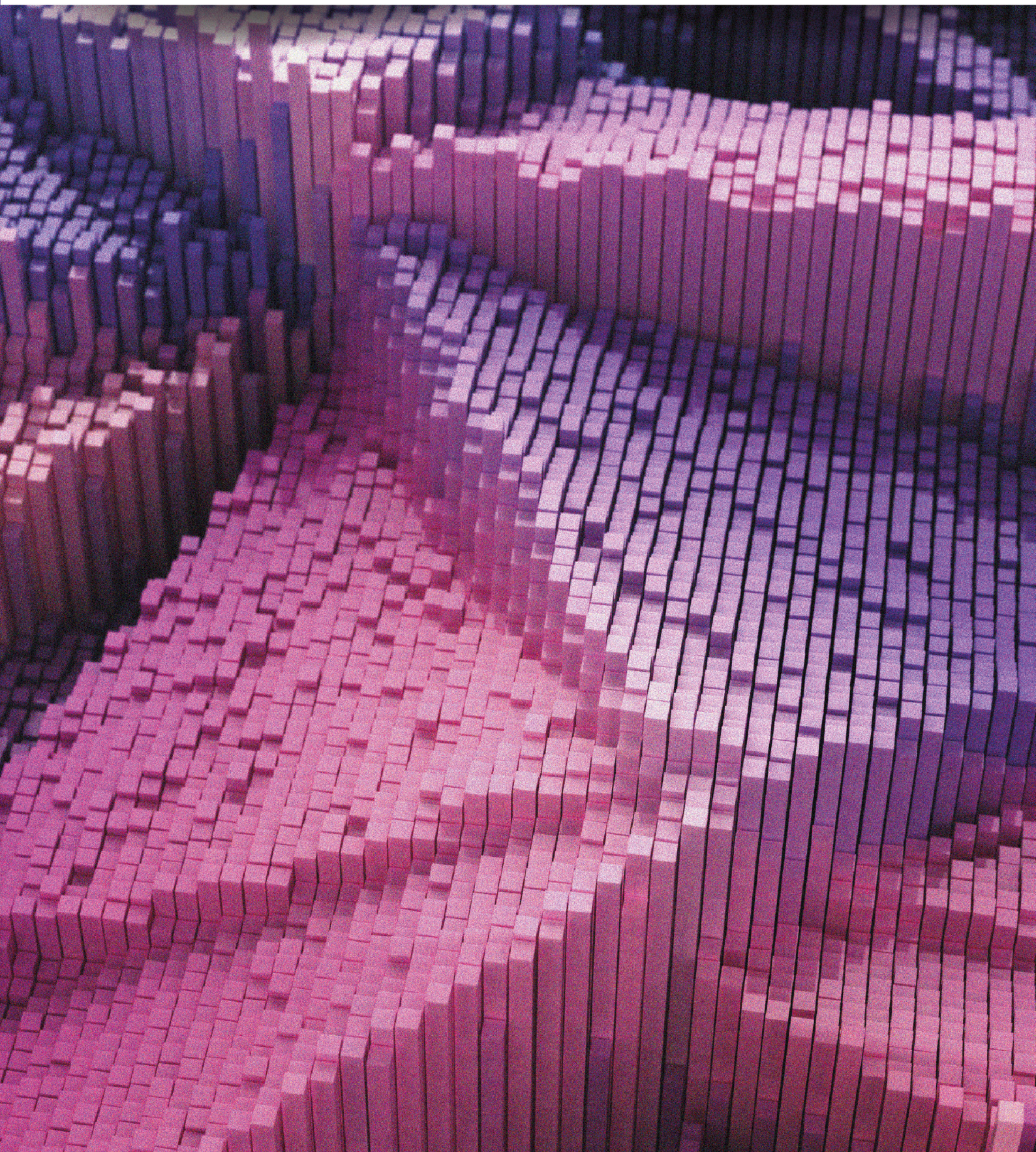

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Dynamism and Sustainability through IBS
A cost-benefit analysis for the industrialised building system industry in Malaysia

All enquiries regarding this book should be forwarded to:

Chief Executive
Construction Industry Development Board Malaysia
Level 10, Menara Dato' Onn,
Pusat Dagangan Dunia Putra,
No. 45, Jalan Tun Ismail,
50480 Kuala Lumpur, Malaysia
Tel: 603-4047 7000
Fax: 603-4047 7070
Email: standard@cidb.gov.my
Website: www.cidb.gov.my

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FOREWORD

The construction sector has always been a significant contributor to Malaysia's gross domestic product (GDP). In the fourth quarter of 2016 (4Q 2016), the construction sector expanded by 5.1%, considerably faster than the overall GDP growth of 4.5% in real terms. With 9,791 registered projects, the total value of construction works done was RM32.56 billion, an increase of 8.1% compared with the same period in 2015. Of this value of construction works, building projects had the highest share at 60.1% in total, with residential buildings at 29.5% and non-residential buildings at 30.6%. The rest were civil engineering at 35.3% and special trade activities at 4.6%. Private-sector projects made up 61.4% of the quarterly value of construction works done, almost unchanged from the private-to-public ratios in previous years.

To the Construction Industry Development Board (CIDB) Malaysia, all these data suggest that during its first year of implementation, the Construction Industry Transformation Programme (CITP) 2016–2020 has begun to bear fruit. The CITP was developed in line with the strategic thrusts of the Eleventh Malaysia Plan (11MP), envisioning a strong and sustainable construction industry that will continue to be a major contributor to Malaysia's economy. The CITP is aimed at helping Malaysia realise its ambition of becoming a developed, high-income nation by 2020 through the transformation of the construction sector leveraging on these four Strategic Thrusts: 1. Quality, Safety and Professionalism - to be ingrained in the construction industry culture, 2. Environmental Sustainability - Malaysia's increasingly environmentally friendly construction practices to be a model for the emerging world, 3. Productivity - to more than double, matched by higher wages, and 4. Internationalisation - Malaysian champions to lead the charge at home and abroad.

Productivity-wise, the construction sector has been one of the sub-performers compared to other sectors in Malaysia. Heavy reliance on low-skilled workers and limited adoption of new technology and modern methods of construction such as the Industrialised Building System (IBS) have been identified as among the causes of the relatively low productivity levels. In addressing these issues, six initiatives have been proposed under the Productivity Thrust of the CITP, and IBS has been put forward under Initiative P3: Accelerate Adoption of IBS, Mechanisation and Modern Practices.

This cost-benefit analysis (CBA) on the IBS industry is one of the efforts listed under Initiative P3. This study aims to highlight the potential positive impacts brought about by the IBS agenda, which began in earnest with the IBS Roadmap 2003–2010. The main objective is to attract various stakeholders of the Malaysian construction sector, in particular from the private sector, to shift towards IBS in a big way. Greater IBS adoption should contribute to higher productivity gains and ensure the success of CITP, providing a strong foundational platform for Transformasi Nasional 2050 (TN50).

Dato' Ir. Ahmad 'Asri Abdul Hamid
Chief Executive
CIDB Malaysia

PREFACE

The federal government has introduced a variety of mechanisms to increase IBS usage in the Malaysian construction sector as a compelling alternative to the conventional method. From Malaysia's first national blueprint, the IBS Roadmap 2003–2010, followed by the second master plan, the IBS Roadmap 2011–2015, IBS has gradually gained ground, especially for public projects. Levy exemption for projects with a minimum of 50 IBS score was also offered to boost the attractiveness of IBS and ultimately its usage in private projects. No doubt, among the value propositions that IBS offers include better quality buildings and infrastructure, higher worker productivity, low dependency on unskilled labour, less wastage, higher site safety, and above all, lower total construction costs. More and more private construction companies and property developers have begun to opt for IBS as the preferred method of construction, and quite a number of them have also significantly invested in IBS component manufacturing, either on-site or off-site.

At present, IBS continues to be the federal government's main focus area apart from being chosen as one of the 21 initiatives under the CITP 2016–2020. The first part of the IBS-specific initiative aims to scale up further the IBS adoption in government projects while accelerating IBS usage in private ones. Secondly, it also targets to deepen the IBS value and supply chain through economic mechanisms. In support of the Initiative P3: Accelerate Adoption of IBS, Mechanisation and Modern Practices, a CBA for the IBS industry in Malaysia has been recommended.

The Construction Research Institute of Malaysia (CREAM), CIDB Malaysia's research and development arm, has been appointed to conduct the CBA. This study will provide an overall picture of quantified pros and cons of the IBS agenda, both tangible and intangible with estimated values. This will provide the industry with a clearer understanding of the benefits of IBS, not only limited to its contributions towards individual construction projects and the construction sector as a whole, but also its linkages with and spillover effects on all other sectors in the economy, namely manufacturing, services, mining and quarrying, and agriculture and forestry.

Datuk Ir. Elias Ismail
Senior General Manager
Technology Development Sector
CIDB Malaysia

ACKNOWLEDGMENT

The authors and researchers of this CBA study acknowledge the contributions and support from all parties involved, in particular the Construction Industry Development Board (CIDB) Malaysia, the IBS Centre and its research and development arm, the Construction Research Institute of Malaysia (CREAM) for providing guidance and the necessary funding to finance this research project throughout the whole process.

The Department of Statistics of Malaysia (DOSM), the Malaysia Productivity Corporation (MPC), the Malaysian Timber Industry Board (MTIB), the Ministry of Science, Technology and Innovation (MOSTI), the Ministry of Natural Resources and Environment (NRE), the Ministry of Human Resource (MOHR) and the Department of Occupational Safety and Health (DOSH) also deserve a special mention for the invaluable help in understanding the big picture and facilitating data gathering. Without the efforts and support of all parties, this study would not have been a success.

EXECUTIVE SUMMARY

Industrialised Building System (IBS) can be defined as "a technique of construction whereby building components are manufactured in a controlled environment, either on-site or off-site, and subsequently transported, positioned and assembled onto a structure, or in short, incorporated into construction sites but with minimal additional site works". IBS, therefore, represents the concept of prefabrication and prior manufacturing in a controlled environment, whether at a factory or even at a construction site of building materials, structural components and other construction elements that will subsequently be transported, positioned and installed onto structures at a site.

Recognising its multitude of benefits, the federal government began promoting the usage of IBS in earnest since early 2000s, especially among private property developers, to improve construction practices, deliver high-quality infrastructure, buildings and properties for use by society, and bring down construction costs as a way to keep property prices in check. The Construction Industry Transformation Programme (CITP) 2016–2020 represents the culmination of all these unwavering efforts.

In many countries, IBS has proven its capability of ensuring completion in record time of a huge number of high-quality residential properties, especially social housing for the mass population, at very reasonable costs. This is particularly crucial for countries in full transformational phase from upper middle-income to developed, high-income status such as Malaysia in dealing with population growth, urbanisation, infrastructure development and housing demand (especially for good quality, sustainable, affordable and urban-centric low- and medium-cost homes). Given the implementation of minimum wages (revisable every two years in Malaysia since 2013), endless foreign worker levy and continuous labour shortage (in particular skilled construction workers), IBS seems the perfect answer, being the building system with the least labour input.

The CBA is a systematic approach in making a well-educated estimate or assessment by assigning values expressed in common monetary terms to a list of existing and/or anticipated benefits and costs of a project, programme or policy on its own or in comparison with other alternatives, accounting for all desirable and undesirable effects on a particular industry, society and economy as a whole. Not necessarily related to hard, tangible, financial or numerical information, the benefits of a project, programme or policy can exemplify gains, strengths, advantages, leverages, virtues, merits and opportunities, among others, while costs can be interpreted as losses, weaknesses, disadvantages, shortcomings, drawbacks, flaws, deficiencies, risks and threats.

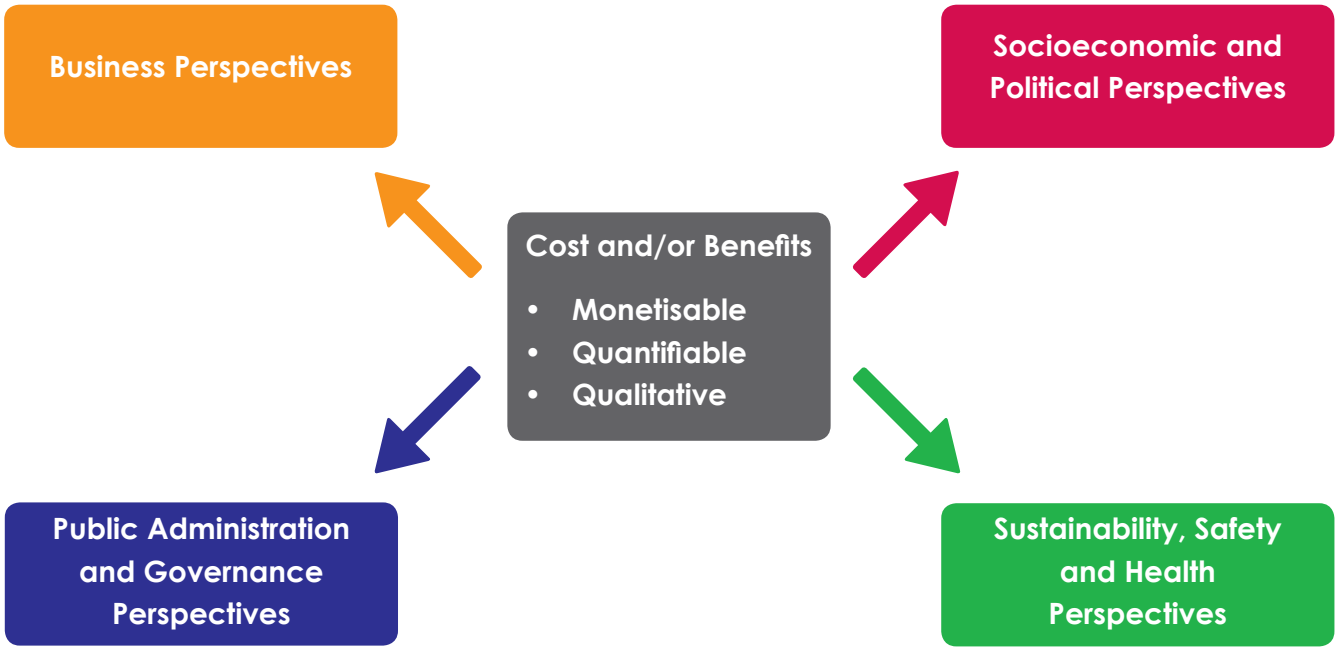
These benefits and costs, which can be direct, tangible or immediate and indirect, intangible or potential effects, will be converted, to the extent relevant and possible, into present monetary terms to provide an objective, balanced and impartial framework in weighing up different impacts of a project, programme or policy and making an informed decision. Some benefits and costs may be difficult to estimate with precision. Even when full quantification of impacts is not possible, a CBA is still useful in providing a clear and results-driven decision-making framework with quantitative and qualitative information. In essence, a CBA may indicate the efficiency of resource, time and effort allocation to a project, programme or policy.

Since a CBA is supposed to present the best estimates of benefits or desirable effects and costs or undesirable effects, they must be measured or monetised, i.e. assigned values in a common currency such as RM to the extent relevant and possible. However, the selection of metrics of measurements and the possibility of assigning values will depend a lot on the availability and comprehensiveness of data (whether underlying or proxy), tangibility of impacts and ease of monetisation. Eventually, the outcomes of this CBA study can be slotted under the following categories:

a. Monetisable category
b. Quantifiable category (but not Monetisable)
c. Qualitative category (but not Monetisable or Quantifiable)

Without the potential boost to nominal private consumption, estimated at RM18.979 billion as a result of a hypothetical reduction in low-skilled foreign workers, which in turn should broaden the skilled labour pool and consequently raise salaries and wages among Malaysians, the interim difference between monetisable benefits and monetisable costs is RM2.8321 billion. However, with the addition of that desirable impact on private consumption, the final positive difference is further enhanced to RM21.8111 billion when comparing the sums of monetisable benefits and costs of RM103.4964 billion and RM81.6853 billion, respectively. This lends even more credence to the rationale of promoting and pushing for a far-reaching IBS adoption instead of the Conventional Building Method (CBM).

Adding the net benefits derived from the quantifiable and qualitative outcomes (the list of desirable effects is considerably heavier than undesirable effects), which are either too difficult or even impossible to assign values in RM, would indubitably affirm the superiority of IBS over any other building methods. Since the combination of all three types of desirable outcomes is considerably higher than its adversary, it can be concluded that the IBS industry has proven its ability to result in and maximise gains and advantages on a net basis not only to the construction sector and the overall IBS value and supply chain, but more importantly, to a multitude of aspects of the Malaysian economy as a whole and its society.



CHAPTER 1: INTRODUCTION

1.1 Definitions, Objectives and Scope

The Conventional Building Method (CBM) or Cast-In-Situ Construction Method (CISCM) can be defined as a construction approach whereby activities of the whole construction process such as formwork fabrication and installation, bar bending, steel reinforcement, concrete placement, compaction, casting and curing are performed on-site. In contrast, IBS is a construction process that fully or partially utilises prefabricated and standardised building products, structural components, techniques and elements. These products and components, which include beams, columns, slabs and walls, among others, are conceived and planned prior to being cast into form, manufactured on a large scale or mass assembled and produced in a controlled or supervised environment, mostly at an off-site factory, although on-site production using innovative and clean technologies exists.

Table 1.1: Various definitions of IBS

Definition	Reference
A construction technique whose components are manufactured in a controlled environment (on- or off-site), transported, positioned and assembled onto a structure with minimal additional site works, contributing to less wastage	CIDB Malaysia, 2003
A prefabrication process and construction industrialisation concept	Kamar et al., 2011
A method of construction established based on innovation and rethinking of the best techniques of construction	Abdullah and Egbu, 2009
Mass production of building components in a factory (off-site) or at a construction site (on-site)	Chung and Kadir, 2007
A construction system that is built using prefabricated components	Rahman and Omar, 2006
A construction method through the use of best construction machineries, equipment, materials and extensive planning of the construction process	Marsono et al., 2006 and Haron et al., 2005
An integrated manufacturing and construction process with a well-planned and efficient organisation and management, preparation and control over resources used, activities and results supported by the use of highly developed components	Lessing et al., 2005
An industrialised system of components production or building assembly or both	Jaafar et al., 2003
The process of pre-assembly, organisation and completion of the final project assembly before installation	Gibb, 1999
A set of interrelated elements that act together to enable the designated performance of building, which includes several procedures (managerial and technological) for the production and installation of these elements	Sanja, 1998
An integrated system, including software and hardware, with which building components are planned, fabricated, transported and assembled at sites	Junid, 1986

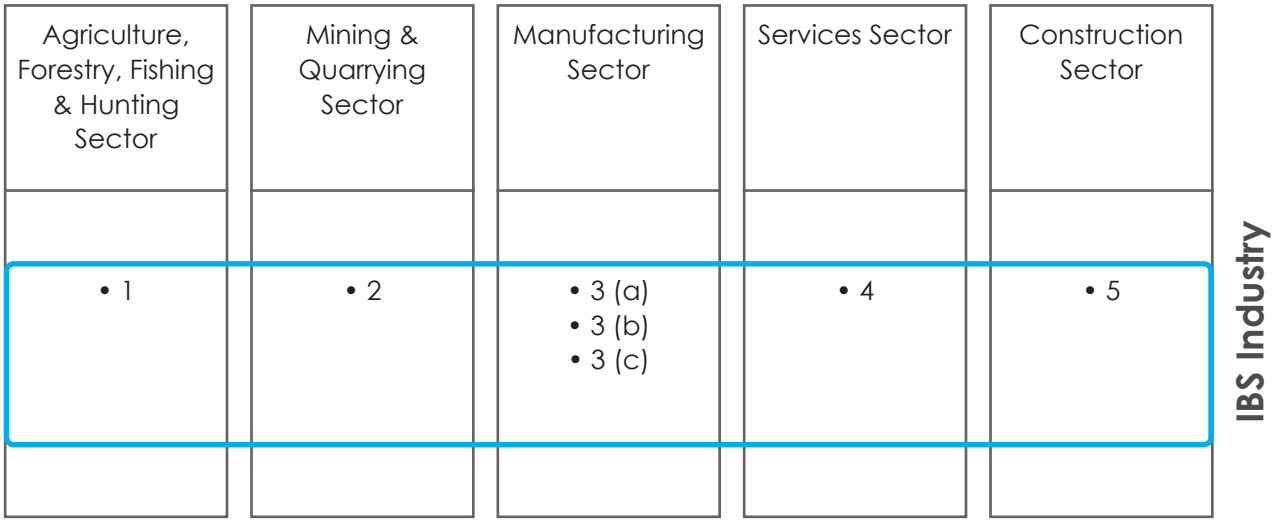
Source: Research on IBS Adoption in Government and Private Projects in Malaysia 2013, Construction Research Institute of Malaysia (CREAM); IBS Roadmap 2003–2010

They will then be transported and placed, positioned, installed or erected onto structures at a construction site with minimal additional site works, although other finishing works may be required.

Also known as Prefabricated Construction (PC), Modern Method of Construction (MMC) or Off-site Construction (OC), IBS features quite a balanced combination between the software and hardware spheres. The software sphere, which provides a foundation to create a conducive environment, usually performs (i) a study of end-user needs and requirements, (ii) market analysis, (iii) design framework and standardisation of products and components, (iv) establishment of manufacturing and assembly layout and processes, and (v) allocation of materials, energy and other resources. The hardware sphere, on the other hand, can be broken down into five major categories, namely framing, panel, box, formwork and block work systems.

Moreover, the IBS industry is unique as it cuts across all five major sectors in the economy, although the value and supply chain seems, in declining order, concentrated in the manufacturing, services, construction, and mining and quarrying sectors, and to a lesser extent, the agriculture, forestry, fishing and hunting sector.

Figure 1.1: IBS industry cuts across all five major sectors



Source: Jasmiza Solutions Sdn. Bhd. (JSSB)

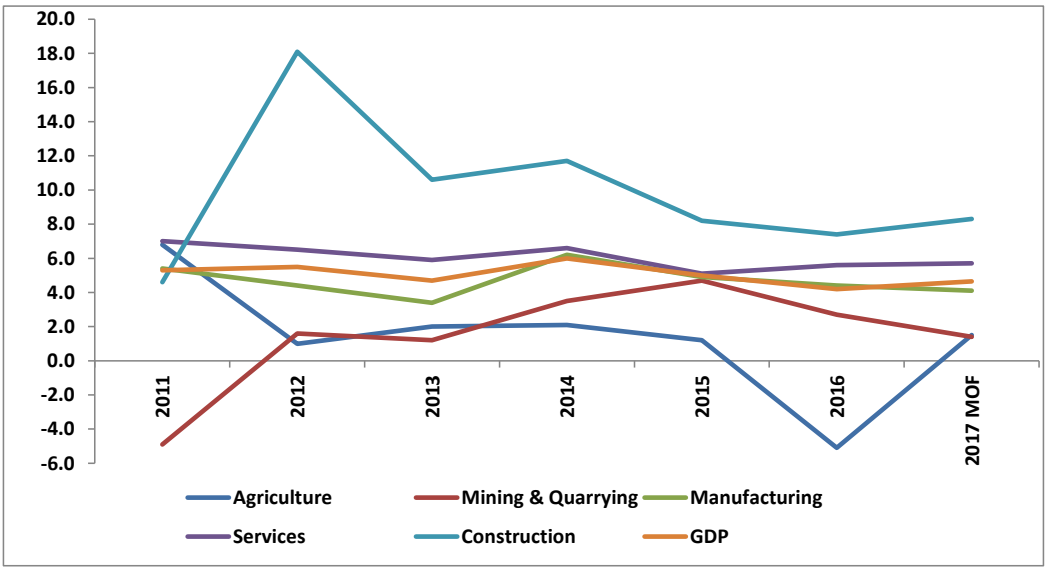
Notes:

1. Products from the agriculture, forestry, fishing and hunting sector are used as inputs for the manufacturing of finished IBS products and components
2. Products from the mining and quarrying sector are used as inputs for the manufacturing of finished IBS products and components as well as of machineries and equipment
3. Manufacturing activities produce:
   a. semi-finished goods as inputs for the manufacturing of finished IBS products and components as well as of machineries and equipment
   b. finished IBS products, components, techniques and elements
   c. machineries and equipment for use by manufacturers of finished IBS products and components as well as providers of services related to ex-factory IBS products and components
4. Delivery of various services to complete usage of ex-factory IBS products and components
5. Construction activities use finished IBS products and components

Figure 1.2: Value-chain mapping for the IBS industry

Source: JSSB

Figure 1.3: Real growth performance of Malaysia's GDP and five sectors (%)



Source: Department of Statistics Malaysia (DOSM), Bank Negara Malaysia (BNM), Ministry of Finance's (MOF) Economic Report 2016–2017, JSSB

Although construction[1] has long been Malaysia's smallest sector as a share of the GDP, the 11th Malaysia Plan (11MP) has pegged a growth forecast of 10.3% per annum from 2016 through 2020. After growing by 7.4% in 2016, albeit at the slowest pace since 2011, the construction sector is still projected to expand by at least 8% in 2017. Thus, construction is set to remain the fastest-growing sector in the Malaysian economy for six years in a row since 2012. In fact, real growth of the construction sector has surpassed the overall GDP since the fourth quarter of 2011 (4Q 2011), equivalent to 21 consecutive quarters of such outperformance up to 4Q 2016.

Among the major catalysts moving forward for the construction sector include:

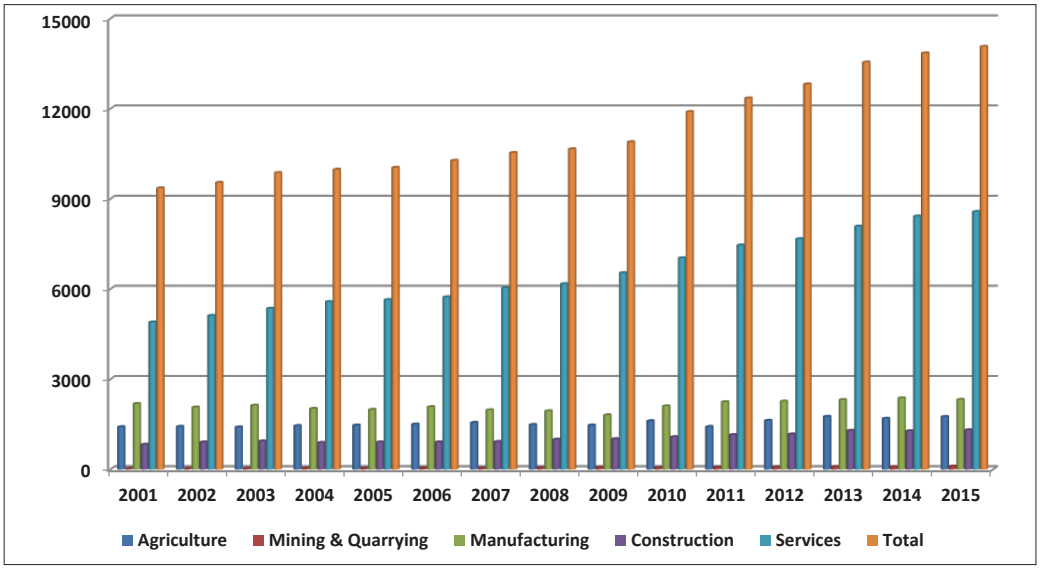
a. New infrastructure projects, mostly public transportation related such as Mass Rapid Transit (MRT) Line 2 and Line 3, Light Rail Transit (LRT) 3, Gemas-Johor double-tracking project, KL-Singapore High Speed Rail (HSR), East Coast RailLine and Pan Borneo Highway as well as other high-impact projects allocated under the 11MP

b. Ongoing projects to provide new social amenities or upgrade existing ones related to housing, especially affordable homes, clean water supply services and sewerage, among others

The construction sector in Malaysia consists of two major sub-sectors, namely general construction activities and specialised construction activities. The general construction sub-sector can be broken down further into civil or heavy engineering (especially infrastructure and public works, including public amenities and facilities), non-residential (commercial, industrial and institutional) and residential. The specialised construction sub-sector or specialty trades may include activities that provide services such as mechanical and electrical works, plumbing, glass works, air-conditioning, painting, carpentry and tiling, among others.

[1] The process of constructing a building or infrastructure at a specified location for a known client. The construction sector typically makes up about 5% to 10% of the GDP in developed economies, although it could be larger in developing ones. However, at constant 2010 prices, the construction sector accounted for 4.5% of the Malaysian GDP in 2016 and 4.0% on average from 2010-2016. Its contribution to the Malaysian economy is, in general, 12 times smaller than the services sector, 7 times smaller than the manufacturing sector and 2.2 times smaller than the agriculture sector.

Figure 1.4: Number of employed persons by sector ('000)



Source: DOSM, JSSB

The construction sector is Malaysia's fourth largest employer behind the services, manufacturing and agriculture sectors, in that order. The construction sector has high forward linkage with other sectors, in particular the services sector, notably sub-sectors such as government services, communications, and real estate and business services. The construction sector has even higher backward linkage, more prominently with agriculture, mining and quarrying, and manufacturing industries, given the ongoing need for non-metallic mineral products, basic metals, fabricated metal products and construction-related equipment.

The construction sector's interdependence and interconnectedness with other sectors in the economy are illustrated by forward linkage and backward linkage indexes of 0.79 and 1.10, respectively, as published by the Malaysia Productivity Corporation (MPC) in its Productivity Report 2014/2015. In short, the construction sector is particularly crucial, given the intensity of multiplier effects (two times) due to the reliance of and interlinkages with more than 120 industries in other sectors vis-à-vis construction projects[2], for example:

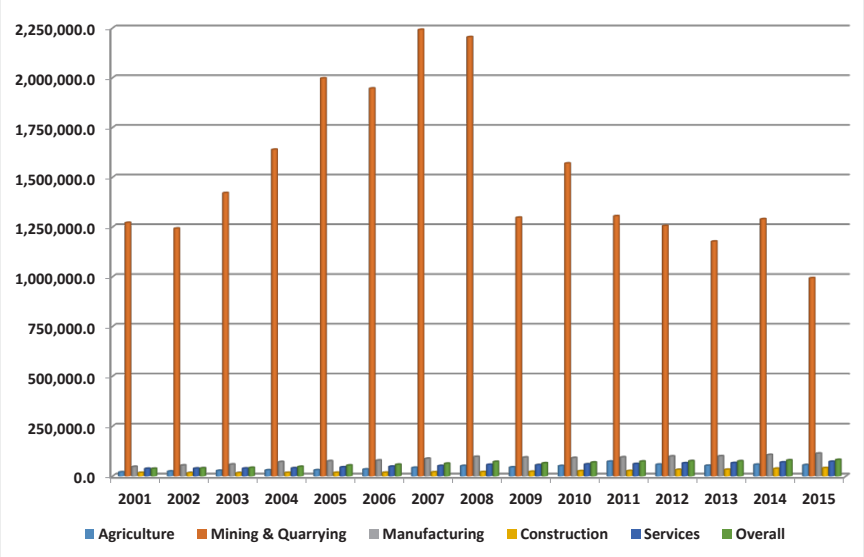
a. The commodities sector comprising agricultural (farming, plantations, forestry, etc.) and mining activities - Production and/or extraction of natural resources and raw materials to be subsequently transformed or converted into intermediate and finished goods and by-products, notably reusable in the manufacturing, construction and services sectors

b. The manufacturing sector - Processing and production of products, components, techniques and elements used in construction works such as wood-based products; manufacturing of prefabricated metal products such as iron and steel; finished goods used in the services sector, in particular machinery, appliances and parts; and transport equipment, among others

c. The services sector - Utilities; transportation, storage and installation; finance and insurance; real estate and business services; safety, health and quality control management (services, tools, etc.); IT systems and software; government services; and wholesale and retail trade, among others

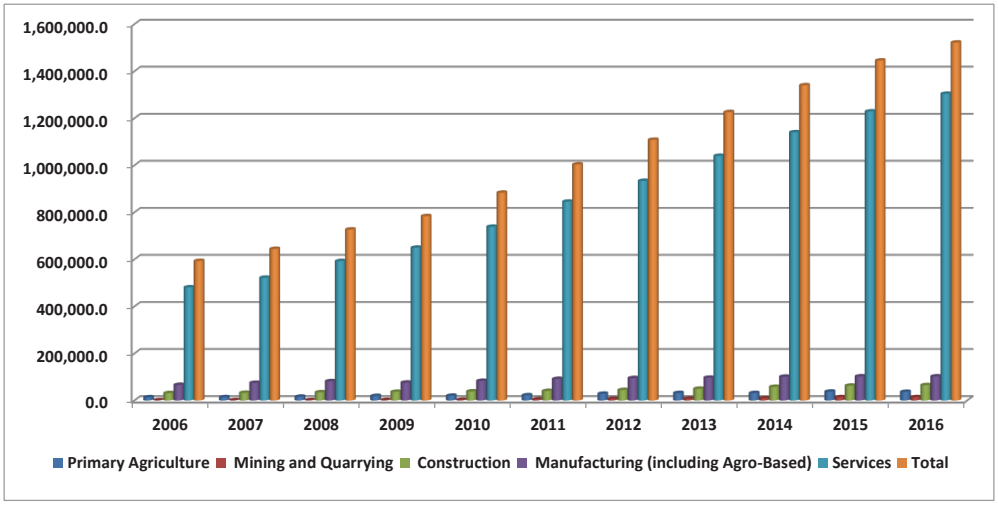
[2] Page 16, CITP 2016–2020 publication

Figure 1.5: Malaysia's nominal value-add per employee, overall and by sector (RM)



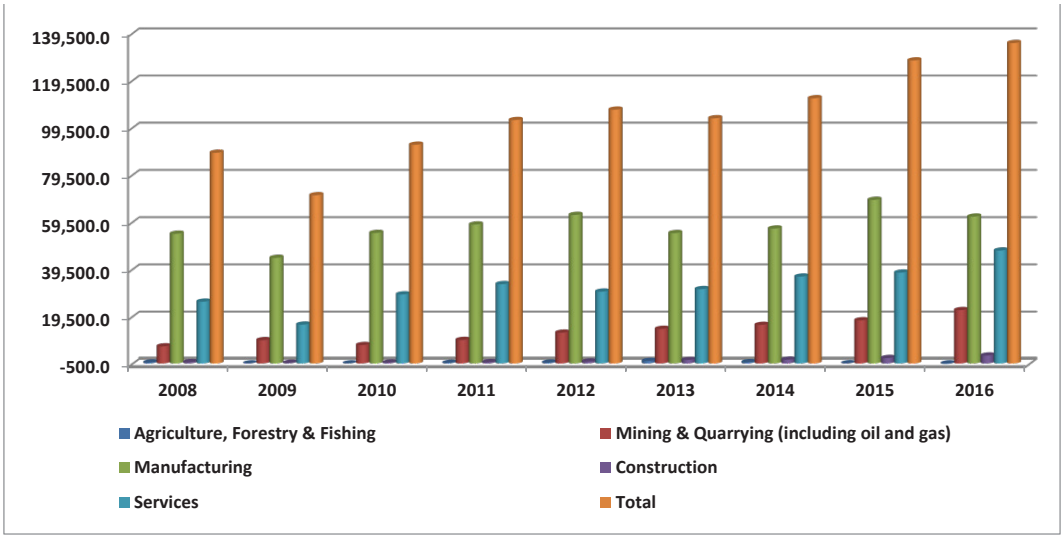
Source: BNM, DOSM, JSSB

Figure 1.6: Banking system's year-end outstanding loans by sector (RM million)



Source: BNM, JSSB

Figure 1.7: Malaysia's gross foreign direct investment (FDI) inflows by sector (RM million)



Source: BNM, DOSM, JSSB

Since the construction sector presents a significantly high investment opportunity, income generation and wealth creation potential according to a multitude of indicators, it is, therefore, an important economic propeller with a multitude of stakeholders and players at various stages of its value and supply chain. Similarly, stakeholders and value-chain participants involved in the IBS industry should include:

a. Businesses involved in ordinary construction activities and all construction-related services to deliver buildings and infrastructure to end-customers, including builders, real estate developers, contractors, companies providing construction-related ancillary services, companies providing consultancy and other support services such as turnkey and bespoke projects; civil, structural, electrical and mechanical engineering; architecture; design; quantity surveying; project planning and management; geology, archaeology and environment; and health and safety.

b. Producers, importers, distributors and suppliers/vendors of raw materials, natural resources and semi-finished goods that are used in the manufacturing and production of finished IBS products, components,

Figure 1.8: Performance of the FTSE Bursa Malaysia Kuala Lumpur Composite Index[3] Kuala Lumpur Construction Index[4] and Kuala Lumpur Property Index[5] (normalised on the basis of 4 January 1993)

Source: Bloomberg

techniques and elements such as steel and aluminium makers, cement manufacturers, glass makers, sand miners, timber and logging companies, producers of chemicals and chemical products, etc.

c. Manufacturers, importers, distributors and lessors of machineries and equipment for the purposes of manufacturing and production as well as transportation, installation, erection and other services for use by finished IBS products, components, techniques and elements

d. Manufacturers, assemblers, importers and distributors of finished IBS products, components, techniques and elements

e. Providers of storage, transportation, installation, erection and other services for use by ex-factory IBS products, components, techniques and elements

f. Public institutions, including ministries, government departments and agencies, and statutory and oversight bodies at every level of government (federal, state and local/municipal) that implement policies and carry out supervisory and regulatory, monitoring and enforcement duties, such as:

- Ministry of Works (MOW)/Kementerian Kerja Raya (KKR)
- Public Works Department (PWD)/ Jabatan Kerja Raya (JKR)
- Ministry of Finance (MOF)/Kementerian Kewangan
- Economic Planning Unit (EPU)/Unit Perancang Ekonomi
- Department of Statistics (DOSM)/ Jabatan Perangkaan
- Bank Negara Malaysia (BNM)
- Securities Commission (SC)
- Bursa Malaysia
- Ministry of International Trade and Investment (MITI)/Kementerian Perdagangan Antarabangsa dan Industri

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[3] Launched on 6 July 2009 to replace the Bursa Malaysia KLCI while inheriting its full history, the FBM KLCI Index comprises 30 largest public-listed companies on Bursa Malaysia Berhad's Main Board, according to full market capitalisation.

[4] Developed with a base value of 100 as of 16 October 1991, the KLCON is a capitalisation-weighted index comprising all stocks in the EMAS Index (KLEMAS) involved in the construction sector.

[5] Developed with a base value of 100 as of 16 October 1991, the KLPRP is a capitalisation-weighted index comprising all stocks in the EMAS Index (KLEMAS) involved in the property industry.

- Malaysian Investment Development Authority (MIDA)
- Malaysia External Trade Development Corporation (MATRADE)
- Ministry of Urban Wellbeing, Housing and Local Governments (MUWHLG)/ Kementerian Kesejahteraan Bandar, Perumahan dan Kerajaan Tempatan (KPKT)
- Ministry of Human Resources (MOHR)/ Kementerian Sumber Manusia (KSM)
- Ministry of Health (MOH)/Kementerian Kesihatan Malaysia (KKM)
- Ministry of Home Affairs (MOHA)/ Kementerian Dalam Negeri (KDN)
- Ministry of Foreign Affairs (MOFA)/ Kementerian Luar Negeri (KLN)
- Ministry of Education Malaysia (MOE)/ Kementerian Pendidikan Malaysia (KPM)
- Ministry of Higher Education (MOHE)/ Kementerian Pendidikan Tinggi (KPT)
- Ministry of Agriculture and Agro-Based Industry (MOA)/Kementerian Pertanian dan Industri Asas Tani
- Ministry of Plantation Industries and Commodities (MPIC)/Kementerian Perusahaan Perladangan dan Komoditi
- Ministry of Domestic Trade, Cooperatives and Consumerism (MDTCC)/Kementerian Perdagangan Dalam Negeri, Koperasi dan Kepenggunaan (KPDNKK)
- Ministry of Energy, Green Technology and Water (MEGTW)/Kementerian Tenaga, Teknologi Hijau dan Air (KeTTHA)
- Ministry of Science, Technology and Innovation (MOSTI)/Kementerian Sains, Teknologi dan Inovasi (KSTI)
- Ministry of Natural Resources and Environment (MNRE)/Kementerian Sumber Asli dan Alam Sekitar
- Department of Occupational Safety and Health (DOSH)
- State governments
- Local authorities/municipal councils/ Pihak Berkuasa Tempatan (PBT)
- State agencies
- Construction Industry Development Board of Malaysia (CIDB)
- National Property Information Centre (NAPIC)
- Board of Architects Malaysia/Lembaga Arkitek Malaysia (LAM)
- Board of Quantity Surveyors Malaysia (BQSM)/Lembaga Juru Ukur Binaan Malaysia (LJUBM)
- Board of Engineers Malaysia (BEM)
- Employees Provident Fund (EPF)/ Kumpulan Wang Simpanan Pekerja (KWSP)
- Social Security Organisation (SOCSO)/ Pertubuhan Keselamatan Sosial (PERKESO)
- Royal Malaysian Customs Department/ Jabatan Kastam Diraja Malaysia (JKDM)
- Internal Revenue Board (IRB)/Lembaga Hasil Dalam Negeri (LHDN)
- Malaysia Productivity Corporation (MPC)

g. Industry or professional associations involved in the construction sector in general and the IBS industry in particular, such as:

- Real Estate and Housing Developers' Association (REHDA)
- Master Builders Association Malaysia (MBAM)
- Institution of Engineers Malaysia (IEM)
- Association of Consulting Engineers Malaysia (ACEM)
- Malaysian Institute of Architects (PAM)
- Royal Institution of Surveyors Malaysia (RISM)
- The Electrical and Electronics Association of Malaysia (TEEAM)
- Building Materials Distributors Association of Malaysia (BMDAM)
- Malaysian Iron and Steel Industry Federation (MISIF)

- Malaysian Energy Professionals Association (MEPA)
- Association of Environmental Consultants and Companies of Malaysia (AECCOM)

h. End-customers, both domestic and overseas, such as the public at large, public institutions at every level of government, businesses whether government-linked investment companies/government-linked companies (GLICs/GLCs), or privately held companies

i. Institutions of learning, education and skills development, such as universities, colleges, vocational, technical and youth development institutes, and technical secondary schools

j. Financial institutions and financing providers

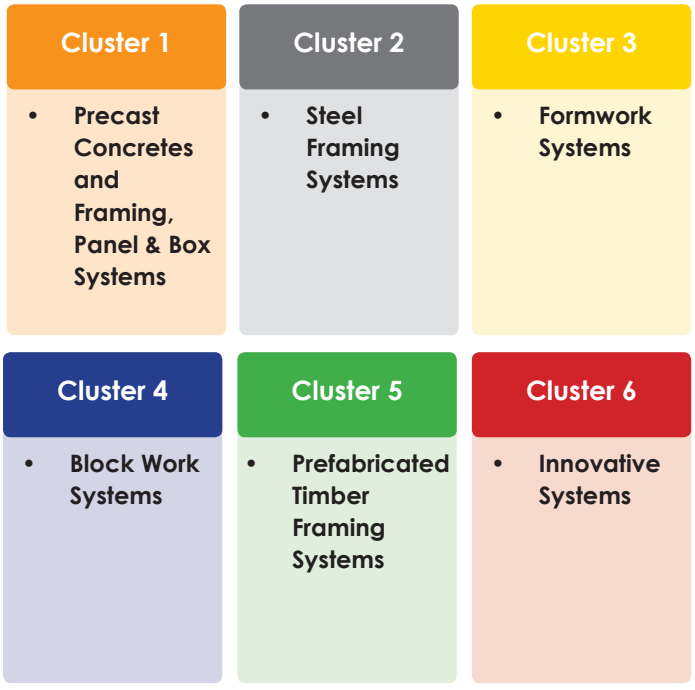
k. Civil society, i.e. relevant non-governmental organisations (NGOs) such as:

- National House Buyers Association (HBA)/Persatuan Kebangsaan Pembeli Rumah (PKPR)
- National Consumer Complaints Centre (NCCC)
- Consumers Association of Penang (CAP)
- Federation of Malaysian Consumers Associations (FOMCA)/Gabungan Persatuan-Persatuan Pengguna Malaysia
- Education and Research for Consumers Malaysia (ERA Consumers Malaysia)
- Muslim Consumers Association of Malaysia/Persatuan Pengguna Islam Malaysia (PPIM)
- Majlis Tindakan Ekonomi Melayu (MTEM)

On an object basis, it can be deduced that the first five stakeholders and value-chain participants above are, in essence, the core segments of the IBS industry. In addition, the IBS industry can be further divided into seven segments based on economic activity as follows:

a. Production of raw materials and natural resources from the agriculture and forestry sector as inputs for the manufacturing of finished IBS products and components

Figure 1.9: Six clusters of the IBS component manufacturing segment



Source: CIDB, JSSB

b. Mining and extraction of raw materials and natural resources as inputs for the manufacturing of finished IBS products and components as well as of machineries and equipment
c. Processing and production of semi-finished goods as inputs for the manufacturing of finished IBS products and components as well as of machineries and equipment
d. Manufacturing of finished IBS products, components, techniques and elements
e. Manufacturing of machineries and equipment for use by manufacturers of finished IBS products and components as well as providers of services related to ex-factory IBS products and components
f. Provision of storage, transportation, installation, erection and other services to complete the cycle of ex-factory of IBS products and components at a construction site
g. Construction activities

Having established the two approaches to categorising core segments of the IBS industry, the manufacturing and production activities of processing and transforming a multitude of inputs into finished IBS products, components, techniques and elements can be broken down further into six clusters according to structural classification aspects, capped with their respective major raw materials, natural resources and semi-finished goods used.

a. Manufacturing of precast concrete components, including beams, columns and slabs; walls; 3-D or volumetric components such as balconies, staircases, toilets and lift chambers; and permanent concrete formworks using mostly:
    - Sand and aggregates (granite, limestone, gravel, recycled concrete and slags, among others)
    - Steel bars
    - Cement (produced by using limestone, sand, bauxite and iron, among others)
    - Chemicals and chemical products
b. Manufacturing of steel framing systems, including steel beams and columns, portal frames, and roof trusses using mostly:
    - Steel such as hot rolls and cold rolls in sheets
    - Coating such as protective paint and metallic coating (e.g. Zincalume)
c. Production of formwork systems, including tunnel forms, moulding forms for beams and columns, walls, slabs and permanent steel formworks (metal decks) using mostly:
    - Steel and steel products
    - Aluminium
    - Engineered bamboo and timber
    - Plastics
d. Manufacturing of block work systems, including interlocking concrete masonry units (CMUs) and lightweight concrete blocks using mostly:
    - Sand and aggregates
    - Cement
    - Chemicals and chemical products
e. Manufacturing of prefabricated timber framing systems, including timber frames, beams and columns, and roof trusses using mostly:
    - Timber, both natural and engineered
    - Metal plates
f. Production of other innovative systems (other than the five above), including hybrid modular houses and other volumetric units, dry wall-gypsum boards, sandwich panels, bio-composite wall panels, wood-wool cement panels and cemboard dry walls using mostly:
    - Sand
    - Cement
    - Composite materials
    - Gypsum, both natural and synthetic
    - Paper
    - Steel and other metal products
    - Engineered timber
    - Chemicals and chemical products

The objectives that the CBA aims to achieve for the IBS industry include but are not limited to the following:

a. To objectively assess the strengths or pros and weaknesses or cons of which building method to be promoted, i.e. IBS vis-à-vis its alternative, CBM
b. To provide facts-driven and evidence-based justification(s) in executing the IBS policy for the construction sector in particular and the Malaysian economy in general, equipped with its key desirability, feasibility and success factors
c. To frame the most appropriate and relevant goals in promoting IBS usage
d. To provide up-to-date, accurate and pertinent information to the government and relevant authorities at all levels as well as the IBS industry stakeholders and value-chain participants in charting the industry's strategic direction
e. To review roles and responsibilities of each and every IBS stakeholder and value-chain participant
f. To subsequently develop and recommend, to the extent possible, an appropriate action plan complete with solutions to various issues, feasible implementation measures, roadmap of realistic targets or milestones and adequate resources required (money, people, technology and equipment, among others) to ensure the success of the chosen policy, i.e. IBS usage by the construction sector

This research should aspire to ensure that the following dimensions or operations (but not limited to) are covered within its study scope:

a. As per the CITP recommendations, highlighting the 'superiority' of IBS over all other building systems by objectively reviewing all existing and potential advantages and drawbacks, both direct and indirect, that IBS adoption could bring to the Malaysian economy as a whole, including prospects for growth, consumer spending, trade and investments; the overall supply and value chain of the IBS industry; public finances; labour market conditions; wage structure; household income levels; the Malaysian society at large; public safety and health; and environment preservation, among others
b. Putting greater emphasis, to the extent possible, on buildings of all types[6] instead of infrastructure works and projects[7] when it involves construction activities
c. Harmonising and converging the views and information from relevant IBS industry stakeholders and value-chain participants
d. Conducting the research using the most appropriate methodology and systematic approach, and achieving the desired results within the stipulated timeframe and with the least errors
e. Analysing all information and data obtained, which subsequently will be reworked and rewritten in an easy-to-understand manner

[6] Building categories include residential (landed such as terraced houses and bungalows as well as high-rise such as flats, apartments and condominiums), commercial (shopping centres and office buildings, among others), industrial (factories and warehouses, among others), institutional or public (schools, universities, stadiums, sports centres, clinics, hospitals, court houses, government offices and public transportation stations, among others) and utility (power stations, water treatment plants, telecommunications base stations and sewerage treatment plants, among others).

[7] Infrastructure includes roads, bridges, railway tracks, airport runways and dams, among others.

1.2 Context and Circumstances

The notion of PC, the earlier designation to describe IBS, was first made popular in Western Europe in the late 1950s or early 1960s. In view of the difficulty faced by the CBM to cope with the population growth explosion, rapid urbanisation and the consequent surge in demand for homes and dwellings, the post-Merdeka Malaysian federal government began to look into the IBS concept in the mid-1960s.

In 1966, two pilot projects using precast concrete elements took off to build high-rise low-cost flats, namely the Pekeliling Flats in Kuala Lumpur and the Rifle Range Road Flats in Penang. Notwithstanding a variety of negative perceptions towards IBS, this maiden debut marked the beginning of IBS usage in housing development projects, ranging from low-cost houses to premium bungalows as well as other non-residential types of buildings, including commercial, industrial and institutional.

In 1980, some 2,600 units of living quarters at the Lumut Naval Base in Perak were partially built using IBS components. The construction of the 30-storey Dayabumi complex, completed in 1984, resorted to prefabricated products and components. Between 1981 and 1993, many property developers adopted some IBS elements to build low-cost houses and even luxury bungalows in Selangor. From 1994 through 1997, implementation of hybrid IBS was quite in vogue.

Since 1998, the CIDB has been aggressively promoting and facilitating IBS implementation in Malaysia's construction sector, which culminated in the launch of the IBS Strategic Plan and the establishment of the IBS Steering Committee in 1999. Subsequently, the Ninth Malaysia Plan (9MP) 2006–2010, the IBS Roadmap 2003–2010, the IBS Roadmap 2011–2015 and the Construction Industry Master Plan (CIMP) 2006–2015 reaffirmed the IBS agenda and further intensified the CIDB's efforts to fast-track achieving all targets set.

Despite these concerted efforts and its numerous advantages, IBS usage, especially in private construction projects, has still been way far from the levels that have been observed in developed countries. Even compared to neighbouring countries such as Thailand and Singapore, Malaysia is evidently trailing behind, most probably because there are areas where the public is still not convinced.

Given such a backdrop, the federal government decided to reiterate its commitment to the IBS agenda by issuing a Treasury/MOF Circular Letter No. 7 Year 2008 (Surat Pekeliling Perbendaharan Bil. 7 Tahun 2008)[8], dated 31 October 2008, and the Action Plan for IBS Implementation in Government Projects (Pelan Tindakan Pelaksanaan IBS dalam Projek Kerajaan). These two initiatives upped the ante for IBS usage by public projects, replacing the Treasury/MOF's earlier instruction dated 6 July 2005 requiring 50% IBS content in all government projects.

[8] Public sector projects worth below RM10 million, carried out in far-off places, hence not easily accessible for IBS purposes and involve renovation and maintenance works instead of construction, are exempted from the rules under this SPB.

Table 1.2: Average IBS content in public- and private-sector projects (adapted from a table on key performance indicators in the IBS Roadmap 2011–2015 as underscored in Research on IBS Adoption in Government and Private Projects in Malaysia 2013)

IBS Adoption	Baseline	Target by 2015
Government projects (buildings)	70%	70%
Private-sector projects (buildings)	-	50% on average

Source: CIDB, CREAM

Furthering the intents and purposes of this circular, the Initiative P3: Accelerate Adoption of IBS, Mechanisation and Modern Practices under the CITP underscores the importance and imperativeness of accomplishing a CBA for the IBS industry in Malaysia. The CITP aims to reach the following targets, as far as the content of IBS products, components, techniques and elements in construction works and projects are concerned, in accordance with the CIDB's most updated IBS Scoring System[9]:

- All public sector-led projects worth RM10 million and above must achieve a minimum of 70 IBS score
- All private sector-driven projects worth RM50 million and above must achieve a minimum of 50 IBS score

Unfortunately, only 24% of public projects worth RM10 million and above have attained an IBS score of 70 in 2014 according to the Implementation Coordination Unit (ICU), Prime Minister's Department Malaysia.

Since private-sector projects typically account for at least 60% of the overall value of construction works done in any given year, this directive or target can be expected to provide a fillip to IBS utilisation nationwide. To encourage further IBS adoption by the private sector, the CIDB recommended one additional requirement, namely projects worth over RM50 million must achieve a minimum 50 IBS score to deserve the issuance of the Development Order (DO) in Greater Kuala Lumpur by 2018 and in Selangor, Penang and Johor by 2020.

Based on findings from an extensive and broad-based consultation with relevant stakeholders, the Malaysian Timber Industry Board (MTIB) published the IBS Roadmap for Timber 2013–2023 to complement the blueprint for national IBS objectives, notably by integrating timber and wood-based products into the IBS agenda, widening their applications and expanding their variety available for market use.

Of late, a growing number of construction players began to recognise the significance and tremendous potential of IBS in view of:

[9] The IBS Content Scoring System (IBS Score) is a systematic and structured assessment system used to measure in a consistent manner the content or usage of the IBS products, components, techniques and elements in construction works and projects. The calculation is based on a predetermined standard formula that comprises three major parts, namely Score for Structural Systems (maximum 50 points), Score for Wall Systems (maximum 20 points) and Score for Other Simplified Construction Solutions (maximum 30 points), mostly outlined in CIS 18:2010 Manual for IBS Content Scoring System (IBS Score), a CIDB publication. Although no changes to the scoring calculation were proposed, the CITP 2016–2020 captures the essence similar to the Singapore benchmark by recommending tightened IBS-related requirements.

Table 1.3: Levels and targets of average IBS content 2012–2015 in private-sector projects by type of buildings (adapted from a table on IBS content for the private sector in the IBS Roadmap 2011–2015 as underscored in Research on IBS Adoption in Government and Private Projects in Malaysia 2013)

	Residential (landed)	Residential (non-landed)	Commercial (shopping centres and offices)	Industrial (factories and warehouses)	Institutional (schools)
2012	-	50	50	50	50
2013	45	50	50	50	50
2014	45	55	55	55	55
2015	45	55	55	55	55

Source: CIDB, CREAM

Table 1.4: Observed average IBS scores in public- and private-sector projects by type of buildings in 2014 (adapted from a table on IBS scores based on Research on IBS Adoption in Government and Private Projects in Malaysia 2013)

Projects	Type of Buildings		
	Residential	Non-Residential	Social Amenities
Government projects	Overall: 70	Overall: 80	Overall: 76
Private-sector projects	Overall: 65 Landed: 61 Non-landed: 70	Overall: 63 Commercial: 67 Industrial: 62	Overall: 64 Schools: 68

Source: CIDB, CREAM

a. The ever-increasing demand for affordable housing and faster completion of projects
b. Escalating construction costs, one of the major factors for soaring property prices
c. Subpar productivity gains in the construction sector due largely to the labour intensity of the CBM, particularly low-skilled workers
d. Heightened concerns about labour issues, especially related to safety, health and general working conditions
e. Shifts in architectural trends and customer preferences towards higher material and natural resource optimisation, energy efficiency, green technology and other ecological credentials

A few buildings and structures using IBS include the refurbished Bukit Jalil Sports Complex and Games Village, the Petronas Twin Towers and stations of the LRT and MRT lines.

CHAPTER 2: APPROACH AND METHODOLOGY

Over the past 15 years or so, studies by way of survey questionnaire conducted by the CIDB and/or CREAM themselves or in collaboration with third parties mostly focused on (i) the levels of awareness and acceptance of IBS in general, (ii) readiness levels, catalysts, challenges and key success factors for IBS adoption, (ii) advantages and usage intensity of IBS products and components in construction works and projects, and (iv) the implementation progress of various roadmaps and blueprints for the construction sector in general and/or IBS in specific. In contrast, this particular CBA study attempts to:

a. Assess, in a systematic and data-driven manner, the positive and negative consequences of IBS adoption and usage, not only to the construction sector (despite focusing more on buildings, both residential and non-residential, instead of infrastructure), but to almost all aspects of society and the entire economy
b. Provide, to the extent possible, a summary of estimated pros and cons of IBS adoption and usage as a whole in order to ultimately affirm the 'superiority' of IBS over all other building methods or systems
c. Determine, to the extent possible, the most accurate structure, and entire value and supply chain of the IBS industry; identify its core segments and clusters for each segment; approximate their size and contributions to the economy; and capture the various linkages between the IBS industry, construction sector and other economic sectors in order to maximise the net benefits to society and the whole economy

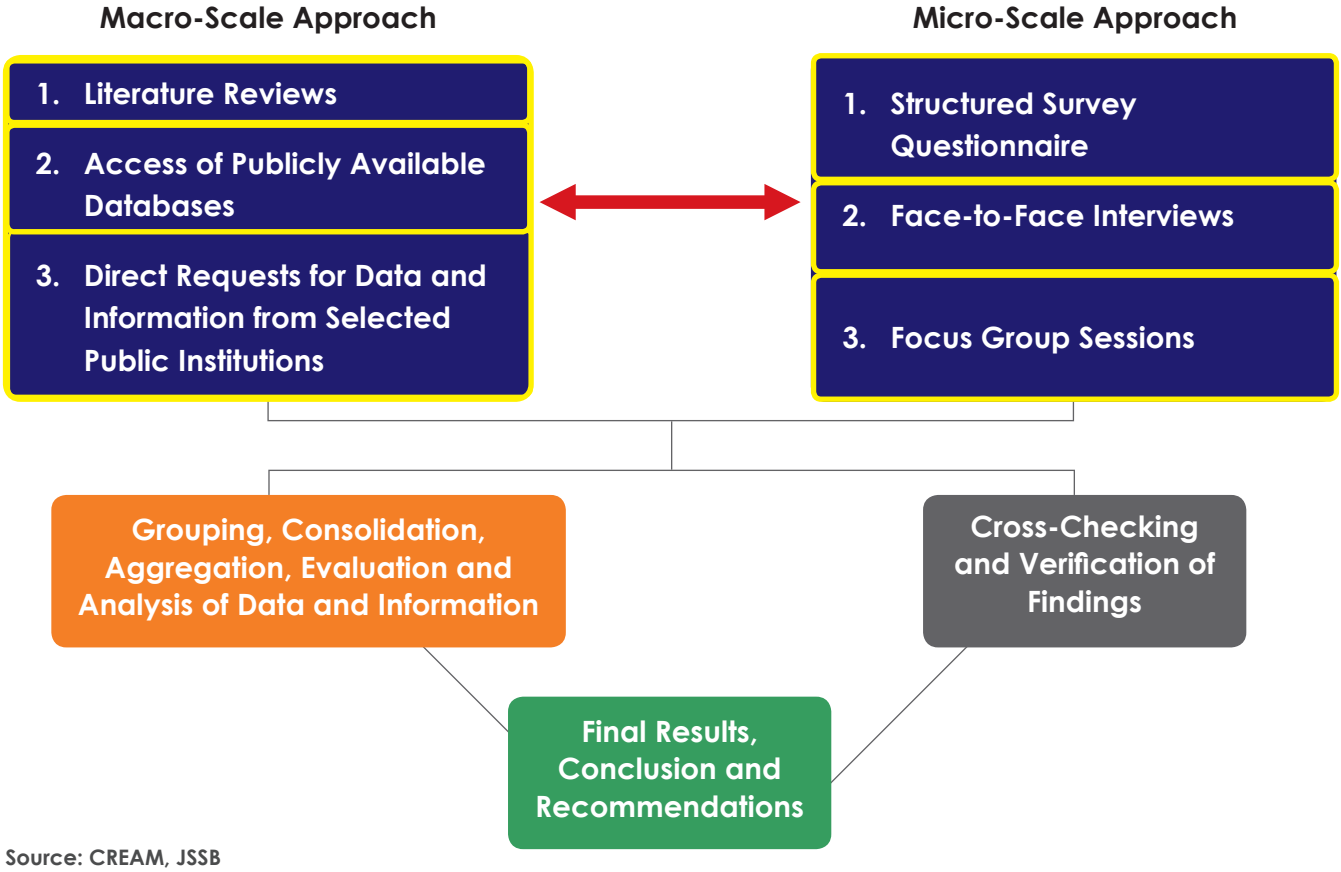
2.1 Research Framework

In essence, comprising both quantitative and qualitative research methods as well as macro-scale and micro-scale analytical approaches to achieve the objectives as discussed in Chapter 1, this study was conducted by way of:

a. Reviews of relevant domestic and international literature as well as access of information databases available in public domain, including Malaysia's House of Representatives' hansard archives
b. A standard and well-structured questionnaire distributed among identified IBS stakeholders or value-chain participants but specific for each category of respondents; face-to-face interviews and focus group sessions to obtain primary data and adequate information for case study comparisons, to the extent possible
c. Secondary data analysis whereby facts and findings are obtained from information and statistics generated, collated and compiled by public institutions at every level of government, notably federal ministries, government agencies and statutory bodies that maintain a specific database for these data and statistics, which may or may not be accessible to the public

Findings emanating from the quantitative and qualitative research methods as well as macro-scale and micro-scale analytical approaches would then be grouped, consolidated, aggregated and analysed further as well as cross-checked and verified to arrive at a conclusion comprising final results and recommendations.

Figure 2.1: Overall research framework



Source: CREAM, JSSB

2.2 Chronology and Description of Research Activities

During the 16 August 2016 meeting at the IBS Centre to present the Framework for the Interim and Final Report of the CBA study, the list of six categories of respondents and the draft survey questionnaire for each category were approved by representatives from the CIDB and CREAM. These categories are:

a. All construction players, being the major intermediate IBS users apart from relevant industry/professional associations, if any

b. All producers, importers, distributors and suppliers/vendors of raw materials, natural resources and semi-finished goods for the purposes of manufacturing and production of finished IBS products and components, whether registered or not with the CIDB apart from relevant industry/ professional associations, if any

c. All manufacturers, importers, distributors and lessors of machineries and equipment for use in processing all inputs to ultimately manufacture and produce finished IBS products and components as well as to ensure transportation, storage, installation, erection and other services for use by ex-factory IBS products and components, whether registered or not with the CIDB apart from relevant industry/professional associations, if any

d. All manufacturers, assemblers, importers and distributors of finished IBS products, components, techniques and elements registered with the CIDB apart from relevant industry/ professional associations, if any

e. All providers of transportation, storage, installation, erection and other services for use by ex-factory IBS products, components, techniques and elements, whether registered or not

with the CIDB apart from relevant industry/professional associations, if any

f. Selected end-customers and relevant NGOs, notably KKR, JKR, KKBPKT, state governments and PBTs, i.e. those not listed under selected public institutions at every level of government for the purposes of secondary data analysis

The survey questionnaire was developed based on an intuitive list of existing and potential benefits and costs, both tangible and intangible, which were itemised after undertaking thorough literature reviews. Any effects deemed desirable are categorised as benefits, while undesirable effects are considered as costs. The questionnaire for each category of respondents, accompanied by the CIDB letterhead, was subsequently sent using the ordinary postal system by the beginning of the fourth week of August 2016 to some 450 potential respondents in total.

Unlike most of the previous studies conducted by the CIDB/CREAM, the survey target audience for this CBA study consisted of business establishments or organisations instead of construction projects, since this study aims to identify and evaluate, to the extent possible, all impacts of IBS adoption. Focusing on construction projects would make the CBA study too construction-centric, contrary to the very essence of the IBS industry that cuts across all economic sectors.

As such, the definition for a potential IBS project as 'a construction project bearing a project value of at least RM10 million' did not apply in this study, while the list of potential respondents or the sample size was determined according to their ability to provide crucial data and information that should meet the objectives of this CBA study insofar as they fall under IBS stakeholders and value-chain participants as elaborated at length in Chapter 1. In fact, the questionnaire did not make any distinction between construction of infrastructure and buildings.

Although there were six slightly different sets of structured questionnaire for each category of respondents, the general skeleton of the questionnaire was laid out into six major parts as follows:

a. Background information
b. Financial performance and customer relations or customer satisfaction and loyalty (for Category 6 only; Appendix 6)
c. Socio-economics
d. Human capital: Mindset, knowledge, expertise and experience
e. Corporate governance and competitive forces
f. Safety, health and environment

Since the purpose of conducting this survey was precisely to capture raw data to enable estimations or value assignments in RM and not preferences or rankings[10], most of the questions in the questionnaire were open-ended, which would require deep thinking and cross-checking with various departments or divisions within an organisation. In total, some 20 organisations participated in the survey exercise, with only one organisation taking up the offer to have a face-to-face interview while the attempt to boost the response rate by holding a series of focus group sessions was barely successful. While respondents were promised a copy of the final report of this study as a token of appreciation, no Contractor Continuous Development (CCD) points were awarded for participation.

Initially given one month to respond to JSSB with the duly filled-up questionnaire and the signed Consent Letter, the extension of the deadline by another three months did not improve much the take-up rate among the respondents. As a mitigation measure, literature reviews and efforts to access databases available in the public domain,

[10] Price-based revealed preference model vs. stated preference model

notably for data and information from public institutions, were intensified to have an even better understanding of the IBS industry and to reduce an over-reliance on the primary data resulting from the survey exercise.

As a matter of fact, the seeming under-par primary data, whether in terms of collection size or quality, is not really a concern since availability of and accessibility to wide-ranging secondary data reign supreme for this CBA study in achieving its objectives. The objectivity, impartiality and non-discrimination of secondary data will go a long way in addressing concerns about subjective and biased findings of primary data analysis.

By mid-October 2016, a special exercise to gather specific data and information relevant to IBS from various federal ministries, government agencies and statutory bodies was set in motion by sending a letter on the CIDB letterhead via ordinary postal system to the following recipients:

- Ministry of Works (MOW)
- Ministry of Urban Wellbeing, Housing and Local Governments (MUWHLG)
- National Property Information Centre (NAPIC)
- Ministry of Finance (MOF)
- Economic Planning Unit (EPU)
- Inland Revenue Board (IRB)
- Royal Malaysian Customs Department
- Department of Statistics Malaysia (DOSM)
- Bank Negara Malaysia (BNM)
- Securities Commission (SC)
- Ministry of International Trade and Investment (MITI)
- Malaysian External Trade Development Corporation (MATRADE)
- Malaysian Investment Development Authority (MIDA)
- SME Corporation Malaysia (SME Corp)
- Ministry of Domestic Trade, Cooperatives and Consumerism (MDTCC)
- Ministry of Human Resources (MOHR)
- Ministry of Health (MOH)
- Department of Occupational Safety and Health (DOSH)
- Ministry of Home Affairs (MOHA)
- Ministry of Foreign Affairs (MOFA)
- Ministry of Education (MOE)
- Ministry of Higher Education (MOHE)
- Ministry of Agriculture and Agro-Based Industry (MOA)
- Ministry of Plantation Industries and Commodities (MPIC)
- Ministry of Energy, Green Technology and Water (MEGTW)
- Ministry of Natural Resources and Environment (MNRE)
- Ministry of Science, Technology and Innovation (MOSTI)
- Malaysia Productivity Corporation (MPC)
- Employees Provident Fund (EPF)
- Social Security Organisation (SOCSO)

The idea of this request for specific data and information, which could be otherwise 'scattered' and 'hidden' within this small group of public institutions, was to gather and regroup these valuable data and information under one roof, namely the CIDB. By the second week of December 2016, this special exercise among selected public institutions was reinitiated via email, together with the scanned copy of the CIDB letterhead and the Excel spread sheets containing the entire list of specific data and information requested but properly spread out to facilitate onward transmission directly to JSSB.

About half of these 30 recipients confirmed to return their responses, while three of them requested a face-to-face session at their premises, which JSSB obliged by sending representatives. Almost all of those who confirmed their participation returned their full or partial data and information as requested. In the interim, secondary data gathering was stepped up, while proxy statistics and results of

past studies were considered after a certain cut-off date.

All data and information, in particular from primary sources, were grouped, consolidated, adjusted, approximated and aggregated, where applicable. Given the low number of eventual participants in the survey exercise, using Excel was perfectly sufficient for analysis purposes. As a rule of thumb, no part of the feedback compiled via the survey questionnaire from primary sources will be attributed to any individual or organisation in the final technical report without their prior written consent detailing the areas or points for specific attribution. To the extent relevant and possible, all data and information derived from primary and secondary sources were leveraged on in performing the following steps:

a. Identify and predict all existing and potential impacts, positive or desirable and negative or undesirable of IBS adoption over a period of time using compounded annual growth rate (CAGR), any regression methods (simple, linear, logistic and polynomial, among others) or other modelling techniques, whichever applicable
b. Select the most appropriate measurements or metrics to estimate or convert impacts into a common temporal footing and currency in a consistent manner, notably via opportunity-cost analysis, cost-effectiveness analysis, cost-utility analysis, risk-benefit analysis, return-on-investment analysis, economic-impact analysis, fiscal-impact analysis, welfare analysis and sensitivity analysis, whichever applicable
c. Monetise these impacts by assigning monetary values (in RM) to the extent possible
d. Discount future impacts to derive present values where applicable
e. Conclude with a sum of final net benefits and distribution of all impacts across society and the entire economy

A CBA is supposed to present the best estimates of benefits or desirable effects and costs or undesirable effects. The selection of metrics of measurements to evaluate any impacts would depend a lot on data availability and ease of evaluation. Given the difficulty of assigning values to certain impacts, particularly if they are intangible, not traded on a market or in the absence of adequate data series, any assumptions made to arrive at those estimates would be detailed to improve the analysis. In such cases, non-market valuing techniques can be considered, such as using market proxies with many similarities in characteristics to estimate the value of a non-market good or service

In addition, a detailed qualitative approach, supported by as much evidence and data as possible to enhance transparency and integrity of the analysis, would also be appropriate in lieu of RM values. In short, the resulting estimations or value assignments for desirable (benefits) and undesirable (costs) effects in this CBA study shall fall under three categories:

- Monetisable
- Quantifiable but not Monetisable
- Qualitative but not Quantifiable nor Monetisable

All results were interpreted, cross-checked and validated for consistency and accuracy. While the majority or the essence of findings from primary data analysis would be pieced together to the extent possible in Chapter 3, some of its minor but still consequential elements can be found in Chapters 4 through 6 for cross-reference purposes. As such, the last three chapters, namely Chapters 4 through 6, would mostly interpret findings from secondary data analysis.

CHAPTER 3: BUSINESS PERSPECTIVES

This chapter attempts to assess the impacts of IBS adoption from the business and corporate viewpoints. Findings from primary data analysis should provide the basis for this chapter but not by much. Given the multitude of challenges in obtaining primary data from the micro-scale approach, especially via the survey exercise as elaborated at length in Chapter 2, data sufficiency, relevancy and reliability in this chapter could be limited. Sections 3.1 to 3.3 represent strengths and opportunities, while Sections 3.4 and 3.5 draw our attention to shortcomings and risks associated with IBS.

3.1 Reduction in Completion Time and Costs Equal Improved Financial Sustainability and Business Viability

It has been revealed by various studies in the past that IBS implementation may result in significantly shorter project duration and ultimately lead to cost savings for construction projects - given the potential for repetitive use of various machineries and equipment for different types of projects - to the advantage of construction players, particularly builders, real estate developers and contractors, being major IBS users apart from other participants in the IBS value and supply chain. Subsequently, these advantages for construction works and projects can be summarised as follows:

a. Faster average time to complete projects and deliver to customers thanks to higher automation, mechanisation and advanced technologies; various simplified processes and procedures; and less vulnerability to weather conditions
b. Cost reductions that can be delineated into various fronts, such as overall manpower/payroll, building materials, machineries and equipment, waste management and other overheads
c. Substantial improvement to cash flows and eventually profit margins

If we deconstruct further the financial performance of various IBS value-chain participants at all layers from turnover (top line) and costs right down to profitability (bottom line), we should be able to identify the following financial gains that IBS can bring as opposed to CBM:

a. Lower manpower-related costs and risks owing to more precise working hours and less overtime costs; less labour requirements, especially on-site, which are mostly filled by unskilled foreign workers given the higher degree of mechanisation and automation at centralised plants to manufacture IBS products and components; and fewer work crew conflicts at construction sites
b. Lower total construction costs and project risks for builders, real estate developers and contractors owing to:
    - Shorter construction period and timely project delivery to end-customers due to compressed project schedules
    - Faster turnaround time for each on-site activity, especially due to simplified and systematic installation and erection processes and procedures, and better sequencing of work flows and scheduling of workforce
    - Less costs and risks related to building materials owing to higher economies of scale and cost-effectiveness with the mass production of IBS components and elements at plants, and reduced requirements for on-site storage of materials, hence lower risks of misplacements, losses or thefts
    - Timely and cost-effective delivery of IBS components to construction sites thanks to effective planning and

coordination as well as systematic storage and transportation services
    - Less wastage, especially in terms of unused materials and duplication of workers
    - Unique features that IBS epitomises such as accuracy, precision and excellent organisation in almost all aspects, virtually weather- and accident-proof construction approach, among others

c. Lower maintenance and depreciation costs of machineries and equipment for IBS manufacturers, as the highly repetitive and reusable nature of most machineries and equipment for a long period makes the initial capital expenditure (Capex) worthwhile (for instance, moulds to cast building materials can generally last at least 10 years)

d. Contributions of a variety of tax incentives to profitability that the federal government provides to promote IBS usage and foster growth of the IBS industry, including:
    - Discounts on levy charges such as an exemption to the tune of 0.125% of the total project value with a minimum IBS score of 50 for builders and contractors
    - Accelerated Capital Allowances (ACA) over three years on the purchase of moulds used in the production and manufacturing of IBS products, components, techniques and elements

e. Enhanced efficiency and effectiveness as a result of integration of processes and procedures, and hiring of skilled and specialised IBS workers

f. Easier for project clients to introduce value innovations in the business strategy canvas (Blue Ocean Strategy)

It has been proven by various studies that IBS can reduce the building and completion time of construction works and projects by 30% on average[11]. For instance, a McKinsey Global Institute (MGI) study published in an October 2014 report entitled A Blueprint for Addressing the Global Affordable Housing Challenge revealed that total construction costs could be reduced by up to 30% and completion time shortened by about 40%–50% if construction companies and property developers resorted to industrial construction approaches such as IBS, value engineering and efficient procurement methods.

The turnaround time for each on-site activity should be faster with IBS since according to MGI, 'many on-site construction activities can be shortened by 20%–30% when incidental activities such as assembling tools and materials, collecting waste or even speaking with supervisors are reduced, shifted to other workers or eliminated'. Applying value engineering principles and introducing capital productivity measures alone could reduce costs by 20%–30%. Meanwhile, MGI also estimated that builders of affordable housing in developing economies typically enjoy operating profit margins of 15%–20%.

Without a doubt, shorter duration to complete construction works and projects will bring down the overall construction costs, particularly due to lower labour requirements. Since labour cost is estimated to account for up to 30% of total construction costs of a typical residential project, findings from the survey exercise among IBS value-chain participants - which suggest that IBS adoption could lower requirements for workers, especially on-site, by at least 20% - would certainly bring down labour costs and eventually total construction costs. As an illustration, according to various studies, it is estimated that a typical 30-storey building would require a crew of 70 workers in a shorter time frame with IBS usage as opposed to 400 workers and a longer period under the CBM environment[12].

[11] Productivity Report 2014/2015 published by MPC

[12] Page 27, Productivity Report 2015/2016 published by MPC

Building materials typically make up between 30%–50% of total construction costs before the addition of logistics and transportation costs[13]. Mass production at factories should help IBS manufacturers achieve economies of scale and continuous quality improvements of IBS components and elements owing to lower per-unit fixed costs, which are spread out over a large number of goods produced, and reduced per-unit variable costs arising from operational efficiencies and synergies. As a result, construction companies and property developers would enjoy cheaper building materials, which they could pass on to end-customers.

Assuming on average, total construction costs and project risks could be lowered by 30% thanks to IBS adoption while maintaining gross or operating profit margins of construction companies at 20%, deriving from the top end of:

a. the average of findings from the survey exercise conducted among IBS value-chain participants for the purpose of this CBA study (-25%) and the results estimated by MGI (-30%) for reduction in overall construction costs (and project risks)
b. MGI's estimates for typical operating profit margins among builders of affordable housing in developing economies of 15%–20%

Taking the overall value of the construction works done (CWD) published by DOSM every quarter as the basis, two additional assumptions are considered as follows:

a. Full or extremely high IBS implementation for all types of CWD in all sub-sectors (residential, non-residential, civil engineering and special trades) with an IBS score of at least 70 for both public-sector and private-sector projects

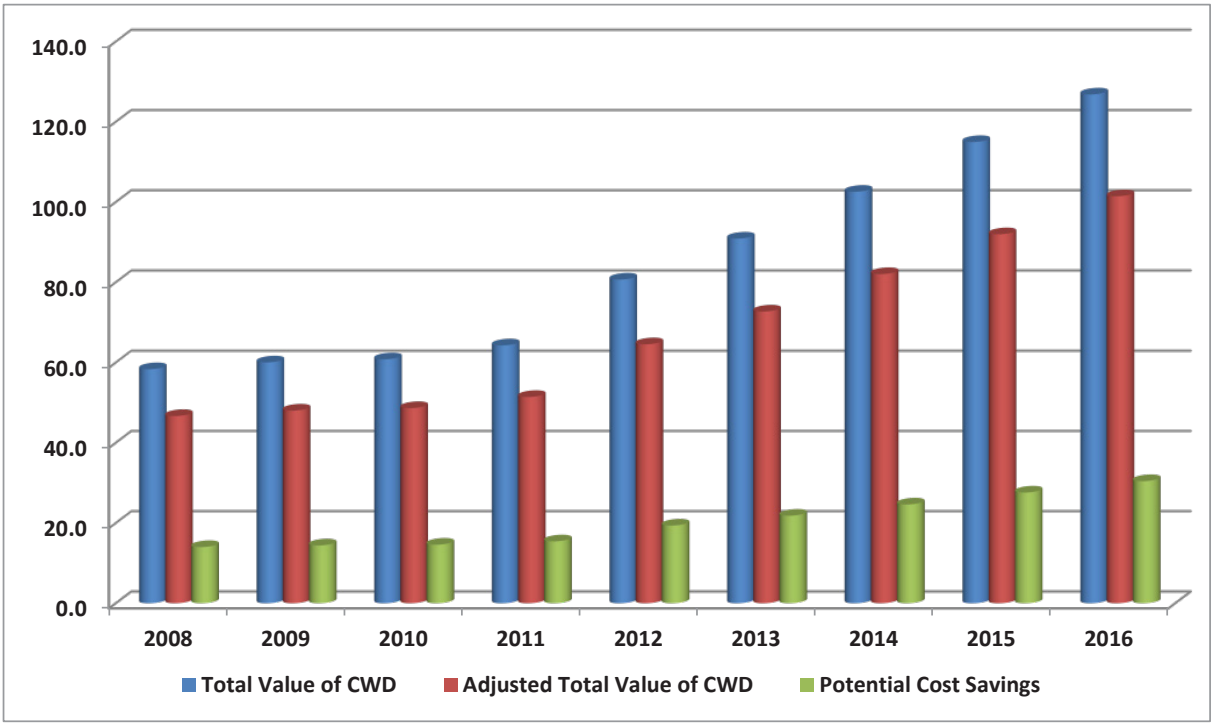
[13] Page 91, Productivity Report 2014/2015 published by MPC

Table 3.1: Averages of survey findings for selected financial metrics

Items	Changes (+ denotes increase, - denotes decrease) due to IBS
1. Total construction costs and risk for builders, real estate developers and contractors	-25%
• Manpower costs (on-site workers)	-15%
- Labour requirements, especially foreign workers	-20%
- Degree of mechanisation and automation	+30%
• Construction period	-20%
- Turnaround time for each site activity	-20%
- Delivery time to end-customers	-20%
• Building material costs and wastages	-15%
• Waste management costs	-20%
• Energy usage	-40%
2. Utilities costs	-33%
3. Maintenance and depreciation costs of machineries and equipment	-10%
4. Efficiency and effectiveness	+10%
5. Cashflows	+12%

Source: JSSB

Figure 3.1: Observed and/or estimated annual total amounts of CWD, adjusted CWD and potential construction cost savings (RM billion)



Source: DOSM, JSSB

b. The final value of construction works and projects charged to the clients or project owners would usually comprise total costs, direct and indirect, incurred to complete construction projects and project risks such as variation orders (VOs), fluctuations due mostly to inflation and other relevant events that may result in claims for expenses or losses, among others, and gross profit margins

To estimate the potential cost savings, calculations should be based on the annual adjusted total value of the CWD, which would infer total construction costs and project risks without the pre-tax profit or mark-up amount. As a result, it is estimated that full or very high IBS adoption could have generated an annual cost savings of almost RM14 billion in 2008 and RM30.4 billion in 2016 or an average of RM20.25 billion over a nine-year period. These cost savings, if realised, would result in substantially cheaper buildings that the clients or project owners could pass on to end-customers.

3.2 Creation of New Business Opportunities

In many ways, IBS and CBM are poles apart, be it in philosophy, basic principles, processes and procedures, competencies and skills sets, especially in the conceptual, design and construction stages. IBS requires a high level of collaboration among all parties involved to attain:

a. Cohesive coordination and integration of the architectural, civil and structural, mechanical and electrical aspects during the design stage

b. Good planning and precision in order to well execute the transportation, assembly and erection of manufactured components at the site during the construction stage

With a different approach to supply chain, planning, scheduling, handling and material purchasing, for instance, IBS should bring about fundamental changes to the way construction activities are undertaken. Thus, almost all of the following IBS value- and supply-chain participants from upstream to downstream shall unearth new business opportunities and hence incremental revenue potential with IBS adoption:

a. Producers, importers, distributors and suppliers/vendors of raw materials, natural resources and semi-finished goods for use in IBS component manufacturing and production
b. Manufacturers, importers, distributors and lessors of machineries and equipment for the purposes of IBS component manufacturing and production as well as for use by services providers to, among others, transport, store, install and erect ex-factory IBS products and components
c. Manufacturers, assemblers, importers and distributors of finished IBS products, components, techniques and elements
d. Providers of transportation, storage, installation, erection and other services for use by ex-factory IBS products, components, techniques and elements
e. Construction players, including builders, real estate developers, contractors, companies providing construction-related ancillary services, companies providing consultancy and other support services

3.3 Customer Acquisition and Retention

IBS could contribute a great deal to customer loyalty and customer base enhancement, which reflects higher reputational gains and customer/user satisfaction as a result of increased professionalism, productivity, effectiveness and efficiency vis-à-vis:

a. Quality and durability aspects of the built environment[14], which include:
    - Improved construction quality, longer building life and better finishing or workmanship owing to higher quality of IBS products, components, techniques and elements that are achieved with advanced technology, modern practices and processes adopted, careful selection of building materials used and highly sheltered or controlled production environment
    - Higher consistency and standardisation, as designing is based on standard template(s)
    - Easier but better quality control or assurance, hence lower risks of construction defects as well as preventive maintenance and repairs
b. Cost effectiveness and value for money for customers or end-users either due to lack of valid reason(s) to pass on any cost increases to customers or even better, higher potential of transfer of construction cost savings to customers as a result of:
    - Lower Capex costs, given the suitability of formwork, block work and framing systems for repetitive use
    - Faster project completion and hence lower risks of cost overruns that end-customers eventually may have to bear
    - Lower labour costs, given the higher degree of machine utilisation at IBS manufacturing plants or reduction in activities at project sites and hence less on-site labour requirements

[14] A term used in social science to describe man-made surroundings, places, spaces and landscape that provide the setting for human activities. Created and modified by humankind, the built environment ranges from buildings, physical infrastructure and transportation systems to water bodies and parks. As opposed to natural environment, it has also been defined as 'the humanitarian-made space in which people live, work, and recreate on a day-to-day basis'.

- Lower preventive maintenance and repair costs for building owners thanks to better finishing

c. Speed of construction or respect of construction schedules, i.e. timely completion or even ahead-of-schedule completion of projects, thanks to a reduction in the duration of each on-site activity since on-site works are mainly required to erect prefab or ready-made components instead of producing them apart from the possibility of simultaneous resumption of foundational earthworks at construction sites and manufacturing of precast elements at factories:
   - Timely delivery of projects or even earlier, taking possession or occupation of buildings thanks to less vulnerability to human errors, adverse weather conditions, and supply interruptions of electricity and water, among others
   - Faster resumption of economic activities and income trickle-in arising from the ahead-of-schedule use of the completed buildings (and infrastructure)

d. Flexibility in the architectural framework of buildings and the design of precast elements, overcoming the issue of monotony or repetition of designs as well as allowing different systems to produce their own unique prefabrication models

3.4 Construction Players' Qualms

As findings from the survey exercise among IBS value-chain participants for the purpose of this CBA study and literature reviews would suggest, the relatively low take-up rate of IBS in Malaysia compared to many developed nations, and even some regional neighbours, could be due to the reluctance to use IBS or low acceptance/usage of IBS among builders, real estate developers and contractors led by:

a. Insufficient demand for IBS-based buildings and properties from end-customers

b. Lack of understanding of customer needs and requirements

c. Unfamiliarity with IBS or lack of previous technical experiences and expertise in IBS due to insufficient knowledge of or inadequate exposure to IBS technology, as the construction of IBS-oriented buildings and projects requires high degrees of accuracy, precision and technical know-how in planning, coordination, designs and installation/ erection, leading to continued preference for CBM

d. Misperceptions of higher overall construction costs[15] and project risks, hence not economical or feasible for small-scale construction players, in particular those who may not enjoy guaranteed continuity of construction projects or the element of repetitiveness. These misperceptions are deemed to be caused by:
   - The current procurement practice of IBS components, whereby a substantial advance must be paid upfront to IBS manufacturers by contractors who have been awarded the construction projects even before receiving the initial payment (a portion of the total contract value) from the clients or project owners while local contractors run short of cash most of the time, overwhelming them with a massive financial burden[16]

[15] A groundless and even erroneous perception by some quarters that IBS could cause a 10% cost increase compared to CBM.

[16] According to a study by Nawi et al., 2007, a client typically pays the contractor between 10% and 25% of the total contract value as an initial payment in a CBM project. However, according to Nawi et et al., 2005, in an IBS-based project, the contractor is expected to advance IBS manufacturers up to 75% of their Capex to ensure on-time delivery of IBS components.

- Requirements to manufacture IBS components for very high quality or super-grade materials, which may be in short supply in Malaysia; to ensure an uninterrupted supply, IBS manufacturers will have to import and assume a variety of risks, in particular related to foreign exchange losses and non-delivery of materials according to specifications
- Importation costs of foreign technology and expertise as well as purchase or lease of expensive machineries and equipment by IBS manufacturers that could make way into the pricing structure of finished IBS products and components
- Perceived higher adoption costs due mostly to lack of standardisation of IBS component specifications[17]
- Significantly higher wages for highly skilled workers or those with machine-oriented skills
- Contributions to a specific human capital development fund for talent pool deepening
- Inadequacy in tax incentives as the CIDB's levy exemption of only 0.125% of the project value for housing projects with a minimum IBS score of 50% effective 1 January 2005 is not sufficient to cover additional costs (for example, a property developer or contractor of a housing project worth RM1 million is entitled to get only a paltry exemption sum of RM1,250)
- Expenses incurred for storage, transportation, installation, erection as well as other coordination- and logistical-related limitations, particularly if construction sites are far away from IBS manufacturers or suppliers

e. Shortage of on-site and factory-based professionals trained and experienced in IBS at reasonable pay, from general workers and designers to engineers and land surveyors for moulding and fabrication at manufacturing facilities as well as project management, logistics, planning, coordination, assembly and erection of IBS components at construction sites

f. Lack of R&D activities, new technologies, support services and testing labs to render IBS more productivity enhancing, innovative and creative

g. Unfounded fears of customer rejection or unjustified and unfavourable public perceptions towards IBS-based buildings in general and relatively poor demand from the public/ customers reflecting bad publicity surrounding:
    - The misfortune of victims of abandoned construction projects, especially housing
    - Perceptions of IBS suitability only for high-rise buildings or changes in designs to allow IBS usage in other types of buildings would be costly are among the causes of low popularity of IBS among potential buyers, especially of landed residential properties
    - Perceived low-quality buildings, wrongly associated with the low-cost image due to misunderstanding about the differences between industrialisation and simplification of designs
    - Unsubstantiated blame as the cause of cracks and leakages, which are in reality due to poor designs and technical inaccuracies
    - Perceived inflexibility and uneconomicality to undertake renovations or changes
    - Perceived limitations in terms of aesthetic value in architecture and designs, given the high standardisation

[17] The CIMP 2006–2015 estimated that costs of IBS building materials would be 10% higher than under CBM due to lack of standardisation.

Table 3.2: Averages of survey findings for customer satisfaction scores (out of 100) of IBS vs. CBM

Items	IBS	CBM
1. Overall quality and durability of buildings	80	70
2. Prevalence of defects on buildings	No major defects reported	Several instances of defects reported
3. Degree of aesthetic value in architecture and designs	80	70
4. Understanding of and knowledge about customer needs and requirements	80	80
5. Speed of construction works and projects	70	70
6. Respect for project completion and customer delivery schedules	70	70
7. Cost effectiveness and value for money in pricing of buildings	70	70
8. Economicality and flexibility to undertake renovations or changes	80	80
9. Suitableness and responsiveness to creativity and innovation	80	80

Source: JSSB

- Unsubstantiated blame as the cause of impediment to creativity and innovation, especially in designs due to perceived rigidity and inflexibility of IBS products and components

h. Limited availability and choice spectrum of IBS products and components as a result of low competition and quasi-monopolistic conditions within the IBS component manufacturing segment, which raise issues related to economies of scale and supply continuity for direct IBS users, namely builders, real estate developers and contractors - insufficient number of available IBS manufacturers and/ or their overconcentration in certain areas, too far from construction site locations

i. Wrongful perceived inconsistency in quality of available IBS products and components

j. Mindset-related issues such as resistance to change in general

3.5 Misgivings about Investing in Manufacturing Facilities for IBS Components

Findings from the survey exercise among IBS value-chain participants for the purpose of this CBA study, and to a certain extent literature reviews, would suggest that the low interest in embarking on production or manufacturing activities of IBS products and components among investors can be attributed to the following factors:

a. Lack of understanding of customer needs and requirements

b. Relatively low demand from direct IBS users, namely builders, real estate developers and contractors

c. Lack of previous experiences and expertise in IBS due to insufficient knowledge or exposure to IBS technology

d. Absence of quality control oversight, especially among smaller manufacturers due to lack of enforcement by relevant authorities

Table 3.3: Comparative business performance between IBS and CBM

	Building Methods	
	CBM Construction	**IBS Construction**
Costs	Higher labour, material, equipment and other overhead costs	Significant cost savings with lower expenditure on labour, materials, equipment and other overheads
Speed	Longer construction period due to disaggregation of components, which are difficult to install and erect, apart from higher risks of delays in project completion	Shorter construction period thanks to easy installation and erection of components, apart from lower risks of delays in project completion because of faster turnaround time and free from weather-related adversity
Wastage	Wastage of materials such as steel, bricks, cement, concrete and timber estimated to be close to 10% of total materials used in a project	Wastage of materials such as timber, cement, brick, soil and concrete estimated to be less than 5% of total materials used in a project
Quality	Higher risks of low quality and poor finishing due to over-reliance on workmanship/craftsmanship, which could lead to higher maintenance and repair expenses, both preventive and reactive	Potential of higher quality and better finishing thanks to mass production of standardised but meticulously designed components in a controlled environment, which could result in lower maintenance and repair expenses, whether preventive or reactive

Source: CIDB, CREAM

e. Perceptions of prohibitive cost factors, especially due to massive Capex requirements to build plants and purchase or lease expensive machineries and equipment
f. Huge initial investment/capital outlay required for potential manufacturers of finished IBS products and components to reach economies of scale
g. Shortage of skilled and semi-skilled workers at reasonable wages for the IBS component manufacturing environment

These are among the barriers that may be holding back new investments into the manufacturing segment of the IBS industry to assemble and produce finished IBS products and components. The truth is, notwithstanding a rather high initial Capex, beyond a certain breakeven point, the overall benefits of industrialisation and mass production will kick in and increase in tandem with the number of units of IBS products and components manufactured.

3.6 Strengths-Shortcomings Balance

Project owners or clients could enjoy up to RM30.4 billion in cost savings in 2016 from full or very high IBS adoption that, if materialised, can be passed on, all or partially, to end-customers in the form of much cheaper buildings.

The limited acceptance or reluctance to adopt IBS among builders, property developers and contractors due to a host of factors has led to a rather low IBS take-up rate in Malaysia compared to their peers in the developed world and even some neighbouring countries such as Singapore and Thailand. This has a compounded lack of interest among potential investors to consider venturing into the manufacturing of IBS products and components.

Since other advantages or desirable effects and shortcomings or undesirable effects are difficult to evaluate or not that straightforward to estimate in the absence of credible proxy data, a table on productivity in Research on IBS Adoption in Government and Private Projects in Malaysia 2013 has been reworded and adapted to become a comparative summary of business performances between IBS and CBM, as demonstrated in Table 3.3.

CHAPTER 4: SOCIO-ECONOMIC AND POLITICAL PERSPECTIVES

This chapter focuses more on the potential socio-economic and political implications as a result of IBS adoption. Sections 4.1 to 4.7 attempt to describe the strengths and opportunities of IBS, while Sections 4.8 and 4.9 point out its shortcomings and risks.

4.1 Emergence of New and/or Expansion of Existing Sub-sectors

The major economic upshot of full-fledged, if not very extensive implementation of IBS would be the emergence of new and/or sustainable expansion of existing sub-sectors in other non-construction sectors, in particular manufacturing and services, and their respective sub-sectors:

a. Manufacturing sector
   - Assembly and production of finished IBS products, components, techniques and elements
   - Production of semi-finished inputs that will be combined together with other raw materials and natural resources, and transformed into finished IBS components and elements
   - Production of machineries and equipment as part of the heavy industry blueprint[18] for use in:
     - the processing and transformation of raw materials, natural resources and semi-finished goods into finished IBS components and elements
     - the provision of services to transport and install/erect ex-factory IBS components and elements at construction sites, such as special lorries, hydraulic truck mobile cranes and tower cranes, among others

b. Services sector
   - Provision of transportation, warehousing, storage, installation, erection and other services for use by ex-factory IBS products, components, techniques and elements
   - Provision of R&D, consultancy and advisory services to support the development of new and expansion of existing segments and clusters of the IBS industry
   - Provision of continuous training and skills development for IBS professionals and talents to increase the breadth and depth of the IBS industry
   - Provision of monitoring, enforcement and accreditation services to ensure that the quality of IBS professionals/ talents is superior and the quality of the finished components are either maintained or improved

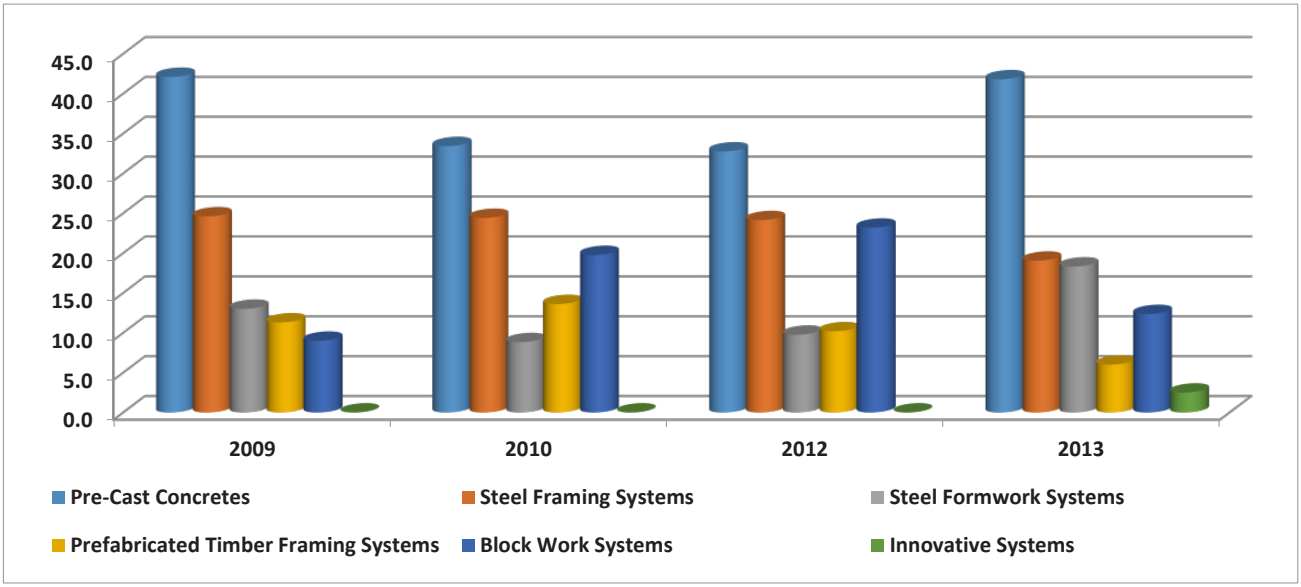
[18] As opposed to light industry, heavy industry is highly capital intensive and requires workforce with advanced technical knowledge and specific skills sets. Given its tremendous potential, capitalising on rising demand from domestic IBS players, efforts to promote the domestic production of machineries and equipment for use by the IBS industry will result in the emergence of a new high-profile manufacturing sub-sector while ensuring access to reasonably priced machineries and equipment, not subject to high import duties, which could go as high as 30% for certain types.

Table 4.1: Costs of ex-factory IBS products and components used by the construction sector according to six clusters (RM'000)

Manufacturing Clusters of IBS Products and Components	2009	2010	2012	2013
Pre-cast Concrete as well as Framing, Panel and Box Systems	82,833	210,069	482,371	862,643
Steel Framing Systems	48,407	153,429	355,433	391,984
Steel Formwork Systems	25,584	55,491	143,722	377,882
Prefabricated Timber Framing Systems	22,252	85,514	150,037	124,016
Block Work Systems	17,699	124,187	341,426	254,892
Other Innovative Systems	0	0	0	51,544
Total	**196,775**	**628,690**	**1,472,990**	**2,063,961**

Source: DOSM

Figure 4.1: Share of six manufacturing clusters of finished IBS products and components out of total number of IBS manufacturers (%)



Source: DOSM, JSSB

Since the IBS industry cuts across all five major economic sectors, it would make a lot of sense to estimate the size of each IBS segment as expounded in Chapter 1 to eventually arrive at the approximate value of the IBS industry as a whole in Malaysia. Unfortunately, relevant data sets to enable such an operation are few and far between. Even if they are available, they are either too inadequate, infrequent or even inaccessible to allow meaningful calculations.

At present, it would appear that only the size of the manufacturing segment of finished IBS products and components can be measured by considering the construction sector's expenditure on IBS products and components. Assuming that 129.8% (the average growth rate for the 2009–2010 period was at 219.5% and the 2012–2013 period was at 40.1%) is the CAGR for expenditure on IBS materials and components by construction players, the size of this IBS component manufacturing segment (by expenditure approach) can be estimated to be worth RM25.048396 billion in 2016, accounting for about 9.1% of the manufacturing sector.

4.2 Expanding the GDP Base

Proper implementation of the IBS agenda could unleash the potential for a more detailed, accurate and comprehensive picture of economic activities and an enlargement of the GDP base, as collation of value-add data to compute the GDP by sectoral approach could be more in-depth, thorough and hence effective owing to:

a. Clearer demarcation of economic activities. For example, activities at off-site plants (and even on-site) related to the processing and transformation of natural resources, raw materials and semi-finished inputs into finished IBS products and components will be adequately captured in the manufacturing sector, while building activities in a strict sense (sensu stricto) using finished IBS products and components will be properly accounted for in the construction sector
b. Reduction in risks of incomplete or inadequate coverage of economic activities due to the existence of underground or shadow economy or the absence/under-coverage of newly emerging industries that would require advanced statistical methodology and/or under-reporting of certain economic activities by industry players, more often for tax avoidance purposes

The Input-Output Tables[19] (IOTs) would eventually be useful to calculate estimates for the size of all IBS segments and their individual contributions to the overall GDP. IOTs can be used to examine structural changes of the economy; track production capacity, productivity and changes in shares of labour and capital across industries; analyse direct, indirect and induced effects from changes in the final demand for particular goods and/or services; and observe relative importance between industries as well as to compare price changes across industries.

IOTs are highly detailed matrices that describe production functions of individual industries as well as the interactions among and between producers and final users within the economy. In other words, IOTs show inter-industry relations of how output of an industry may become input for another, i.e. flows of goods and services that make up the production processes of industries or sale-and-purchase relationships between producers and consumers/users within the economy.

In short, IOTs demonstrate flows of intermediate and final goods and services defined according to industry outputs (industry by industry tables) or according to product outputs (product by product tables). A product-by-product IOT shows how much each product is being used as input for the production of another product. Similarly, it shows how much of each product is consumed or used by different consumers or user categories (households, businesses, government and non-profit organisations serving households, among others).

[19] IOTs are part of the statistical and macro-analytical framework to organise a copious amount of data and information required to capture to the extent possible all economic activities that take place or goods and services produced or income generated in the economy after making use of all types of input in calculating the GDP.

Table 4.2: IOT mapping for Malaysia's construction sector 2000 vs. 2010 (RM'000)

	2000		2010	
	Domestic Production	**Imports**	**Domestic Production**	**Imports**
Stone, clay and sand quarrying	1,397,110	3,431	2,223,557	231,640
Apparel	2,658	152	11,295	27
Footwear	55,640	50,623	-	-
Sawmill products	823,015	246,160	-	-
Other wood products	190,243	32,479	-	-
Furniture	8,543	101	-	-
Paper and board	84	-	-	-
Veneer sheets, plywood, laminated and particle boards	-	-	2,553,601	390,834
Builders' carpentry and joinery	-	-	1,118,430	226
Printed products	268	-	-	-
Industrial chemicals	206	-	-	-
Paints and lacquers	217,281	-	-	-
Paints and varnishes	-	-	476,320	241,039
Soap and cleaning preparations	1,168	-	-	-
Other chemical products	800	-	-	-
Petrol and coal products	320,367	295,392	-	-
Petroleum refinery	-	-	2,291,607	1,015,394
Rubber products	91,263	-	-	-
Plastic products	2,261	-	456,409	203,437
China, glass and pottery	890,994	1,158,925	-	-
Sheet glass and glass products	-	-	302,395	167,882
Clay and ceramic products	459,222	389,743	1,716,414	750,438
Cement, lime and plaster	1,178,055	17,234	3,686,109	310,065
Concrete and other non-metallic mineral products	-	-	5,629,102	404,674
Iron and steel products	3,138,798	1,797,201	7,193,792	4,914,328
Other fabricated metal and fixtures	-	324	-	-
Structured metal products	777,768	21,115	-	-
Basic precious and non-ferrous metals	-	-	54,387	665,924
Casting of metals	-	-	1,591,475	218,149
Structural metal products	-	-	548,732	107,296
Other fabricated metal products	789,350	1,289,865	174,092	145,038
Industrial machinery	106,439	859,999	-	-
General purpose machinery	-	-	469,396	1,127,129
Special purpose machinery	-	-	29,493	53,505
Household machinery	371,020	25,481	-	-
Domestic appliances	-	-	22,097	221,015
Other electrical machinery	603,945	1,363,088	-	-

Insulated wires and cables	-	-	138,645	1,006,418
Electric lamps and lighting equipment	-	-	183,136	2,413,567
Motor vehicles	56,931	3,292	-	-
Other products	22,728	10,470	-	-
Other manufacturing	-	-	46,956	12,480
Repair and maintenance	-	-	23,219	-
Electricity and gas	139,324	-	272,789	1
Waterworks	33,164	-	91,752	131
Buildings and constructions	192,504	1,314,252	-	-
Residential	-	-	4,469,082	70,833
Non-residential	-	-	860,791	491,761
Civil engineering	-	-	453,353	-
Special trade works	-	-	746,427	27,576
Wholesale and retail trade motor vehicles	2,358,292	-	5,523,705	31,217
Hotels and restaurants	235,558	-	-	-
Restaurants	-	-	89,974	-
Transportation	770,053	2,068	-	-
Land transportation	-	-	701,473	-
Air transportation	-	-	26,777	-
Highway, bridge and tunnel operation services	-	-	5,786	-
Communications	239,467	-	5,577	5,357
Telecommunications	-	-	186,745	19,667
ICT and computer services	-	-	9,939	2,111
Banking services	84,772	-	192,479	8,953
Other financial services	52,515	-	-	-
Insurance	134,339	-	160,303	57,141
Real estate	742,007	-	1,517,541	
Rental and leasing	-		3,465	4,968
Professional services	-	-	1,079,864	554,326
Business services	586,183	1,039,045	90,127	-
Education - Private	9,994	-	-	-
Entertainment	173	0	-	-
Repair motor vehicles	61,988	-	-	-
Other private services	-	-	13,383	34,578
Total Intermediate Input	19,615,402	10,321,352	47,441,990	15,923,557
Total Input	44,537,636	10,321,352	47,441,990	-
Total Output	-	-	91,361,903	-

Source: DOSM, MPC

Among the major highlights when comparing IOTs for 2000 vs. 2010 include:

a. Emergence of new line segments or industries such as veneer sheets, plywood, laminated and particle boards; builders' carpentry and joinery; basic precious and non-ferrous metals; casting of metals; structural metal products; insulated wires and cables; electric lamps and lighting equipment; highway, bridge and tunnel operation services; telecommunications; ICT and computer services; rental leasing; and professional services
b. Expansion of existing line segments or industries such as sawmill products into sawmilling and planning of wood, and drugs and medicines into pharmaceuticals, chemicals and botanical products
c. Breakdown or sub-division of existing line segments or industries into new ones such as buildings and constructions into residential, non-residential, civil engineering and special trade works; transportation into land transportation, water transportation, air transportation and other transportation services; hotels and restaurants into accommodation and restaurants, among others
d. Disappearance or exit of certain line segments or industries such as rubber primary products, coconut, tea, crude coal, ice and knitted fabrics, among others

With the IBS industry cutting across a multitude of industries in all five major economic sectors, future IOTs can be expected to reflect better structural changes of the Malaysian economy, taking into account the emergence and/ or rising importance of new and existing IBS segments.

4.3 Establishing Other Positive Spillover Effects

Apart from the more direct GDP-related impacts, i.e. economic growth, other positive spillover effects from IBS adoption could be on the cards, particularly in the form of:

a. Production of new employment opportunities and hence the creation of a new breed of construction professionals while moving up the value and supply chain, notwithstanding the destruction of certain types of occupations
b. Increase in wages, household incomes[20] and wealth creation, especially among Malaysians, with the deepening of the pool of knowledge-intensive and skilled labour that is consistent with the developed, high-income nation targets by 2020[21] and hence positive for consumer spending or private consumption
c. Creation of new business opportunities, especially for small-medium enterprises (SMEs), a catalyst for entrepreneurship

[20] In Malaysia, the four sources of income that can be received by or accrued to a household comprise income from gainfully paid employment; self-employment; various types of investments such as property, stocks and unit trusts, and current or cash transfers.

[21] As outlined in the Eleventh Malaysia Plan 2016-2020, Malaysia is targeting a Gross National Income (GNI) per capita, or in short, per capita income of USD15,900, exceeding the minimum requirement of USD15,000 to join the league of developed, high-income nations on the back of an average real GDP growth of 5%-6%. As a result, the economy should create some 1.5 million job opportunities.

Table 4.3: Employment by categories of skills 2010–2020

	2010		2015 (Estimated)		2020 (Forecasted)	
	Number ('000)	Workforce (%)	Number ('000)	Workforce (%)	Number ('000)	Workforce (%)
Skilled workers	3,306.2	27.6	3,858.8	28.0	5,351.7	35.0
Semi-skilled workers	7,291.9	61.0	8,530.7	61.9	8,927.2	58.4
Low-skilled workers	1,360.4	11.4	1,391.9	10.1	1,013.1	6.6
Total employment	**11,958.5**	**100.0**	**13,781.4**	**100.0**	**15,292.0**	**100.0**

Source: Appendix A5-4, 11MP 2016–2020

As at end December 2015, the construction sector provided significant employment opportunities for 1.3099 million people, accounting for 9.3% of Malaysia's total employed persons of 14.0677 million. However, the ratio of citizens to non-citizens in the construction sector's workforce was 43.1% to 56.9%, the most foreign worker-dominated compared to other sectors. With the emergence of new and/or further expansion of existing sub-sectors, industries and clusters as well as the creation of new business opportunities thanks to IBS, the economy should observe:

a. Creation of new types of occupations, both generalists and specialists, including factory workers, designers and engineers at IBS component manufacturing facilities as well as machinery developers, mould makers, planners, erectors/installers and crane operators, among others, at other workplaces
b. Higher sophistication of existing jobs such as IBS-certified talents and experts among ICT professionals, engineers, designers, architects, quantity surveyors, estimators, project managers and even workers at construction sites

During the 11MP period, the number of skilled workers is projected to increase by 6.8% on average (+3.1% in 10MP), as opposed to 0.9% for semi-skilled workers (+3.2% in 10MP) and -6.2% for low-skilled workers (+0.5% in 10MP). This explains why one of the CITP's initiatives is to encourage continued investment in skills upgrading and human capital development with the objective of providing more than 30,000 skilled and certified graduates for the construction workforce by 2020.

Based on findings from the Household Income and Basic Amenities Survey (HIS & BA) and the Household Expenditure Survey (HES) that the DOSM conducted over 12 months in 2014 as shown in Table 4.4, consumer expenditure tends to increase in tandem with the rise in household incomes, which count wages and salaries as the largest sources.

Consider the following assumptions and calculate vis-à-vis the 2015 levels:

a. A 3.12% increase in total labour force, which represents a 20-year average growth during the 1996–2015 period
b. A more conservative reduction in the number of registered foreign workers by 1%, 2% and 3% until the share of foreign

Table 4.4: Monthly household incomes and consumption expenditure

	Median Monthly Household Income			Mean Monthly Household Income			Mean Monthly Household Consumption Expenditure		
	2012 (RM)	2014 (RM)	CAGR (%)	2012 (RM)	2014 (RM)	CAGR (%)	2009 (RM)	2014 (RM)	CAGR (%)
Overall	3,626	4,585	11.7	5,000	6,141	10.3	2,190	3,578	9.8
Urban	4,238	5,156	9.8	5,742	6,833	8.7	2,465	3,921	9.3
Rural	2,372	3,123	13.8	3,080	3,831	10.9	1,599	2,431	8.4

Source: DOSM

workers out of the total labour force is down to around 13%, only about 2% better than the 11MP target of 15% by 2020, while anything beyond, namely the 4% and 5% reductions, represent stress test or stretch goal situations

c. GNI per capita[22] as a proxy for household incomes

As a result, the hypothetical amount of private consumption in nominal terms could turn out as in Table 4.5. Taking the results that correspond the closest to the 11MP's target of keeping the share of foreign workers out of the labour force at 15% by 2020, a hypothetical reduction of 1% to the number of registered foreign workers vs. the 2015 levels would translate into a RM18.979 billion increase in the nominal private consumption amount.

[22] Average income earned per person or total income received both domestically and abroad [GDP plus product taxes (minus subsidies) not included in output valuation plus net receipts from primary income (employee compensation and property income) earned abroad by residents] divided by the number of mid-year population.

Table 4.5: Predicted amount of nominal private consumption (RM'000) vs. the 2015 levels (positive impact)

	-1%	-2%	-3%	-4%	-5%
Labour Force (million) at +3.12%	14,970,962	15,438,056	15,919,723	16,416,418	16,928,611
Number of Foreign Workers	2,113,685	2,092,334	2,070,984	2,049,634	2,008,000
Share of Foreign Workers out of Labour Force (%)	14.12	13.55	13.01	12.49	11.86
GNI Per Capita (RM)	37,192.19	38,740.19	40,336.49	41,982.59	43,680.05
Private Consumption Amount (RM million)	645,217.95	688,888.99	733,922.56	780,361.19	828,248.70
Variance (RM million)	18,978.95	62,649.99	107,683.56	154,122.75	202,009.70

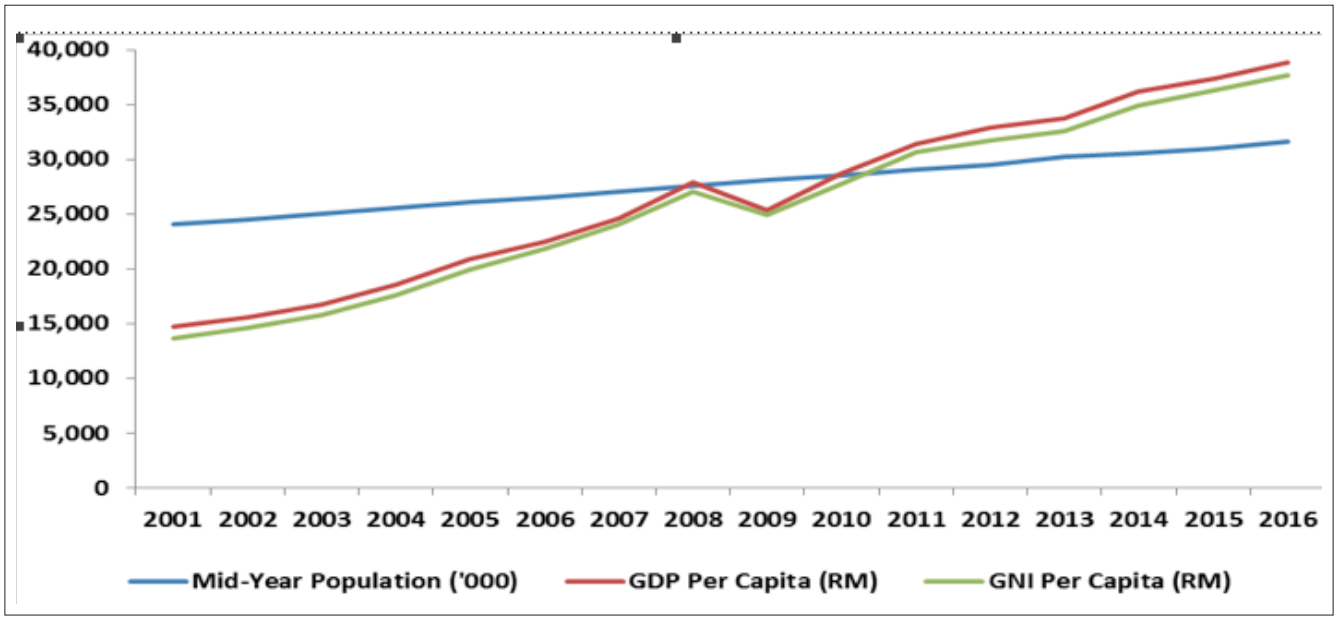
Source: JSSB

Table 4.6: New definition of SMEs across sectors (effective 1 January 2014)

Sector	Micro-Enterprise	Small Enterprise	Medium Enterprise
Manufacturing	Amount of annual sales/turnover < RM300,000 or number of full-time employees < 5	Amount of annual sales/turnover from RM300,000–RM15 million or number of full-time employees from 5–75	Amount of annual sales/turnover from RM15 million–RM50 million or number of full-time employees from 75–200
Services and Other Sectors		Amount of annual sales/turnover from RM300,000–RM3 million or number of full-time employees from 5–30	Amount of annual sales/turnover from RM3 million–RM20 million or number of full-time employees from 30–75

Source: SME Corp, BNM

Figure 4.2: Malaysia's population, GDP and GNI per capita



Source: BNM, DOSM, JSSB

Given the irreversibility of mechanisation, automation, computerisation, digitalisation and robotisation, there is no choice but to embrace this steadily emerging and entrenching trend. In view of the intensity of these characteristics within the IBS industry, no doubt such an advanced and technology-based construction method is the way forward to create new high-paying jobs that are consistent with workers' rising skill sets. With high IBS adoption, the IBS industry as a whole can be expected to create new jobs, not only within the construction sector but also in other sectors, especially manufacturing and services.

Table 4.7: CIDB's new definition of SMEs in the construction sector[23]

Type	Definition	Contractor Category
Micro-Enterprise	Amount of annual sales/turnover < RM200,000 or number of full-time employees < 5	G1
Small Enterprise	Amount of annual sales/turnover from RM200,000–RM1 million or number of full-time employees 5–19	G1–G3
Medium Enterprise	Amount of annual sales/turnover from RM1 million–RM5 million or number of full-time employees 20–50	G4–G5

Source: CIDB

Table 4.8: CIDB's contractor grades[24]

Grade	Minimum Paid-Up or Accumulated Capital	Tendering Capacity
G1	RM5,000	< RM200,000
G2	RM25,000	< RM500,000
G3	RM50,000	< RM1 million
G4	RM150,000	< RM3 million
G5	RM250,000	< RM5 million
G6	RM500,000	< RM10 million
G7	RM750,000	No limit

Source: CIDB

Table 4.9: Breakdown of SMEs according to size

Size of SMEs	Number of Establishments	Percentage of Total
Micro-Enterprises	496,458	77.0%
Small Enterprises	128,787	20.0%
Medium Enterprises	19,891	3.0%

Source: SME Corp

[23] Page 115, CITP 2016–2020 publication

[24] Page 114, CITP 2016–2020 publication

Table 4.10: Sectoral breakdown of SMEs

Sector	Number of Establishments	Percentage of Total
Services	580,985	90.0%
Manufacturing	37,861	5.9%
Construction	19,283	3.0%
Agriculture	6,708	1.0%
Mining and Quarrying	299	0.1%

Source: SME Corp

Table 4.11: SMEs by ownership

Type of Ownership	Percentage of Total
Individual	71.0%
Private Limited (Sdn. Bhd.)	18.4%
Partnership	8.5%
Others	2.1%

Source: SME Corp

Table 4.12: SMEs and employment

	Number of People Employed	Percentage of Total Employment
2013	5.1 million	57.5%
2014	6.2 million	65.0%
2015	6.6 million	65.5%

Source: SME Corp

Table 4.13: Key indicators of SMEs

	2010	2015 (Estimated)	2020 (Forecasted)	Overall 10MP (Estimated)	Overall 11MP (Forecasted)
Contribution to GDP (RM billion; 2010=100)	262.9	372.0	578.6	1,605.8	2,420.8
Average Annual Growth (%)	8.3	9.3	9.3	7.5	9.3
Contribution to GDP (%)	32.0	35.0	41.0	41.0	38.4
Exports (RM billion; 2010=100)	100.3	147.8	243.7	634.0	995.0
Contribution to Total Exports (%)	15.7	19.0	25.0	17.3	22.4
Contribution to Total 2013 Employment (%)	57.1	59.0	62.0	57.8	60.7

Source: SME Corp, EPU, DOSM

Table 4.14: List of IBS component manufacturers and distributors, and IBS contractors nationwide as at end November 2016

	Number of IBS Manufacturers and Distributors	Number of IBS Contractors
Selangor	82	1,553
Johor	35	785
Negeri Sembilan	14	414
Perak	14	400
Sabah	13	299
Sarawak	13	508
Melaka	9	192
FT Kuala Lumpur	8	1,012
Kedah	8	472
Kelantan	7	544
Pahang	7	604
Terengganu	7	548
Penang	6	628
Perlis	1	172
Total	**224**	**8,131**

Source: IBS Digest Issue 2, 2016

Pending the final results of the Economic Census 2016 (with 2015 as the reference year) conducted by DOSM since April 2016 and the Distributive Trade Census in 2014, the most recent official data on SMEs from the Economic Census 2011 revealed that there were 645,136 SMEs in 2010, representing 97.3% of all business establishments in Malaysia or 98.5% based on the new definition effective 1 January 2014.

Nonetheless, SMEs are estimated to have contributed only 32% to Malaysia's GDP in 2010 or 36.3% in 2015, most probably in great part due to their meagre size, as micro-enterprises accounted for 77% of these SMEs. Their annual turnover based on gross output value was estimated at RM507 billion in 2010.

Within Malaysia's construction sector, contractors are grouped into categories or grades according to specific size brackets: small-sized contractors (G1 to G3), medium-sized contractors (G4 to G5) and large-sized contractors (G6 to G7). SMEs within the construction sector generally fall under the G1 to G5 categories. These sub-scale SMEs collectively account for about 90% of the total construction contractors. On the other hand, most construction professionals, including architects, engineers and quantity surveyors, are sole proprietors. About 56% of all construction-related firms are Bumiputera-owned, while two-thirds of G1 contractors are Bumiputera-owned[25].

As at end-November 2016, Malaysia had in total 224 IBS product and component manufacturers (207) and distributors (17) as well as 8,131 IBS contractors, who are mostly SMEs. The uniqueness of the IBS industry that cuts across all five major economic sectors provides a good platform to step up the 11MP target of making SMEs contribute 41% to the overall GDP by 2020 or 38.4% on average during the 11MP period with 9.5 million jobs in all five major sectors[26]. SMEs within the respective segments of the IBS industry should subsequently consider forging consortia or other forms of collaboration with their counterparts in Malaysia or abroad to pool resources, expertise and technology in order to increase their overall potential.

With continuous efforts to develop the IBS industry throughout the entire value and supply chain, particularly segments within the manufacturing and services sectors, creation of new business opportunities will generate enough interest among SMEs to eventually participate in these emerging and/or expanding IBS segments. Given more stringent criteria to qualify as SMEs in the manufacturing sector, and to a lesser degree the services sector, superior quality and more deep-pocketed SMEs are expected with an increased ability to invest in advanced, productivity-driven, cost-saving and environment-friendly technologies to populate the IBS industry. Streamlining Bumiputera SMEs into certain areas of promoted IBS segments and mimicking the CITP's recommendation for Bumiputera construction contractors[27] could enable the former to create niche clusters within the IBS industry.

4.4 Unlocking Tremendous Export Potential of Selected IBS Segments

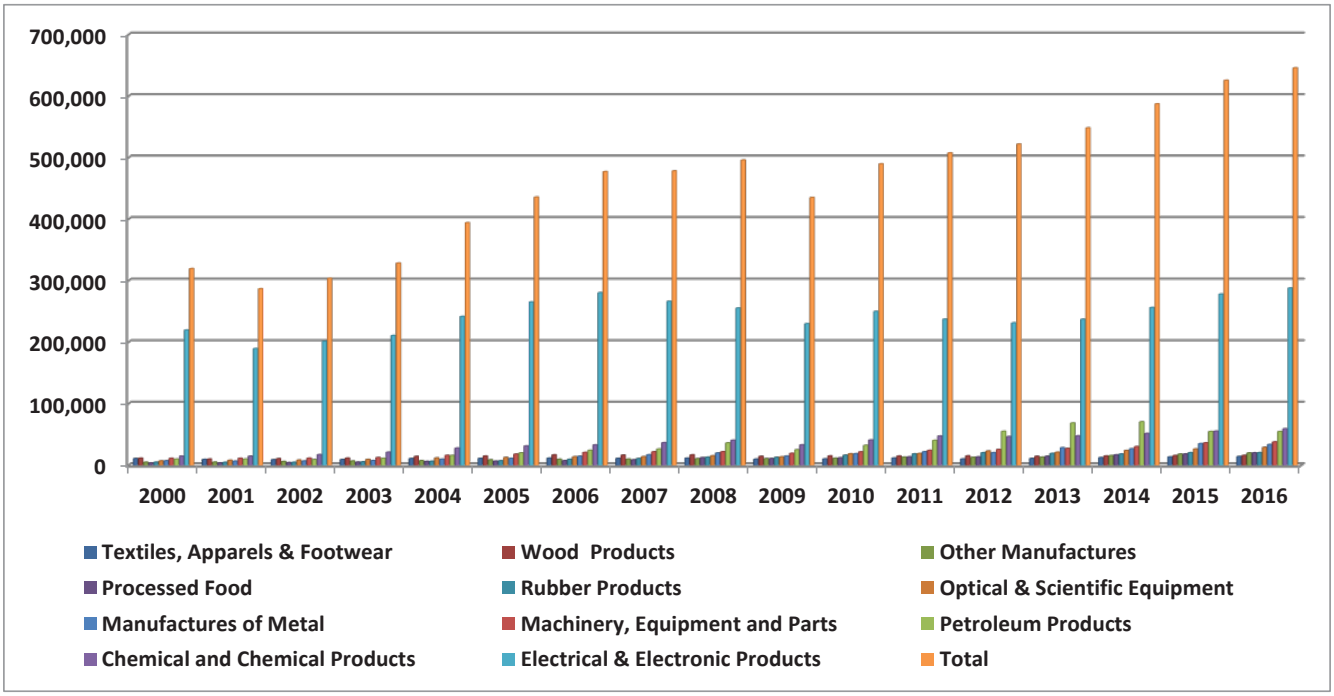
In step with the CITP's Internationalisation Strategic Thrust, a number of IBS segments such as the manufacturing of semi-finished inputs, manufacturing of prefabricated building materials and other IBS components, and the production or assembly of machineries and equipment for use by the IBS industry have the capacity to be turned into major export drivers.

[25] Pages 114 and 115, CITP 2016-2020 publication

[26] Chapter 8.14, 11MP

[27] Initiative P6: Advance SME/Bumiputera Capacity and Capability Building, Page 133, CITP 2016–2020 publication

Figure 4.3: Malaysia's selected major gross exports of manufactured goods (RM million)



Source: DOSM, BNM

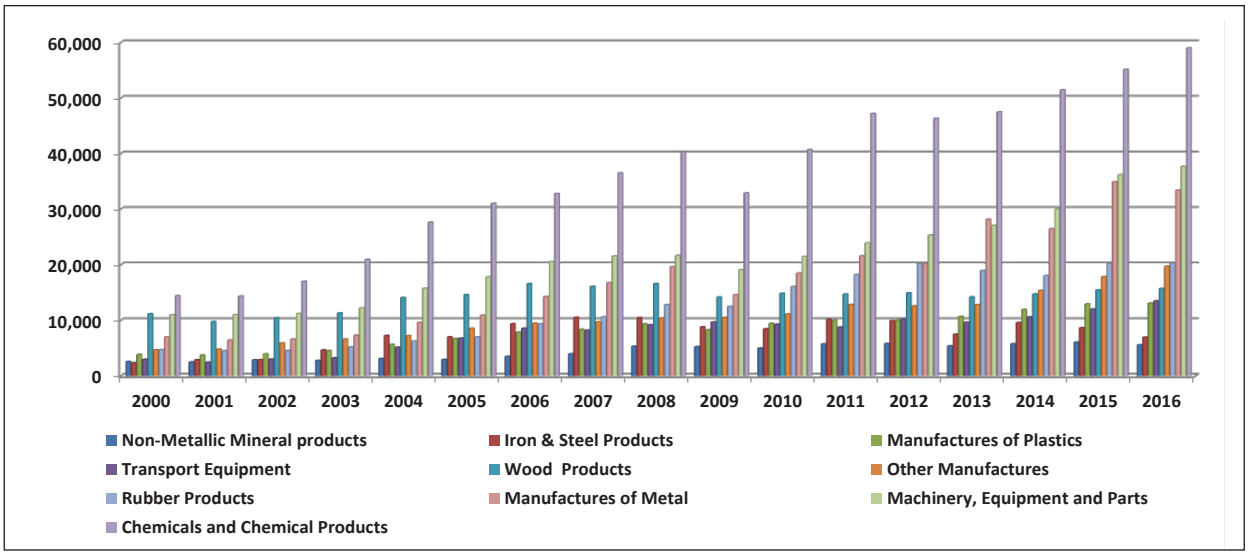
Leveraging on highly innovative technology and highly sought-after talents, these segments could serve as breeding grounds to nurture and develop Malaysian champions without compromising too much Malaysia's cost-effectiveness and price-competitiveness, especially to cater to demand within the Association of Southeast Asian Nations (ASEAN), provided strict compliance with international standards and best practices related to construction and IBS specifications is observed.

Once the critical mass for domestic needs is achieved, companies in a handful of IBS segments have the potential to sell abroad their surplus products and/or services, especially in the Southeast Asian region, so long as they meet customer requirements and the needs of these overseas markets. This overseas foray will assist larger IBS-related companies and GLCs in preparing themselves for greater global competition, as Malaysia remains committed to domestic market liberalisation while continuing to push for greater outbound market access.

It will also help prevent a saturated domestic market while allowing SMEs ample time and space to consolidate and ensure a solid footing and subsequently expand at a more sustainable pace. Spreading their wings regionally first should prove to be a good strategy for larger companies and GLCs involved in the IBS industry to gain the much-needed international experience and market know-how before going one step further: global expansion.

Electrical and electronics (E&E) industry has remained by far the manufacturing sector's largest export segment, followed by chemicals and chemical products, and petroleum products. The biggest export potential among IBS manufacturing segments only comes in fourth position in Malaysia's league of exports of manufactured goods in 2016. In a nutshell, IBS segments within the manufacturing sector are (i) exports of semi-finished inputs, (ii) finished IBS products, materials, components and elements, and machineries and equipment for use by the IBS industry that are likely to be captured in machinery, equipment and parts,

Figure 4.4: Malaysia's major gross exports of construction-related manufactured goods (RM million)



Source: DOSM, BNM

transport equipment, (iii) manufactures of metal, (iv) wood products, (v) manufactures of plastics, and (vi) iron and steel products and non-metallic mineral products. These are apart from other segments in the future, pending the emergence of new and/or sub-division of existing segments.

There is tremendous IBS export potential in three major manufacturing segments, namely machinery, equipment and parts; other manufactures; and transport equipment, not to mention exports of IBS-related services, in particular transfer of knowledge, skills, expertise and technology via training, skills development, consultancy, advisory and other educational services.

All other things being equal (ceteris paribus), consider the following assumptions and calculate vis-à-vis the 2016 levels:

a. A more aggressive impact on merchandise export outlook, whereby IBS brings about a 5%, 10%, 15% or 20% increase to Malaysia's combined export amount (of machinery, equipment and parts; other manufactures; and transport equipment) vs. the 2016 level of RM70.8473 billion

b. The 50% increase represents a stress test or stretch goal situation

As a result, hypothetically, the total exports of manufactured goods could turn out as in Table 4.15, resulting in an increase by as much as RM14.1695 billion.

Apart from expanding and diversifying Malaysia's export base and spectrum, IBS could also prove to be an excellent conduit for Malaysian businesses to make the most of globalisation, capitalising first and foremost on the ASEAN Economic Community (AEC), Regional Comprehensive Economic Partnership (RCEP) and other bilateral, multilateral or plurilateral free trade agreements (FTAs) in order to transform themselves into global or at least regional champions.

4.5 Propelling Innovation, Creativity, Productivity and Professionalism

IBS is widely seen as a push-factor to enhance capacities and capabilities, an essential element (sine qua non) to catalyse innovation, creativity, productivity and professionalism within Malaysia's construction sector and the

Table 4.15: Predicted combined export amount of IBS manufacturing segments with the most export potential and total exports of manufactured goods vs. 2016 levels (RM million)

	2016 Levels	+5%	+10%	+15%	+20%	+50%
Combined Export Amount of Three Major Potential Segments (RM million)	70,847.29	74,389.66	77,932.02	81,474.39	85,016.75	106,270.94
Total Exports of Manufactured Goods (RM million)	645,672.63	649,214.99	652,757.36	656,299.72	659,842.0	681,096.28
Percentage Increase (%)		0.55	1.10	1.65	2.19	5.49
Variance (RM million)		+3,542.37	+7,084.73	+10,627.09	+14,169.46	+35,423.65

Source: JSSB

economy as a whole. This is particularly pivotal when the construction sector has the lowest labour productivity[28] level in Malaysia due to the over-reliance on low-skilled foreign labour and limited modernisation or relatively low usage of advanced construction techniques.

With IBS, the construction sector will be more modern technology intensive and less labour intensive, particularly by reducing overdependence on foreign and unskilled workers, apart from being much safer, cleaner, faster and well executed. This is due to multiple aspects of standardisation and quality consistency of easily installed and erected components that are produced under controlled environment in a factory setting, reduced vulnerability to weather conditions, less Variation Order (VOs), shorter completion period due to all-weather construction activities, and superior quality of finished buildings (and infrastructure).

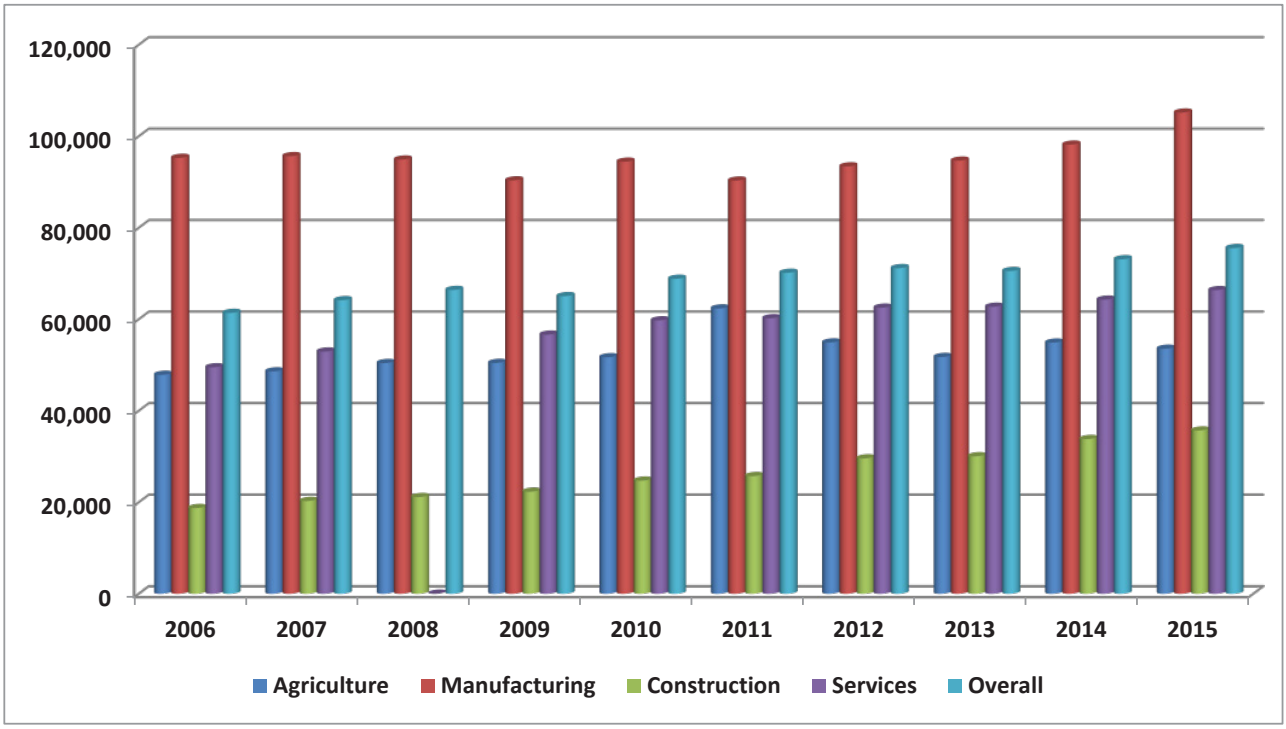
In short, being a highly mechanised and automated technology-based construction approach and low-labour intensive with a specific focus on operational excellence (OE), higher IBS usage will lead to higher productivity gains within the construction sector. OE is an element of organisational leadership and management with basic principles, systems, standards and best practices, tools and strategies to exceed or at least meet various key performance metrics or key performance indicators (KPIs). The purpose of an OE framework is to achieve and improve these deliverables, mostly related to work culture and ethics, processes and procedures, cost structure, quality and reliability of products and/or services, and customer-centric requirements, among others.

In designating an accelerated adoption of IBS as a major productivity stimulant, the CITP 2016–2020 in its Productivity Strategic Thrust aims to raise the construction sector's productivity levels by 2.5 times to USD16,500[29] per worker, matched by higher wages by

[28] Labour productivity is one of the most crucial determinants of the standard of living and long-run economic growth potential. The higher the productivity, the higher household incomes and growth trajectory shall be. Stronger productivity gains will help Malaysia achieve and retain its high income, developed nation goals.

[29] Assuming a conversion rate of USD1=RM3.7539

Figure 4.5: Malaysia's sectoral labour productivity levels (RM)



Source: MPC

Table 4.16: Malaysia's labour productivity per number of employment (2010=100)

	Levels (RM'000)		Average Growth (%)	
	2015 (actual)	2020 (targeted)	10MP (actual)	11MP (targeted)
Agriculture	53.54	68.8	1.32	3.6
Mining and Quarrying	N/A	1,210.0	N/A	1.1
Manufacturing	105.156	112.1	2.25	2.6
Construction	35.673	61.939	7.74	9.6
Services	66.346	83.4	2.13	4.1
Overall	75.538	92.3	1.2	3.7

Source: Rancangan Malaysia Kesebelas 2016–2020, "Pertumbuhan Berpaksikan Rakyat; MPC's Productivity Report 2015-2016"

2020 in sync with the 11MP goals of creating 1.5 million new jobs, especially high-skilled and knowledge-based through productivity step-ups and foreign worker reduction.

The CITP also recommended three key drivers, namely workforce, technology and processes. The workforce driver focuses on human capital improvements to raise output per worker; the technology driver deals with which and how technology can scale up overall output, expand the production frontier, and increase time and cost savings; while the processes driver attempts to make things work more efficiently and effectively through better planning and management.

Shifts in architectural trends towards customer preferences for aspects related to higher natural resource and material optimisation, energy efficiency and other eco-credentials would have a direct impact on demand for IBS-based buildings, which in turn would help boost productivity of the construction sector.

Box Article 1: Adapted from pages 8, 18 and 19 from the 23rd Productivity Report 2015/2016

Total Factor Productivity-Driven Labour Productivity Growth in Construction

The two major determinants of labour productivity are (i) total factor productivity (TFP), which measures increases in the qualitative aspects of labour and capital inputs and the efficiency in the utilisation of these inputs, and (ii) capital intensity, which represents quantitative expansion of physical capital per worker.

Being a measure of efficiency in the utilisation of inputs, TFP brings about technological dynamism, while capital intensity refers to the utilisation of capital among the workforce. Better quality inputs directly result in the generation of more outputs, especially when inputs are utilised effectively and efficiently. Investments on capital alone would not reflect higher productivity but must be complemented with efficient managerial practices and work procedures, advanced machineries and technology and skilled labour. Productivity growth means more value is added to products and services and subsequently will generate more incomes for distribution. To ensure a higher standard of living in Malaysia, higher TFP contribution towards economic growth is, therefore, a prerequisite.

Throughout 2006–2015, the productivity of all major economic sectors, except for agriculture, were mainly TFP driven. During this 10-year period, the highest TFP growth contribution to productivity was in the construction sector, and this was mainly due to the demand intensity resulting from mega construction projects nationwide. The adoption of more advanced building practices and systems such as the IBS, Green Building Index (GBI) and Building Information Modelling (BIM) also contributed to the improved performance in construction.

Source: MPC

Thus, it can be intuitively deduced that IBS is certainly an important productivity driver for the construction sector, although no specific study has so far been undertaken to objectively assess its contribution to the annual productivity gains enjoyed by Malaysia's construction sector, particularly since the turn of the 21st century.

Estimating IBS' contribution to the construction sector's productivity gains deserves a detailed study on its own. Notwithstanding the absence of an in-depth analysis to estimate productivity of the IBS industry per se and its share within the construction sector, it has been established that the following factors could affect labour productivity of construction works and projects, whether directly or inversely:

a. Material delivery patterns and practices
b. Weather conditions and geographical/ geological events - rain, inundation, droughts, winds, earthquakes and tsunamis, among others
c. Temperature and humidity levels, especially during daytime
d. Repetitiveness and replication of activities/tasks
e. Frequency of reuse of machineries and equipment
f. Crew size or number of workers at a site
g. Skills and experience levels of construction workers
h. Daily working hours and scheduled overtime, as extra work or excessive workload for an extended period may result in productivity losses due to fatigue, poor focus and low morale
i. Frequency and size of VOs, which may jack up project costs, negatively affect work schedule and disrupt the momentum of workers, among others
j. Characteristics of each construction site and general activities - site location, working environment and space, and building type and size, among others

Investments in machineries and equipment, human capital formation as well as trade and investment openness are among the prime factors influencing productivity growth trends. Through innovation, creativity and diffusion of new technologies, each of these three factors enhances productivity gains within the economy.

On the other hand, innovation and creativity, led by increased dynamism of R&D initiatives would help boost productivity and professionalism within the construction sector in general but more specifically the IBS industry as a whole. For instance, the high compatibility between sustainable and environment-friendly solutions and IBS elements and components means tremendous potential for innovation and creativity to thrive, supported by a flurry of R&D activities.

Among innovative solutions to emphasise further may include recycled containers, engineered timber products such as glued laminated timber (glulam), laminated veneer lumber (LVL), self-compacting concrete (SCC), prefab reinforcement cages and lightweight IBS blocks in the rapid construction of affordable dwellings.

However, innovation- and creativity-based R&D activities require a huge amount of capital, time and effort, although all these investments could prove worthwhile if we manage to enhance our future capabilities and capacities, churn out products and services with high-technology content but at reasonable prices for end-consumers, while strengthening efficiency and effectiveness in general.

Should Malaysia become a developed, high-income nation by 2020 as envisaged, its long-term viability, durability, stability and sustainability from almost all perspectives, especially socio-economic, will depend a lot on its ability and ingenuity to transform into an economy that accentuates productivity,

entrepreneurship, innovation and creativity (PEIC).

All four intersect with each other in the sense that I and C are among the tools to achieve productivity and entrepreneurship excellence, while P, E and I require creativity most of the time to revitalise, reinvent and reaffirm goals. A number of innovation indices on a global scale exhibit the level or status of innovativeness, especially in the battle of ideas and wits, and the innovation friendliness of countries around the world.

Table 4.17: Key details of major global innovation-related indices

Name of Index	Publisher(s) or Producer(s)	Number and Types of Countries Covered	Measurement Metrics, Assessment Parameters or Contributing Factors
Global Innovation Index (GII)	(i) INSEAD (founded in 2007) (ii) Johnson Cornell University (iii) World Intellectual Property Organisation (WIPO)	128 countries, representing 97.9% of the global GDP and 92.8% of the world's population	(i) Innovation Input Sub-Index comprising institutions, human capital and research, infrastructure, market sophistication and business sophistication (ii) Innovation Output Sub-Index comprising knowledge and technology outputs and creative outputs
International Innovation Index (III)	(i) Boston Consulting Group (BCG) (ii) National Association of Manufacturers (NAM) (iii) Manufacturing Institute (MI)	110 small and large countries as well as 50 US states	(i) Innovation Inputs comprising fiscal policy and other government policies that include education, trade, intellectual property, immigration, infrastructure and innovation environment (ii)Innovation Performance comprising patents, technology transfer, R&D investments and other R&D results; business performance (labour productivity, total shareholder returns, etc.) and impact of innovation (on employment growth, investment, business migration and economic growth)
Bloomberg Innovation Index (BII)	Bloomberg	78 countries (which reported at least 6 out of 7 categories of measurement metrics)	R&D intensity, manufacturing value-added, productivity, high-tech density, tertiary efficiency, researcher concentration and patent activity

Source: Respective websites and publications

Table 4.18: Performance of Malaysia vs. the top-ranked country on global innovation-related indices

Name of Index	Most Recent Year	Top-Ranked Country		Malaysia	
		Country	Score	Ranking	Score
GII	2016	Switzerland	66.28	35	43.36
III	2009	Singapore	2.45	21	1.12
BIII	2017	South Korea	89.00	23	66.98

Source: Respective websites and publications

4.6 Minimising Hidden Costs to the Economy

Being one of the world's largest importers of foreign workers, Malaysia, especially its construction sector, seems to have a penchant for foreign workers as its major labour source. Underpinned by low-pay, low-skilled workforce, Malaysia's construction sector has long been synonymous with intensive labour usage, characterised by a particularly high number of foreign workers (vs. the sector's share of GDP) who fill the void left by uninterested locals[30].

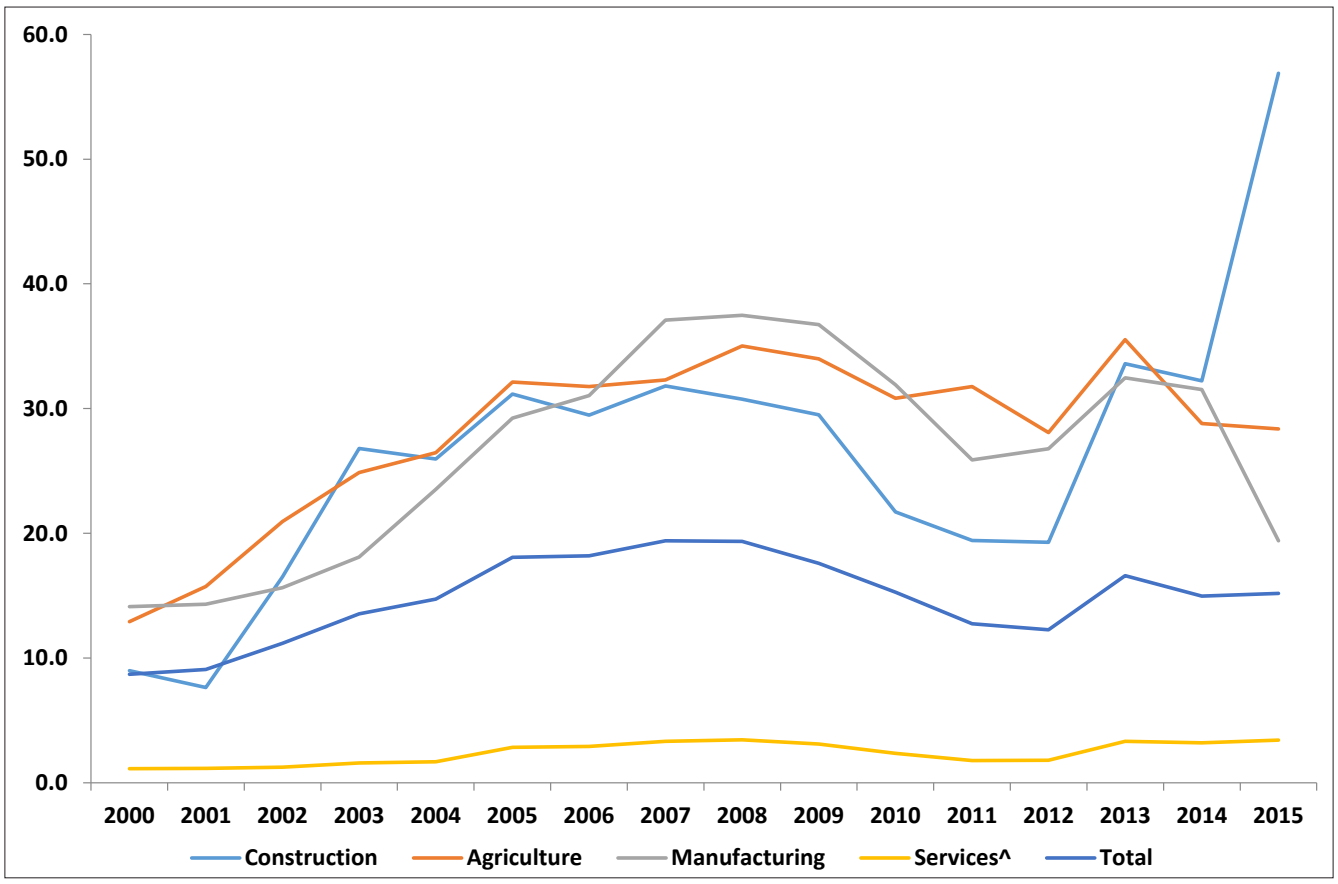
[30] Reluctance or even total lack of interest among Malaysians to take up construction employment, in particular on-site jobs, could be due to a variety of negative perceptions such as menial, repetitive, unglamorous and low-status type of jobs; tough working conditions (long working hours under the sun and sometimes rain, intense physical exertion, workplace-related safety and health risks); too frequent relocations away from home for too long and limited career progression, among others.

Table 4.19: Distribution of foreign workers across economic activities in Malaysia

Year	Construction	Agriculture^	Manufacturing	Services	Domestic Helpers	Total
2000	68,226	200,474	307,167	53,683	177,546	**807,096**
2001	63,342	222,886	312,528	56,363	194,710	**849,829**
2002	149,342	298,325	323,299	64,281	232,282	**1,067,529**
2003	252,516	350,351	385,478	85,170	263,465	**1,336,980**
2004	231,184	384,473	475,942	93,050	285,441	**1,470,090**
2005	281,780	472,246	581,379	159,662	320,171	**1,815,238**
2006	267,809	477,497	646,412	166,829	310,662	**1,869,209**
2007	293,509	503,201	733,372	200,428	314,295	**2,044,805**
2008	306,873	520,867	728,867	212,630	293,359	**2,062,596**
2009	299,575	499,910	663,667	203,639	251,355	**1,918,146**
2010	235,010	497,711	672,823	165,258	247,069	**1,817,871**
2011	223,688	451,542	580,820	132,919	184,092	**1,573,061**
2012	226,554	457,350	605,926	138,823	142,936	**1,571,589**
2013	434,200	625,093	751,772	269,321	169,936	**2,250,322**
2014	411,819	488,090	747,866	270,048	155,591	**2,073,414**
2015	745,131	497,480	450,364	293,433	148,627	**2,135,035**

Source: MOHA, EPU
Note: ^ denotes inclusion of plantation activities

Figure 4.6: Share of foreign workers out of total employment across sectors in Malaysia (%)



Source: MOHA, EPU, JSSB
Note: ^ denotes exclusion of domestic helpers

Instead of reducing the number of foreign workers to 225,000 in 2015 as targeted in the IBS Roadmap 2011–2015, the construction sector became the largest employer of foreign workers compared to other sectors or economic activities, with 745,131 migrant workers or almost 35% of total legal or documented foreign workers in Malaysia.

Apart from the construction sector, foreign workers are found in abundance in the agriculture and manufacturing sectors. Looking back, the construction sector experienced a sudden surge in foreign worker influx starting from 2002, and the rising trend persisted up to 2008 before easing slightly between 2009 and 2012. In 2013, the tally of foreign workers in the construction sector swelled beyond the 400,000 mark for the first time before reaching its highest so far in 2015.

The overall migrant labour statistics in Malaysia could be even higher if the illegal, unauthorised or undocumented foreign workers were taken into account. Some estimates suggest the combined tally of legal and undocumented foreign workers could easily exceed 4 million, which implies that the number of undocumented foreign workers to be around or slightly over 2 million.

The total documented and undocumented foreign workers in excess of 4 million would translate into an equivalent of 27.6% of the national labour force totalling 14.518 million people in 2015, a far cry from the 15%-limit set by the 11MP to achieve by 2020. The Master Builders Association of Malaysia (MBAM) estimated that in early 2016 the construction sector alone employed at least a quarter of a million undocumented foreign workers.

The Indonesian government's unilateral move in July 2015 to raise by 25% the wages of its citizens working in the Malaysian construction sector without consulting either the Malaysian government or the construction industry players could probably be the straw that broke the camel's back - the push-factor for Malaysia to urgently wean off its foreign labour dependency by increasingly resorting to advanced technology as well as highly mechanised and automated processes. Indeed, owing to its high mechanisation and automation aspects, IBS can be counted on to result in fewer labour requirements for the construction sector, especially on-site workers who are mostly represented by foreign workers, 93% of whom are estimated to be low skilled or unskilled[31]. According to a strategy paper that formed part of the 11MP, the number of these low-skilled foreign workers in Malaysia surged by 152% between 2000 and 2013.

A corollary to this is that IBS has been acknowledged as a potent answer in breaking this vicious cycle while eliminating or at least bringing down substantially several hidden costs to the economy, especially related to the overdependence on unskilled and semi-skilled foreign labour, particularly by:

a. Minimising risks or issues perceived to be associated with or brought about by migrant labour such as:
   - Huge foreign exchange outflows in the form of remittances, mostly personal transfers, which consist of all current transfers, in cash or in kind, made or received by resident households to or from non-resident households[32]
   - Concerns over losses of job security and small business opportunities among citizens
   - Risks of huge demographic shifts due to inter-marriages between locals and foreign workers
   - Social ills and public order or safety issues such as perceptions of rampant incidents of crime and worsening crime index, particularly in foreigner enclaves, among others
   - Undue pressures on public infrastructure, amenities and services - usage of virtually free public goods and other highly subsidised goods and services, especially access to healthcare and medical treatment, public transportation, education and training
   - Re-emergence of dangerous and fatal diseases that were thought to have been eradicated such as tuberculosis (TB) and the emergence of new strains of diseases such as Hepatitis B

b. Preventing negative consequences vis-à-vis domestic political landscape and social stability and equilibrium (balance of powers among various layers in society, national integration and unity, racial and religious harmony, among others)

Unfortunately, this CBA study was unable to obtain relevant data to shed light on several perceived concerns allegedly caused by migrant labour, namely:

a. Losses of small business opportunities and erosion of job security for citizens

[31] Page 107, CITP 2016-2020 publication

[32] The international concept of 'remittances' is broader than that of personal transfers, encompassing the net income generated by short-term workers abroad, i.e. Compensation of Employees in the Primary Account of the Balance of Payments (BoP) and measured net of the expenses incurred abroad for travel, transport, taxes and social contributions. Three main measures of remittances are personal remittances, total remittances, and total remittances and transfers to non-profit institutions serving households (NPISHs).

b. Risks of huge demographic shifts due to inter-marriages between locals and foreign workers through naturalisation[33] of foreign workers and/or births of children of mixed parents (Malaysian and non-citizen parents)

c. Pressures on facilities and services related to education and training at government schools (pre-, primary and secondary); government vocational and skills development institutes; public institutions of higher learning and training centres as well as public transportation facilities and services, especially land and riverain/sea modes of transportation

d. Implications for national integration and unity as well as domestic social stability and political landscape

[33] The legal act or process by which a non-citizen may acquire citizenship or nationality of the host country, either by statute/law without any effort on the part of the non-citizen individuals or they themselves apply from the relevant authorities. The rules and regulations of naturalisation may vary across jurisdictions, which may include requirements such as minimum legal residency, knowledge of the national dominant language and/or culture, and an oath of allegiance, especially a pledge to obey and uphold the country's laws and even renouncement of any other existing citizenship(s).

Table 4.20: Foreign workers' annual remittances by country of destination (RM million)

	2011	2012	2013	2014	2015
Total Remittances	15,704	18,358	22,717	28,208	34,753
Indonesia	2,497	2,957	4,281	5,315	6,208
Bangladesh	2,490	3,032	3,234	3,806	4,621
Nepal	1,725	1,990	2,693	3,178	3,649
India	423	625	1,329	1,688	1,958
Philippines	398	561	819	965	1,125

Source: Written reply to a parliamentary question on 26 May 2016

Table 4.21: Flows of secondary income account, current account under balance of payments (RM million)

Year	Net	Credit	Debit
2010	-21,790	1,920	23,711
2011	-21,061	4,683	25,744
2012	-18,469	6,661	25,130
2013	-17,498	7,597	25,096
2014	-17,443	10,496	27,939
2015	-21,896	11,912	33,807
2016	-18,724	15,872	34,595

Source: BNM, DOSM

Table 4.22: Predicted amount of annual remittances (RM million) vs. 2015 levels

	-5%	-10%	-15%	-20%	-50%
Labour Force (million) at +3.12%	14,970,962	15,438,056	15,919,723	16,416,419	16,928,611
Number of Foreign Workers	2,028,283	1,921,532	1,814,780	1,708,028	1,067,518
Share of Foreign Workers out of Labour Force (%)	13.55	12.45	11.40	10.40	6.31
Amount of Annual Remittances (RM million)	25,835.31	23,962.86	22,090.42	20,217.97	8,938.31
Variance (RM million)	8,917.69	10,790.14	12,662.58	14,535.03	25,769.69

Source: JSSB

Table 4.23: Annual federal government expenditure for public order and law enforcement

Year	Amount (RM)	Percentage of Operating Expenditure (%)
2011	7,453,165,342.93	4.08
2012	8,164,235,967.45	3.97
2013	7,924,125,057.70	3.75
2014	7,097,561,911.07	3.23
2015	8,922,457,731.26	4.11
2016*	9,095,288,597.27	4.33
Total	**48,656,834,607.88**	**3.90**

Source: Written reply to a parliamentary question on 6 April 2017
Note: * denotes preliminary statistics

Table 4.24: Non-citizens caught in serious crimes

Offences	2011	2012	2013	2014	2015
Homicide	90	69	449	575	244
Rape	72	69	203	188	126
Gang Robbery with Firearms	41	59	53	23	49
Gang Robbery without Firearms	231	551	330	250	168
Robbery with Firearms	7	8	2,815	2,371	1,739
Robbery without Firearms	54	185	814	651	592
Causing Injury	182	212	806	1,281	956
Total	677	1,153	5,470	5,339	4,074

Source: Written reply to a parliamentary question on 27 October 2016

Consider the following assumptions and calculate vis-à-vis the 2015 levels:

a. A 3.12% increase in total labour force, which represents a 20-year average growth during the 1996–2015 period
b. A more aggressive reduction in the number of registered foreign workers by 5%, 10%, 15% or 20% until the share of foreign workers out of the total labour force is down close to 10%, almost 5% better than the 11MP target of 15% by 2020, while anything beyond, namely the 50% reduction, represents a stress test or stretch goal situation

As a result, the amount of annual remittances could hypothetically be reduced by as much as RM14.535 billion as demonstrated in Table 4.22. Under the Balance of Payments (BOP) based on the Sixth Edition of the BOP and the International Investment Position Manual (BPM6), remittances are captured as outflows in two subsets of the Current Account, mostly in the Secondary Income Account and a markedly small portion in the Compensation of Employees of the Primary Income Account.

While the federal government has spent a total RM48.56 billion to ensure public order and safety, and to enforce law with emphasis on crime prevention and reduction as well as national peace, stability and security from 2011 through 2016, there is no way we can apportion the amount specifically to the immigrant populace. Should we postulate that a declining number of immigrants, especially foreign workers, could guarantee a reduction in the annual expenditure for public order and law enforcement purposes, we are implicitly alluding that most immigrants, particularly the undocumented ones, are criminals, or in other words, more immigrants lead to more crime.

Table 4.25: Non-citizens caught in property crimes

Offences	2011	2012	2013	2014	2015
Thefts	267	349	2,148	3,533	3,020
Car Thefts	162	81	3,155	1,184	1,107
Motorcycle Thefts	468	283	1,078	2,077	1,366
Thefts of Vans/ Lorries/ Heavy Machineries	12	10	112	146	117
Snatch Thefts	46	42	705	499	348
Burglary & Robbery	468	505	6,387	5,772	4,427
Total	**1,423**	**1,270**	**13,585**	**13,211**	**10,385**

Source: Written reply to a parliamentary question on 27 October 2016

Table 4.26: Overall crime index involving non-citizens in all types of crimes

	Male	Female	Total
2011	2,027	73	2,100
2012	2,292	131	2,423
2013	17,810	1,245	19,055
2014	16,966	1,584	18,550
2015	13,065	1,394	14,459

Source: Written reply to a parliamentary question on 27 October 2016

Based on the number of foreign workers and various data on foreigners implicated in criminal activities in Malaysia over the years, there seems to exist a relationship, whether weak or strong, between immigration and criminal offences, although linking migrant labour, registered or otherwise, with increased levels of crime may be far-fetched at best. For example, despite the slight increase by almost 3% in the number of registered foreign workers to 2,135,035, all crime data involving non-citizens showed a remarkable drop in 2015.

In the absence of comparative data on crimes committed by citizens and non-citizens, it would be a fallacy to conclude that immigrants pose a bigger threat to national security and public safety, although claiming immigrants are totally blameless in worsening overall crime statistics is far from the truth, too. Since the findings of some studies overseas suggest that people born abroad are less likely to commit crimes than those born in the country of residence, there is a need to undertake a thorough research into exploring wider societal trends related to immigration patterns.

Nonetheless, the federal government remains committed to lowering crime rates as well as increasing the personal safety perceptions and public confidence in law enforcement agencies with the following 11MP targets: 5% reduction annually in crime index and 60% hike in perceptions of personal safety.

Without adequate data series, it was rather arduous to link the increase in the number of foreign workers with the rise in subsidy sums in a more statistically proper manner, although intuitively, it can be safely deduced that the relationship exists since foreign workers form a sizeable domestic consumer base, which will be discussed further in Section 4.9.

Table 4.27: Subsidies for selected consumer goods (controlled items)

Consumer Goods	Period	Total Subsidy Amount	Annual Average
Sugar	2009–2013	RM2.04 billion	RM0.34 billion
Cooking Oil	2008–2015	RM8.18 billion	RM1.0225 billion
Flour	2008–2015	RM1.25 billion	RM0.15625 billion
LPG	2000–2014	RM20.89 billion	RM1.39267 billion
Diesel	2000–2014	RM74.04 billion	RM4.936 billion
Petrol	2000–2014	RM61.83 billion	RM4.122 billion

Source: Written reply to a parliamentary question on 9 March 2017

Table 4.28: Selected statistics on patients and fee collection at MOH clinics and hospitals

	2003	2015
Total inpatients and outpatients at MOH facilities	32.7 million	62.6 million
• Number of inpatients at MOH hospitals	1.7 million	2.5 million
• Number of outpatients at MOH clinics and hospitals	30.9 million	58.9 million
Collection of medical treatment fees	RM94,132,845.11*	RM353,846,985.24

Source: Written reply to a parliamentary question on 8 November 2016
Note: * denotes 2000 as the base year

While the number of people getting treatment at MOH's healthcare facilities continued to rise between 2003 and 2015 as demonstrated in Table 4.28, the share of non-citizen patients out of the total paying visits to MOH's healthcare facilities has remained surprisingly negligible at only 2% during the same period. Although in terms of the number of patients, non-citizens do not seem to exert substantial pressure on healthcare and medical facilities and services, especially at government clinics and hospitals, any record on uncollected bills from them has not been made publicly available.

No doubt, globalisation and the resulting free movements of information, goods and services, capital and particularly people could bring about much easier and faster migration of dangerous, contagious and even fatal diseases as well. A slew of news reports in recent years have warned of increasing incidences of communicable diseases such as TB, malaria, dengue fever, leprosy, cholera and typhoid. Some of these infectious diseases, TB in particular, were previously thought to have been under control.

The Foreign Workers Medical Examination Monitoring Agency (FOMEMA), a private company owned by Khazanah Malaysia Berhad, tasked to screen and check the health status of all registered foreign workers in Malaysia, revealed in early January 2016 that about 10% of those who undergo the medical screenings and examinations are infected with transmissible diseases, the most prevalent ones being TB, Hepatitis B and even HIV/AIDS. Taking into account FOMEMA's data of 1.2 million registered foreign workers on average in Malaysia who undergo its health screening tests every year, Malaysians are indeed exposed to higher risks of contracting these infectious diseases, with at least 120,000 sufferers or carriers living among us.

On top of that, potential sufferers or carriers among undocumented immigrants whose medical certificates issued in their countries of origin are mostly falsified and unreliable but subsequently slip through the cracks vis-à-vis the mandatory health screening tests. However, the fault lies more in the irresponsible and profit-oriented agents and middlemen than the undocumented migrant workers who are usually uneducated and naïve.

In a written reply to a parliamentary question in November 2016, MOH identified seven types of viruses that made an appearance for the first time or re-emerged (generally thought of having been eradicated previously), namely SARS-COV, Chikungunya (Asian genotype strain), Chikungunya (Central/East African genotype strain), Influenza A pdm 09, Avian Influenza H7N9, MERS-COV and Zika between 2000 and 2016. This was done without specifying the extent of resources - namely public funds and civil servants deployed to fight new strains and/or re-emerged diseases - or whether foreign workers have been identified as the primary vectors. Nonetheless, this CBA study was unable to get hold of any research conducted to prove that the emergence of new strains of still prevalent diseases and the re-emergence of previously eradicated diseases in Malaysia could be linked to the influx of migrant workers.

To conclusively shake off Malaysia's cheap foreign labour addiction and transform it into a knowledge-based and productivity-driven economy, the country must make clear-cut changes to some areas of its immigration and human resource policies. This includes minimising new inflows of foreign workers, especially unskilled and low skilled, while allowing existing undocumented foreign workers and refugees to register with the relevant authorities and legalise themselves at reasonable costs; shifting immigration

Table 4.29: Annual averages for selected public transportation data for 2000–2015

	Number of Users	Maintenance, Upgrade and Replacement Expenditure
Bus Services (Peninsular Malaysia)	250.8 million^	RM141.82 million^
Rail-based Transportation Services	37.3 million	RM387.85 million^
Air Transportation Services	52.3 million	N/A

Sources: Suruhanjaya Pengangkutan Awam Darat (SPAD), airport and STOLport operator(s) as derived from a written reply to a parliamentary question on 20 October 2016
Note: ^ denotes a period from 2012 to 2015

focus towards high-skilled workers and exceptional talents; introducing fixed contracts for documented foreign workers; and strengthening labour rights of foreign workers, including the rights to guaranteed social safety nets, adequate worker facilities and amenities, and participation in trade unions (which will result in higher wages for foreign workers, dampening further demand for them among employers).

4.7 Enabling Property Ownership and Keeping Property Prices in Check

The manifest relentless rise in house prices has been identified as one of the main causes of escalation in costs of living in Malaysia, notably in urban areas. This upward house outpricing can be tackled by ensuring an adequate supply of quality and comfortable homes at price ranges that are within the reach of the majority of Malaysians, both in rural and urban areas, or in other words, development of more affordable and low-to-medium cost (but not substandard quality) dwellings, both high-rise and landed.

Equipped with resource-efficient, cost-saving and productivity-enhancing technologies and techniques, IBS can be relied upon to increase the speed of construction and scale of delivery of houses, especially affordable housing, at reasonable costs. The extent of impact would be even greater should all private-sector builders, real estate developers and contractors adopt IBS in a big way.

Between 2010 and 2015, Malaysia's annual growth rates on average for the supply of properties in three main segments ranged as follows:

a. Residential properties - 1.2% to 9.2%
b. Commercial properties - 1.6% to 13.6%
c. Industrial properties - 0.0% to 9.4%

With the full adoption or a very high usage (with a minimum score of 70) of IBS components and elements within the property development market, especially the residential segment, IBS can be counted on to:

a. Ensure an adequate supply of houses, especially social and affordable homes, due to an accelerated build rate of cost-effective housing schemes on a very large scale that should more than meet the ever-increasing housing demand
b. Put a lid on property prices, the residential segment in particular, as IBS helps to reduce the overall construction costs, especially wages of site workers and building materials
c. Enable the democratisation of housing by narrowing the affordability gap[34] and ensuring increased accessibility to ownership of all types of properties, especially residential and commercial,

[34] Defined by MGI as the difference between the cost of an acceptable standard housing, which may vary by location and what buyers, households in particular, can afford to pay using no more than 30% of income.

Table 4.30: Annual growth of the Malaysian House Price Index (MHPI) (2000=100) and its selected components

Year	MHPI (2000=10)	Type of Residential Properties				Selected States					
		Terraced	Semi-Detached	Detached	High-rise Unit	Kuala Lumpur	Selangor	Johor	Penang	Negeri Sembilan	Perak
2000	6.0	6.7	6.3	5.3	1.9	10.6	5.9	11.1	2.2	6.3	4.1
2001	1.1	0.0	2.6	4.6	2.8	1.6	3.5	-12.3	2.9	4.2	6.0
2002	2.5	4.7	-0.6	0.8	-5.9	5.5	2.1	-4.1	-0.3	4.7	6.8
2003	4.0	2.9	4.0	1.3	15.1	0.9	2.8	2.1	12.6	2.3	4.6
2004	4.8	3.7	9.1	8.7	1.5	6.5	5.2	1.9	3.0	1.7	5.1
2005	2.4	2.1	3.5	4.1	1.0	6.5	0.7	-0.2	3.9	3.4	1.5
2006	1.9	1.6	1.3	6.1	1.2	5.3	0.3	0.7	1.9	0.9	3.6
2007	5.3	3.9	7.2	7.2	2.9	7.9	3.2	3.1	4.7	5.1	3.9
2008	4.7	4.9	4.1	6.3	2.4	4.4	4.6	-0.1	6.1	3.8	6.5
2009	1.5	2.0	2.1	-2.3	1.4	-2.5	-0.9	5.5	4.0	0.5	0.6
2010	6.7	6.5	7.6	7.4	6.2	12.2	9.0	2.7	3.5	3.8	5.1
2011	9.9	10.6	9.0	5.2	11.1	12.2	11.3	7.0	8.9	12.6	10.6
2012	11.8	11.1	9.2	11.8	21.4	11.1	16.4	8.5	12.0	6.8	10.7
2013	11.6	10.0	12.2	16.4	17.3	15.6	6.7	22.7	15.6	6.9	6.9
2014	9.4	10.9	7.5	7.5	10.7	10.4	9.7	13.1	13.3	11.8	10.6
2015	7.4	6.2	2.2	8.8	2.2	7.4	8.1	5.5	7.6	5.9	6.4

Source: NAPIC, BNM

among Malaysians whether for self-occupancy/own usage or investment purposes, as a result of adequate supply of quality properties at reasonable prices

An October 2014 report by MGI, A Blueprint for Addressing the Global Affordable Housing Challenge, argued that a concerted use of four largely market-oriented approaches - namely lowering the costs of land (acquisition at the right price, time and location), construction, operations and maintenance (or increased efficiencies), and financing (for buyers and developers) - could reduce the costs of affordable housing by 20%–50% and substantially narrow the global affordable housing gap by 2025, a welcome news for households earning 50%–80% of median income.

MGI also estimated that the combination of productivity-enhancing and less-labour intensive industrial construction techniques, value engineering and efficient procurement methods - characteristics that IBS represents - could shorten the delivery time to end-customers by 40%–50% and reduce total construction costs by 30%. The construction timeline compression should help raise the rate of returns on a development project or allow the developer(s) to sell a housing unit at a lower price point. Examples in the MGI study indicated that selling prices can be reduced by as much as 8% owing to cost savings generated by a 40%–50% shorter construction period.

Unfortunately, despite already enjoying one of the lowest construction costs in the world, in the face of fierce competition, Malaysian property developers and contractors seem to have an undying passion for the low-cost business model in securing contracts in order to preserve profits as they are accustomed to plump profit margins, resulting in poor quality buildings that may reflect attempts to cut corners and an addiction to cheap foreign labour. Only through technology-driven and less-labour intensive IBS as well as continued mechanisation and automation will the Malaysian construction sector be able to constantly bring down costs without compromising quality and goodwill.

Table 4.31: Annual average growth rate for supply of properties by property types and states 2010–2015

States	Average Growth Rate		
	Residential	Commercial	Industrial
FT Kuala Lumpur	2.0	3.1	0.1
FT Putrajaya	9.2	13.6	0.0
FT Labuan	1.5	1.6	0.1
Selangor	2.0	3.7	2.0
Johor	1.6	1.7	1.3
Penang	2.6	1.7	0.9
Perak	2.2	3.5	2.2
Negeri Sembilan	1.2	2.0	3.1
Melaka	1.9	2.9	9.4
Kedah	1.9	1.8	3.4
Pahang	2.5	3.4	4.4
Terengganu	4.5	5.9	2.6
Kelantan	2.5	2.6	2.9
Perlis	2.8	3.5	5.5
Sabah	3.6	2.4	5.6
Sarawak	2.6	3.1	5.2

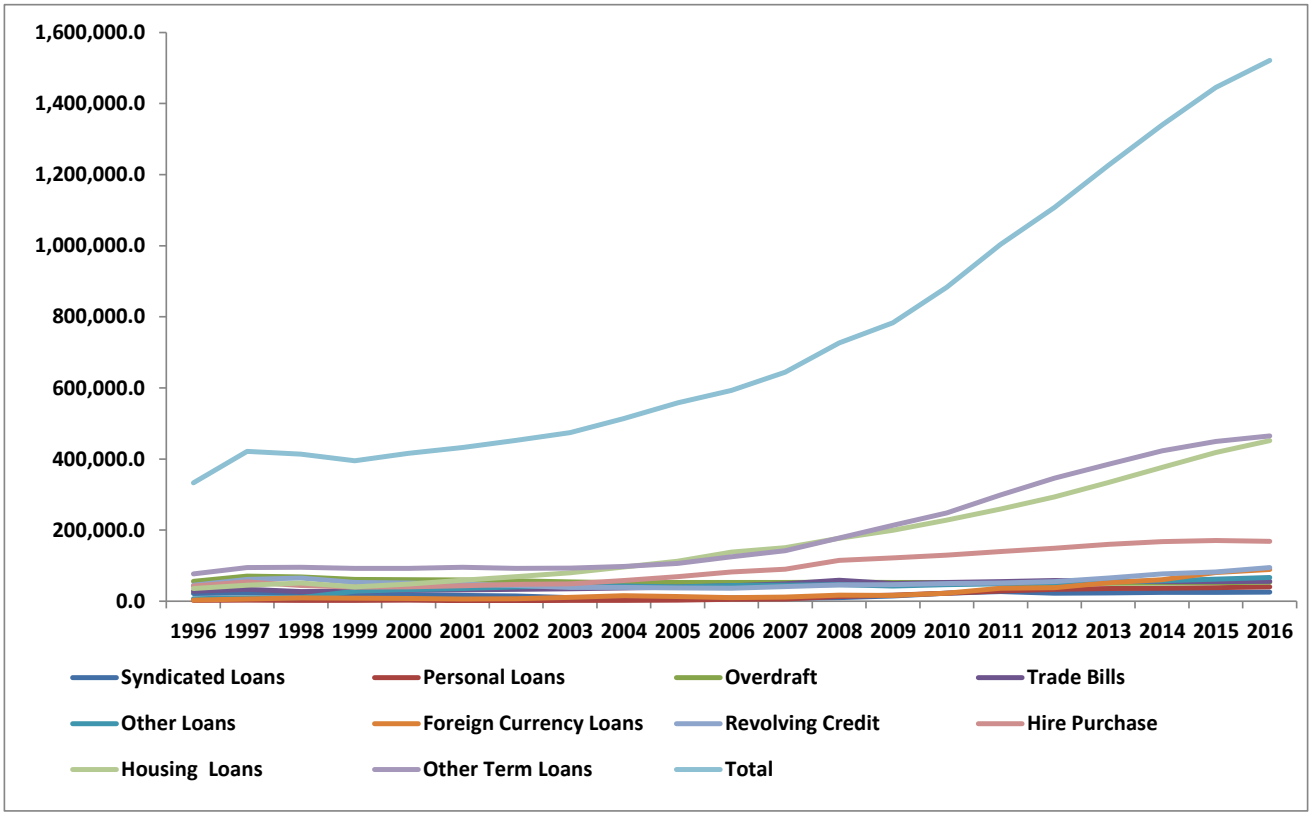
Source: Written reply to a parliamentary question on 23 May 2016

Table 4.32: Selected housing statistics

	Number of Housing Units Approved by KPKT in Peninsular Malaysia	Levels of Malaysian House Price Index (2000=100)
2010	120,801	140.7
2011	159,653	154.6
2012	235,249	172.8
2013	177,568	192.9
2014	185,021	211.0
2015	138,279	226.7

Source: KPKT, NAPIC, BNM

Figure 4.7: Banking system's top 10 categories of year-end outstanding loans (RM million)



Source: BNM

Box Article 2: Adapted from pages 96 and 97 from A Blueprint for Addressing the Global Affordable Housing Challenge

The Government's Critical Role in Ensuring IBS Adoption

Governments can help accelerate the use of industrial approaches to construction and make them practical and available for affordable housing with the following ways:

1. Enabling scale. To help provide the scale that industrial techniques require, governments can work with the private sector to generate construction volumes - through public-private developments, incentives for private development on large land parcels and other initiatives. It can also help create demand within specific areas to achieve the minimum scale required for capital investments in fabricating plants. Lastly, government schemes that reduce end-user financing costs, enhance the creditworthiness of targeted population segments, or reduce search costs also act as demand enablers.

2. Pooling volume. For specific building materials that can be standardised across vendors, governments can play a role in pooling volume and allowing multiple developers and contractors to benefit from frame contracts for purchasing specific building materials. Such volume contracts can provide an option for procurement of building materials at cheaper costs. The procurement efficiency initiative for affordable housing in the United Kingdom is an example of such an initiative.

3. Shaping consumer acceptance. Factory-produced houses still carry a stigma in many markets. This negative perception is driven by lack of knowledge about the quality of these homes. The government can play a role in supporting the housing industry in educating consumers and encouraging acceptance. This can be done through mechanisms such as government-enabled certifications, quality assurance programmes, consumer incentives and technical assistance programmes for builders.

4. Reducing financing risks. Governments can play a large role in the financing ability of construction companies. Lower financing costs or increased access to financing pools can influence the risk appetite of construction companies to invest in industrial scale construction methods.

5. Standardising building codes. There are many examples around the world where building codes vary considerably across the country, regions and provinces, and sometimes even within cities. If governments would make the effort to promulgate uniform building codes across cities, provinces or even across the entire country, the standardisation would help enable the growth of industrial construction approaches.

6. Supporting innovation. Given the limited innovation and knowledge sharing within the construction sector, governments can play a key role in encouraging and incubating innovation. This could be through support in terms of innovation for lower-cost building materials for the sector, housing technology incubators and innovation centers set up through government support.

7. Improving competition and industry structure. In many countries, the government may need to improve the structure of fragmented construction and real estate industries so that they can take on affordable housing development. It can do so in a variety of ways. For example, governments can encourage participation of smaller players in tenders for public projects so that these firms can build capacity over time and help open up competition to more players. It can also support participation by international developers in public procurement programmes and ease the rules for foreign players to enter the market and tie up with local developers. This will enable both capacity and capability building in the market and accelerate the introduction of new technologies and approaches. Governments can also improve leasing companies' access to funding and support the development of specialised leasing companies to provide machinery and equipment to affordable housing developers.

Source: McKinsey Global Institute

4.8 Occupational Destruction Triggers Income Loss and Unemployment

With full IBS adoption, 'destruction' of certain 3D (dirty, dangerous and demeaning/demanding/difficult), manual, low-skilled and low-paying jobs at construction sites - such as labourers or general workers for carpentry, concreting, bar bending, welding, ironworking, steel fixing, conventional formwork, bricklaying and plastering, and to a certain extent, menial work at IBS factories - for Malaysians and foreigners alike could result in:

a. A short-term loss of sources of income for existing workers, citizens and foreigners alike as well as subcontractors involved in CBM activities
b. A possible slight uptick to the job-loss data and unemployment rate in Malaysia due to disruptions to the CBM supply chain
c. Transitory cost hikes for builders, real estate developers and contractors if IBS manufacturers indiscriminately incorporate all costs involved in factory-produced building components and elements into their pricing structure following a halt to unjustified cheap labour

Not only could these negative effects prove to be rather modest and temporary, they are, in fact, bearable adjustments that need to be accepted as the transition price in order to modernise and upgrade the construction sector and its workforce. Indeed, the average survey findings for the purpose of this CBA study would suggest that the destruction of certain types of occupations due to full IBS adoption could eventually, on a net basis, result in:

a. A 15% increase in income for Malaysians, but a 50% plunge in income for foreign workers
b. A 10% increase in employment opportunities for Malaysians, but a 15% decline for non-citizens

To be fair, many labour-related issues are not specific to the construction sector alone. The share of skilled workers out of the total workforce has declined in many industries, although the situation is more dire in the construction sector as employers, mostly operating on a low-cost model, are not willing to pay more for higher skills to ensure quality, preferring instead to resort to a readily available pool of low-skilled but easily trained and underpaid foreign workers for profit maximisation.

Table 4.33: Malaysia's principal labour statistics

Year	Number ('000)				Percentage (%)		
	Labour Force	Employed Persons	Working Less than 30 Hours	Unemployed	Outside Labour Force	Labour Force Participation Rate	Unemployment Rate
2001	9,699.4	9,357.0	525.0	342.4	5,239.9	64.9	3.5
2002	9,886.2	9,542.6	516.7	343.5	5,473.8	64.4	3.5
2003	10,239.6	9,869.7	529.0	369.8	5,458.6	65.2	3.6
2004	10,346.2	9,979.5	599.3	366.6	5,730.5	64.4	3.5
2005	10,413.4	10,045.4	484.4	368.1	6,048.2	63.3	3.5
2006	10,628.9	10,275.4	471.9	353.6	6,205.1	63.1	3.3
2007	10,889.5	10,538.1	511.3	351.4	6,330.1	63.2	3.2
2008	11,028.1	10,659.6	470.7	368.5	6,575.7	62.6	3.3
2009	11,315.3	10,897.3	478.7	418.0	6,665.7	62.9	3.7
2010	12,303.9	11,899.5	503.0	404.4	7,023.0	63.7	3.3
2011	12,740.7	12,351.5	520.6	389.2	7,023.3	64.5	3.1
2012	13,221.7	12,820.5	589.3	401.2	6,927.4	65.6	3.0
2013	13,980.5	13,545.4	645.8	435.1	6,781.2	67.3	3.1
2014	14,263.6	13,852.6	534.8	411.1	6,821.0	67.6	2.9
2015	14,518.0	14,067.7	580.3	450.3	6,869.9	67.9	3.1

Source: DOSM, EPU

Malaysia's immigration policies, which favour mostly low-skilled and cheap labour for most 3D jobs, are partly to blame for this foreign hiring tendency in many sectors, especially construction. Malaysians themselves, even low-skilled or with little work experience, seem to avoid the sector. The long-standing unattractiveness of construction jobs has a lot to do with the underlying societal mentality, perceived limited construction career prospects and the cyclical nature of the sector.

As a result, construction players have no choice but to turn to cheap foreign labour despite their serious lack of skills. Subsequently, the already low wage levels of Malaysia's construction sector are further depressed by this low-pay foreign worker glut, making the sector even less attractive to Malaysians, especially those with better skills and more experience, creating a vicious cycle.

Regarding job destructions due to mechanisation and automation, characterised more and more by computerisation, digitalisation and robotisation, a 2016 joint study conducted by the Oxford University and the Oxford Martin School predicted up to 47% of jobs will disappear in the US within the next 25 years, while PricewaterhouseCoopers (PwC) in a 2017 study foresaw British jobs to be fewer by 30% and the US to shed jobs by 38% by 2030s.

An MGI report from January 2017 entitled A Future That Works: Automation, Employment and Productivity suggests that about half of the existing jobs in the world are to be automated by 2055, especially the physical ones in highly structured and predictable environments as well as in data collection and processing, equivalent to almost USD15 trillion in lost wages. This automation, thanks to technological change and emergence of high-tech and digital disruptors, could boost annual global productivity growth by 0.8% to 1.4% while causing huge implications for the labour market worldwide.

Table 4.34: Job creations by sectors under 10MP and 11MP

	10MP (Estimated)		11MP (Forecasted)	
	Number of Jobs ('000)	Percentage of Total (%)	Number of Jobs ('000)	Percentage of Total (%)
Agriculture, Forestry, Farming and Fishing	11.2	0.6	-5.2	-0.3
Mining and Quarrying	-0.8	-0.0	1.0	0.1
Manufacturing	430.7	23.6	318.6	21.1
Construction	77.9	4.3	40.1	2.7
Services	1,303.9	71.5	1,156.1	76.5
Total Employment	**1,822.9**	**28.5**	**1,510.6**	**23.5**

Source: Appendix A5-2, 11MP

Table 4.35: Selected construction-related labour market statistics

Year	Number of Employees in Construction Sector ('000)	Salaries and Wages Paid to Construction Workers (RM'000)
2001	829.8	N/A
2002	905.1	9,108,167
2003	942.5	N/A
2004	890.8	9,284,764
2005	904.4	10,867,665
2006	908.9	N/A
2007	922.5	12,956,935
2008	998.0	N/A
2009	1,015.9	13,966,992
2010	1,082.7	19,841,387
2011	1,151.5	N/A
2012	1,174.7	22,433,961
2013	1,292.1	25,323,614
2014	1,277.7	N/A
2015	1,309.9	N/A

Source: DOSM, BNM, EPU

If the workforce shifts from agriculture to industrialisation in the developed world in the 20th century are of any guide, increased automation and mechanisation should not result in long-term mass unemployment. While around 70%–80% of existing traditional jobs, especially low-skilled, cheap and blue-collar jobs may disappear over the next 20 years, many new-age occupations can be expected as replacement. The global job market will transform itself and adapt in time, while people displaced by mechanisation and automation will find employment in these new types of jobs, provided that people change in tandem and learn to work alongside machines.

Indeed, the debate surrounding the centuries-old battle between man and machines has been too skewed towards the job-destroying effects of technological revolution without fully appreciating the gains in terms of productivity, household incomes, spending power, price declines for many items and even personal leisure time, which create new demand and needs, new industries and new types of jobs. A study by Deloitte UK on census results for England and Wales from 1871 through 2014 revealed that technology has been a 'great job-creating machine', owing to labour switching to futuristic industries of the time or era.

Eventually, as observed in many developed countries, high labour costs would compel the construction sector towards more productive and cost-effective construction methods such as IBS being increasingly mechanised, automated, technology-oriented and less-labour intensive. The challenges are to lure skilled local workers back into the construction sector while preventing intersectoral migration of foreign labour from construction activities to other sectors, in particular agriculture, manufacturing and services, which could negate much of Malaysia's push to reduce overdependence on migrant workers and achieve the 11MP's goal of capping the share of foreign workers out of the total labour force to 15% across the board by 2020.

4.9 Less Foreign Labour Equals Lower Private Consumption

The presence of fewer foreign workers in Malaysia due to less labour requirements in all sectors in general and the construction sector in particular is not without adverse ramifications for the Malaysian economy. Substantial impact would be felt on consumer spending or private consumption as millions of migrant workers form a considerably significant base of consumers in Malaysia. In nominal terms, private consumption as a share of GDP has been on a steady uptrend, from 48.1% in 2010 to 54.1% in 2015.

Consider the following assumptions and calculate vis-à-vis the 2015 levels:

a. A 3.12% increase in total labour force, which represents a 20-year average growth during the 1996–2015 period
b. More conservative reduction in the number of registered foreign workers by 1%, 2% and 3% until the share of foreign workers out of the total labour force is down to around 13%, only about 2 percentage points better than the 11MP's target of 15% by 2020, while anything beyond, namely the 4% and 5% reductions, represent stress test or stretch goal situations

As a result, the hypothetical amount of private consumption in nominal terms could turn out as in Table 4.37. Taking the results that correspond the closest to the 11MP's target of keeping the share of foreign workers out of labour force at 15% by 2020, a hypothetical reduction of 1% to the number of registered foreign workers against 2015 levels would translate into a RM75.041 billion decline in the nominal private consumption amount.

Table 4.36: Selected annual statistics on population, foreign workers and national accounts (in nominal terms)

Year	No. of Registered Foreign Workers	Mid-Year Population	Private Consumption (RM million)	GDP (RM million)
2010	1,817,871	28,589,000	395,245	821,434
2011	1,573,061	29,062,000	437,340	911,733
2012	1,571,589	29,510,000	482,238	971,252
2013	2,250,322	30,214,000	527,749	1,018,614
2014	2,073,414	30,598,000	579,985	1,106,466
2015	2,135,035	30,996,000	626,239	1,157,139

Source: DOSM, BNM

Table 4.37: Predicted amount of nominal private consumption (RM'000) vs. 2015 levels (negative impact)

	-1%	-2%	-3%	-4%	-5%
Labour Force (million) at +3.12%	14,970,962	15,438,056	15,919,723	16,416,419	16,928,611
Number of Foreign Workers	2,113,685	2,092,334	2,070,984	2,049,634	2,008,000
Share of Foreign Workers out of Labour Force (%)	14.12	13.55	13.01	12.49	11.86
Private Consumption Amount (RM million)	551,197.84	546,822.31	542,446.78	538,071.25	529,538.96
Variance (RM million)	75,041.16	79,416.69	83,792.22	88,167.75	96,700.04

Source: JSSB

4.10 Strengths-Shortcomings Balance

IBS facilitates the emergence of new sub-sectors and/or expands existing ones as the industry cuts across all five major economic sectors. While the value of the IBS industry as a whole in Malaysia is unable to be estimated at present in the absence of relevant data sets for other IBS segments, the size of the manufacturing segment of IBS materials and components (demand approach) is estimated to be worth RM25.0484 billion in 2016 based on the assumption of 129.8% as the CAGR for expenditure on IBS materials and components (the average growth rates for the 2009–2010 period at 219.5% and the 2012–2013 period at 40.1%).

IBS provides many spillover effects to the Malaysian economy through the creation of new sub-sectors and/or the expansion of existing sub-sectors, industries and clusters, apart from the generation of new business opportunities. With IBS, the economy should observe the creation of new types of occupations, both generalists and specialists, as well as higher sophistication of existing jobs. During the 11MP period, the number of skilled workers is projected to increase by 6.8% on average (10MP: +3.1%), 0.9% for semi-skilled

workers (10MP: +3.2%) and -6.2% for low-skilled workers (10MP: +0.5%). This will also lead to the rise in household incomes and consumer spending in tandem.

Indeed, reduction in low-skilled migrant workers is expected to deepen the pool of knowledge-intensive and skilled labour in Malaysia, a booster for higher salaries and wages among Malaysians. Being the main source of Malaysian household income, a steady uptrend in salaries and wages would undoubtedly provide a fillip to consumer spending. The assumption of only a 1% reduction in foreign workers, which corresponds the closest to the 11MP's target of keeping the share of foreign workers out of labour force at 15%, would translate into a hypothetical increase by RM18.979 billion to the nominal private consumption amount. However, on the flip side of the coin, having formed a sizeable consumer base in Malaysia, an exodus of registered foreign workers could leave a vacuum in private consumption, potentially causing a RM75.041 billion decline.

In general, SMEs in any segment of the IBS industry should be encouraged to forge consortia or other forms of collaboration with their counterparts in Malaysia or abroad to pool resources, expertise and technology in order to increase their overall potential. Streamlining Bumiputera SMEs into certain areas of promoted IBS segments within its entire value and supply chain, mimicking the CITP's recommendation for Bumiputera construction contractors, could enable the creation of niche clusters within the IBS industry.

Consistent with the CITP's Internationalisation Strategic Thrust, exports of semi-finished inputs, finished IBS products, materials, components and elements, and machineries and equipment for use by the IBS industry are likely to lead the charge once new IBS segments emerge and/or existing ones sub-divide. In addition, IBS-related services - in particular transfer of knowledge, skills, expertise and technology via training, skills development, consultancy, advisory and other educational services - command high export potential. All other things being equal (ceteris paribus), assuming a more aggressive impact on merchandise export outlook - whereby IBS brings about a 5%, 10%, 15% or 20% increase to Malaysia's combined export amount (machinery, equipment and parts, other manufactures and transport equipment) against the 2016 level of RM70.8473 billion - total exports of manufactured goods could increase by as much as RM14.1695 billion.

Much in sync with the CITP's target in its Productivity Strategic Thrust to raise the construction sector's productivity levels by 2.5 times to USD16,500 per worker matched by higher wages by 2020, IBS has been targeted as an important productivity stimulant for the construction sector. In line with one of the 11MP's goals, namely capping the share of foreign workers out of the total labour force to 15% across the board by 2020, widespread IBS adoption could be one of the catalysts in lowering the amount of annual remittances by as much as RM14.535 billion.

Full or significantly high IBS adoption with a minimum score of 70, notably within the residential property development market, could:

a. Ensure an adequate supply of houses, especially social and affordable homes
b. Keep property prices in check, especially the residential segment
c. Narrow the affordability gap and ensure increased accessibility to ownership among Malaysians of all types of properties, especially residential and commercial

CHAPTER 5: PUBLIC ADMINISTRATION AND GOVERNANCE PERSPECTIVES

This chapter deals with the potential fiscal, good governance, geopolitical and diplomatic repercussions as a result of nationwide IBS adoption. Sections 5.1 to 5.5 aim to flag up the strengths and opportunities of full IBS implementation, while Sections 5.6 through 5.8 seek to demonstrate what could be shortcomings and risks engendered by such an agenda.

5.1 IBS Upholds Good Governance

Good governance[35], an indeterminate term commonly used to describe how public institutions conduct public affairs and manage public resources, can actually apply to various domains such as international relations, public sector (especially the government), socio-politics, corporate or business, private sector and voluntary organisations (including civil society) at the global, national and local levels. To promote good governance, reforms should be undertaken within three major categories of institutions, namely the public sector, especially the government, including its agencies, statutory bodies, subsidiary and associate companies; the private sector; and civil society.

While the International Monetary Fund (IMF) declared in 1996 that 'promoting good governance in all its aspects, including by ensuring the rule of law, improving the efficiency and accountability of the public sector, and tackling corruption, as essential elements of a framework within which economies can prosper', the United Nations (UN) outlined eight characteristics of good governance, namely consensus orientation, participation, rule of law, effectiveness and efficiency, accountability, transparency, responsiveness, and equitability and inclusiveness.

Governance, as described by the Worldwide Governance Indicators (WGI), a project of the World Bank Group (WBG), consists of traditional institutions by which the authority in a country is exercised, which includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them.

Produced by Daniel Kaufmann of the Natural Resource Governance Institute and the Brookings Institution and Aart Kraay of the World Bank Development Research Group, these WGIs represent a set of aggregate and individual governance indicators for over 200 countries and territories over the 1996–2015 period for the six dimensions[36] of governance, namely voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and control of corruption.

Although interpretations of good governance may vary to a great extent in different jurisdictions, organisations and contexts, inculcating and adhering to good governance principles such as competency,

[35] Governance is the process of interactions and decision-making among the actors involved in the public sector, private sector, business and civil society spaces, through which leadership and authority are exercised and by which decisions made are implemented (or not).

[36] These dimensions were derived based on 31 underlying data sources produced by a variety of survey institutes, think tanks, NGOs, international organisations and private-sector firms combining worldwide governance perceptions and expert assessments from survey respondents among a large number of companies, citizens and subject matter experts.

transparency, accountability and integrity, especially in the conduct of public office holders, management of public funds, government procurement contracts and concessions have been proven to contribute to a great extent towards, among others:

a. Ensuring ethical, responsible and sustainable management and decision making while encouraging other positive behaviours
b. Arriving at well-informed (and arguably better) decisions
c. The best outcomes for the greater good, equipped with oversight, control and monitoring mechanisms
d. Improving reputation and recognition among the international/supranational community, investors, customers, the community at large, the ecosystem and other stakeholders
e. Lowering the costs of accessing capital for the government, businesses and people
f. Restoring public trust and confidence in political systems, public administration and institutions
g. Energising overall economic and business vibrancy, sustainability and resilience

Many studies with empirical evidence point towards a strong correlation between governance quality and successful economic development, particularly per capita income levels, although the question of causality remains whether governance components tend to enhance per capita income or vice versa, higher per capita income increases the demand for higher governance quality, or perhaps the causality runs both ways. Nonetheless, it is not within the scope of this CBA study to determine the causality nor to measure the impact of good governance implementation on Malaysia's economic growth. On the same token, quantifying how IBS adoption influences the quality of governance in Malaysia or vice versa would require an entirely new study.

Still, with IBS, everything from planning and budgeting, management and decision making to monitoring and disclosures will be scientific, evidence based and fact driven. Given its emphasis on the respect for rule of law, IBS adoption can be expected to be an impetus for Malaysia to have an adequately designed and developed regulatory and supervisory environment.

One of the CITP recommendations of separating the IBS procurement from the main contract will not only reduce the upfront costs to be assumed by contractors and remove a great deal of their financial burden but will also effectively enhance transparency, accountability and integrity, especially in government contracts and concessions. Given the high number of construction projects undertaken by Jabatan Kerja Raya (JKR), it should provide leadership by piloting all government procurement contracts.

5.2 IBS Helps Reduce Wastage, Leakage and Other Negative Elements

One major category of the benefits of abiding by good governance principles is the potential of preventing, reducing and even eliminating any forms of abuse of power or responsibilities entrusted by the office or position held as well as misuse of funds and other resources, both in public and private sectors, all of which may be termed as mismanagement, misappropriation, mishandling, misconduct, misrepresentation, malfeasance and other fraudulent activities.

IBS components and elements, which are pre-manufactured under a controlled and consistent environment, have to be pre-ordered, i.e. designed, planned and measured according to the project and site

specifications prior to the commencement of construction activities. As such, virtually all details, especially related to costs and risks, are known well ahead. This should go a long way in helping plug wastage, leakage and other pervasive negative elements such as financial improprieties and irregularities, bid rigging, fraud, bribery, theft, graft, embezzlement, breach of trust, state capture and other corrupt practices and scandals, notably in government procurement processes and procedures, and general public administration. However, for public-sector construction works and projects, the following can contribute by way of:

a. Significant cost savings and expenditure cutbacks for the government, for example via reduction of VOs and/ or additional rectification works, the major causes of cost overruns that lead to over-budget situations, while minimising recourse to labour, especially low skilled
b. Reduction in construction period, hence less risks of losses, both financial and in-kind to be borne by the government as the client
c. Elimination or at least minimisation of inexcusable delays, which are rampant in the conventional method of construction

As opposed to cost escalation, a cost overrun or cost increase entails unexpected costs incurred in excess of budgeted or planned allocations due mostly to an underestimation of actual costs during the budgeting process. The size of cost overruns may vary widely depending on the point of reference in measuring them, including the difference between costs at the time decision is made and at final completion, and the difference between costs at contract award and at final completion. There are four possible causes of cost overruns:

a. Political-economic explanations (the most common cause historically) as a result of strategic misrepresentation of the scope of budgets
b. Technical explanations as a result of imperfect forecasting techniques and inadequate underlying data, among others
c. Psychological explanations due to over-optimism among forecasters or number crunchers
d. Escalation of commitments to a cause of action (the least explored possible cause), a theory grounded in social psychology and organisational behaviour that suggests the tendency of people and organisations to become locked-in in a particular course of action, ever willing to splurge just to make sure the venture succeeds

Wastage, leakage and corruption, whether petty or grand, could act as an additional (regressive) tax on businesses, hence increasing the cost of doing business or any transactions, which could lead to inefficient use of resources, public and private. Since it has been established that these negative elements may - (i) distort market and pricing mechanisms, (ii) misallocate scarce resources and budget allocations, (iii) deter highly sought-after private investments, (iv) derail economic growth, (v) bleed national coffers, (vi) be a disincentive for taxpayers to pay taxes, (vii) perpetuate poverty and socio-economic inequalities, (viii) corrode public trust, (ix) delegitimise the authorities, (x) undermine the rule of law and government's basic functions, and (xi) cause civil strife, public unrest, violence and even political instability - they are not without implications for the public at large.

Such additional costs are typically passed on to consumers, one way or another, in particular if demand for the concerned products or services is less sensitive to price changes. Various studies conducted by PwC suggest that commodity-intensive industries

such as within the agriculture, mining and construction sectors, and to a certain extent some manufacturing clusters, are areas where these negative elements could lurk. After all, demand for commodities in these industries is largely inelastic due to lack of alternatives, either perfect substitutes or synthetics.

While it is both a demand and supply problem, corruption, defined at the broadest level as the 'misuse of office for unofficial ends' or 'abuse of entrusted power for personal gains[37]' both in public and private sectors is not a developing world phenomenon alone, although its scale varies across countries. Estimates for corrupt transactions annually worldwide vary: USD1 trillion[38] in global bribery between the private and public sectors (private firms and public officials/politicians or MNCs and governments), according to the World Bank Institute (WBI), the WBG's research arm; USD1.5–USD2 trillion[39] in bribery and public-sector corruption or roughly 2% of the global GDP, according to the IMF; and USD2.6 trillion[40], equivalent to more than 5% of the global GDP in worldwide corruption.

Due to its nature and definitional nuances, it is almost impossible to measure the scale and extent of corruption as well as assess its costs on the entire economy and ecosystem with high accuracy. Nonetheless, there is a number of in-depth and well-analysed, and substantiated statistics, especially those compiled and published by TI such as the annual Corruption Perceptions Index (CPI), the Global Corruption Barometer and the Bribe Payers Index as well as other less internationally recognised such as the Global Financial Integrity's Report on Illicit Financial Flows and the Economist's Crony-Capitalism Index.

The same CITP recommendation mentioned in the previous section about decoupling IBS procurement from the main contract provides a good illustration of how IBS can help address leakage, wastage and other negative elements, especially in public administration. As a client or project owner, JKR will handle procurement of IBS components directly with IBS manufacturers/suppliers. With this type of procurement policy, IBS manufacturers will submit detailed quotations directly to JKR, for instance, immediately eliminating any potential mark-up or overcharging by contractors. Overcharging is one of the common forms of leakage and wastage of public funds.

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[37] Transparency International (TI)

[38] The amount revealed in 2005 for actual bribes paid worldwide in both industrial and developing countries based on 2001-2002 worldwide surveys. Since it excludes embezzlement of public funds, theft of public assets, 'tainted procurement', among others, this amount represents only part of overall corruption transactions, not covering all forms of corruption.

[39] The amount was revealed in a May 2016 publication entitled 'Corruption: Costs and Mitigating Strategies' that may include an abuse of public office for private gains, tax evasion and arbitrary tax exemptions, among others, a 2015 extrapolation by Daniel Kaufmann based on his earlier estimate of USD1.1 trillion.

[40] The amount is unverified but oft-cited by the WEF and Forbes.

Table 5.1: Various estimates of direct and indirect economic costs of corruption worldwide

No.	Quotes	Origins
1	Corruption is estimated to increase the cost of achieving the UN Millennium Development Goal on water and sanitation by USD48 billion	Transparency International (TI); Page 4, 'The Anti-Corruption Catalyst: Realising the MDGs by 2015'
2	Countries that score badly on the World Bank's Doing Business Indicators also score badly on the Corruption Perceptions Index. This suggests that highly corrupt countries have difficulty attracting resources-resources-business	Inferred from comparing the WBG's Doing Business Index 2010 against TI's Corruption Perceptions Index 2010
3	Corruption adds 10% to the cost of doing business in countries, and up to 25% to the cost of public contracts	Remark by the Secretary-General of the Organisation for Economic Coordination and Development (OECD) at the B20 Taskforce on Improving Transparency and Anti-Corruption's dinner; 10 October 2012
4	In 2012, the cost of private-sector corruption was estimated at over USD500 billion in 105 developing countries, which only accounts for 22% of the global GDP	CSIS Project on Prosperity and Development
5	International cartels have chalked up aggregate sales of USD1.2 trillion and caused direct economic losses to consumers through overcharges of almost USD500 billion	J. M. Connor and C. G. Helmers; Page 2, 'Statistics on Modern Private International Cartels 1990–2005' (November 2006)
6	There is a 400% governance dividend of good governance and corruption control: countries that improve on control of corruption and rule of law can expect on average, in the long run, a four-fold increase in income per capita	Six Questions on the Cost of Corruption With WBI's Global Governance Director, Daniel Kaufmann
7	Corruption constitutes a very substantial tax on investment. For instance, one study on FDIs estimates that corruption is the equivalent of a 20% tax to foreign investors	Six Questions on the Cost of Corruption With the WBI's Global Governance Director, Daniel Kaufmann
8	64 million people were pushed into poverty by the economic crisis, which was in part caused by lax regulation, lack of financial transparency and conflicts of interest	World Bank; Page viii, 'Global Monitoring Report: The MDGs After The Crisis'
9	67% out of 144 economies surveyed by the WEF identified corruption as one of the top three challenges to conducting business in their country	WEF in its annual Executive Opinion Survey on the Top 5 barriers to doing business; Page 33, 'Global Competitiveness Report 2013'
10	In a survey of more than 1,000 executives, almost one in five claimed to have lost resources-resources-business due to a competitor paying bribes	Ernst & Young; Page 5, '10th Global Fraud Survey: Corruption or Compliance – Weighing Costs' (2008)

11	In a survey of more than 350 resources-resources-businesses worldwide, 35% of companies had been deterred from an otherwise attractive investment because of the host country's reputation for corruption	Page 3, Control Risks, 'Facing Up to Corruption: A Practical Resources-Resources-Business Guide' (2007)
12	More than a third of international resources-resources-business managers estimated corruption increases international project costs by more than 10% while one-sixth believed corruption inflates costs by more than 25%	Simmons & Simmons; Page 10, Control Risk, 'Facing Up to Corruption: A Practical Business Guide' (2007)
13	Countries weak in government effectiveness, rule of law, and control of corruption have a 30% to 45% higher risk of civil war	US Aid; 'Promoting Accountability & Transparency' (13 May 2013)
14	Based on a survey of 214 executives, 28% opted not to do resources-resources-business in a country due to bribery and corruption issues	KPMG; Page 1, Global Anti-Bribery and Corruption Survey 2011
15	75% of all those interviewed agree that there is a commercial advantage to ethical behaviour	Ernst & Young; 'European Fraud Survey 2011: Recovery and Integrity' (2011)
16	More than half of the 70,000 people interviewed in 69 countries for TI's 2009 Global Corruption Barometer said they were willing to pay more to buy from corruption-free companies	TI; Page 16, 'Global Corruption Barometer' (2009)

Source: WBG, IMF, TI UK, Centre for Strategic and International Studies (CSIS), Malaysian Anti-Corruption Commission (MACC)

5.3 IBS Boosts Ease of Doing Business

Improvement to public delivery system should help raise ease of doing business in Malaysia and enhance its long-term international competitiveness – increasing its attractiveness as an investment destination of choice among domestic and foreign investors alike, in particular as a magnet for FDIs. Increased ease of doing business will help minimise opportunities for corrupt practices and transactions as discussed at length in Section 5.2.

Measures to encourage IBS adoption that would eventually contribute to the general ease of doing business and eliminate costly delays may include:

a. Reduction in red tape and other bureaucratic hurdles, including simplification and even removal of 'nice-to-have' but unnecessary and obsolete regulatory, supervisory and legal requirements; minimising the number of relevant authorities at the federal, state and municipal levels for the construction sector in general and the IBS industry in particular

b. Integration and automation of all processes and procedures in submitting and obtaining approval for IBS-based construction permits such as e-submission and e-approval for substantial time and cost savings

c. One-stop registration and/or licensing of IBS players in all cross-sectoral segments (refer to Chapter 1, Section 1.1 for further details on the five or

seven core segments of the IBS industry based on object or economic activities, respectively)

d. Establishment of a specific tribunal as a recourse for disputes or appeals related to the construction sector in general and the IBS industry in particular between regulators/supervisors and industry players on a case-by-case basis to:
   - Improve clarity and consistency in interpretations of rules and regulations in order to remove any ambiguity or potential related issues
   - Propose a review and a replacement of rules and regulations considered archaic and no longer suitable for the 21st century and beyond
   - Ensure greater nationwide uniformity in application of rules and regulations and address issues arising from variations in different states
   - Accelerate dispute resolutions at reasonable costs that will significantly save time, money and effort

Direct procurement of IBS components by project owners or clients in one of the CITP recommendations under the Productivity Strategic Thrust as discussed in Sections 5.1 and 5.2 can also prove to be a good mechanism to raise long-term competitiveness of IBS component manufacturers and ensure demand predictability for IBS products, components, techniques and elements.

Table 5.2: Key details of major global ease of doing business and competitiveness-related indices

Name of Index	Publishers or Producers	Definition(s) and Countries Covered	Measurement Metrics, Assessment Parameters/ Criteria
Doing Business (DB)	The World Bank Group (WBG)	Ranking 190 economies according to ease of doing business by comparing them with one another and to 'distance to frontier' by sorting the aggregate distance of each economy to benchmark scores or the best performance observed on each indicator with respect to regulatory best practices	11 areas of the life of a business: Starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts, resolving insolvency and labour market regulations
World Competitiveness Yearbook (WCY)	International Institute for Management Development (IMD)	Benchmarking the performance of 62 countries based on 342 criteria measuring different facets of competitiveness using two types of data: 2/3 hard statistical data from national, regional and international organisations and 55 partner institutes worldwide, and 1/3 survey data from almost 5,500 senior executives	342 criteria are derived from 4 principal categories of competitiveness factors, namely Economic Performance (83 criteria), Government Efficiency (73 criteria), Business Efficiency (71 criteria) and Infrastructure (115 criteria), broken down further into 20 sub-categories of factors

Global Competitiveness Report (GCR)	World Economic Forum (WEF)	Assessing the competitiveness landscape (defined as the set of institutions, policies and factors that determine the productivity levels of an economy, which in turn sets the level of prosperity that a country can achieve) of 138 economies	114 indicators that capture concepts that matter for productivity and long-term prosperity, grouped into 12 pillars, namely Institutions, Infrastructure, Macroeconomic Environment, Health and Primary Education, Higher Education and Training, Goods Market Efficiency, Labour Market Efficiency, Financial Market Development, Technological Readiness, Market Size, Business Sophistication and Innovation. These 12 pillars are, in turn, organised into 3 sub-indexes that are given different weights in the calculation of the overall index, depending on each economy's stage of development, as proxied by its GDP per capita and the share of exports represented by raw materials: Basic Requirements, Efficiency Enhancers, and Innovation and Sophistication Factors
Business Environment Rankings (BER)	Economist Intelligence Unit (EIU), part of The Economist Group	Gauging the quality or attractiveness of the business environment in 82 countries between 2009 and 2013 while making projections for the 2014–2018 period, derived mostly from national and international statistical sources for the historical period (2009–2013) and from EIU's assessments for the forecast period (2014–2018). Some indicators are qualitative in nature, drawn from a range of data sources and business surveys adjusted by the EIU for the 2009–2013 period	A total of 91 indicators assessed by the EIU for the last five years and the next five years contained in 10 separate criteria or categories, namely the Political Environment, Macroeconomic Environment, Market Opportunities, Policy towards Free Enterprise and Competition, Policy towards Foreign Investment, Foreign Trade and Exchange Controls, Taxes, Financing, Labour Market and Infrastructure. Each indicator is scored on a scale of 1 (very bad for business) to 5 (very good for business)

Source: Respective websites and publications

Table 5.3: Performance of Malaysia vs. the top-ranked country on global ease of doing business and competitiveness-related indices

Name of Index	Most Recent Year	Top-Ranked Country		Malaysia	
		Country	Score	Ranking	Score
DB	June 2016	New Zealand	87.01	23	78.11
WCY	2016	Hong Kong	100	19	83.048
GCR	2016–2017	Switzerland	5.81	25	5.16
BER	2014	Singapore	8.65	19	7.56

Source: Respective websites and publications

Ultimately, the CITP under Quality, Safety and Professionalism, its first Strategic Thrust, targets an improvement by 5 percentage points in the World Bank's ease of doing business indicator, especially when dealing with construction permits[41]. Owing to various initiatives under the 10MP, the following achievements in 2015 were observed:

a. A 59.5% reduction in the number of procedures to obtain construction permits, from 37 to 15 procedures
b. A 37.5% reduction in the number of business licensing types at the federal level, from 717 to 448 licences
c. A 69.1% reduction in the number of business licensing types at the local authority level, from 1,455 to 449 licences

As an example, ICT services have contributed towards improving the public delivery system. To effectuate the Digital Government agenda, the Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) and various public-sector agencies have accomplished three main categories of ICT initiatives, namely Infrastructure, Applications and Services. These ICT initiatives, especially to consolidate and integrate a multitude of government services, have helped optimise resource use and returns in terms of value for money with cost savings estimated at around RM800 million in 2016. In total, some RM9.34 billion worth of savings have been generated from the implementation of value management on 214 public-sector projects by 2015[42].

5.4 IBS Contributes to the Nation's Coffers

A fully developed IBS industry across all its segments, in particular those found in the manufacturing and services sectors, would effectively give rise to an improved revenue collection for the federal government, notably under the Tax Revenue category in both the Direct Taxes and Indirect Taxes sub-categories.

In the Direct Taxes sub-category, company income and individual income taxes are the most likely to observe a significant jump, on account of an increasing number of sustainably profitable IBS-centric businesses and an expanding pool of IBS professionals and talents with above-average compensation packages. The Indirect Taxes sub-category, on the other hand, will immensely benefit from a greater intensity in consumer spending and transactions, an impetus for the Goods and Services Tax (GST) owing to higher household incomes, especially among those whose family members are within the IBS workforce, and higher export duties as a result of a successful export strategy for the IBS industry.

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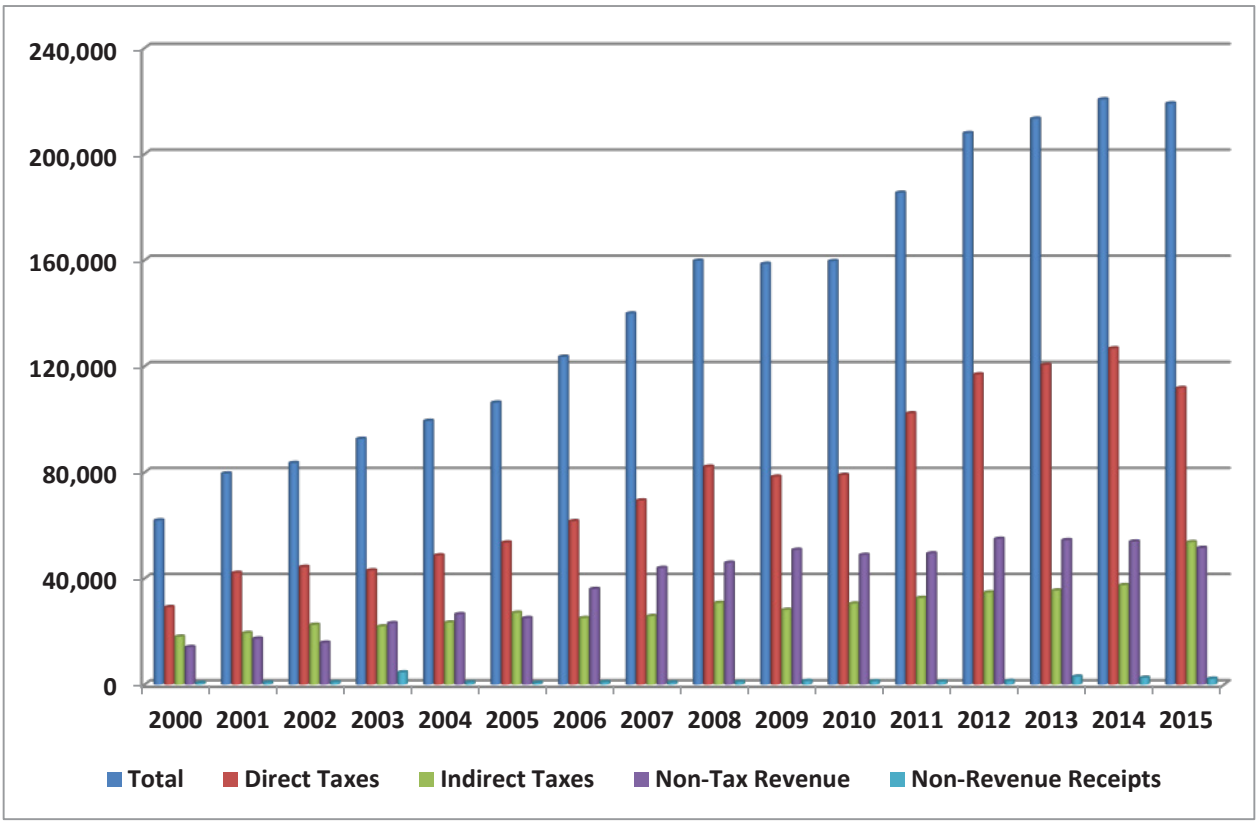
[41] On page 66 in the CITP 2016-2020 publication, as per the WBG's DB Report 2015, a construction permit was reported to take more than 74 days to obtain in Kuala Lumpur, compared to 66 days in Hong Kong, 44 in United Arab Emirates, 29 in South Korea and 26 in Singapore.

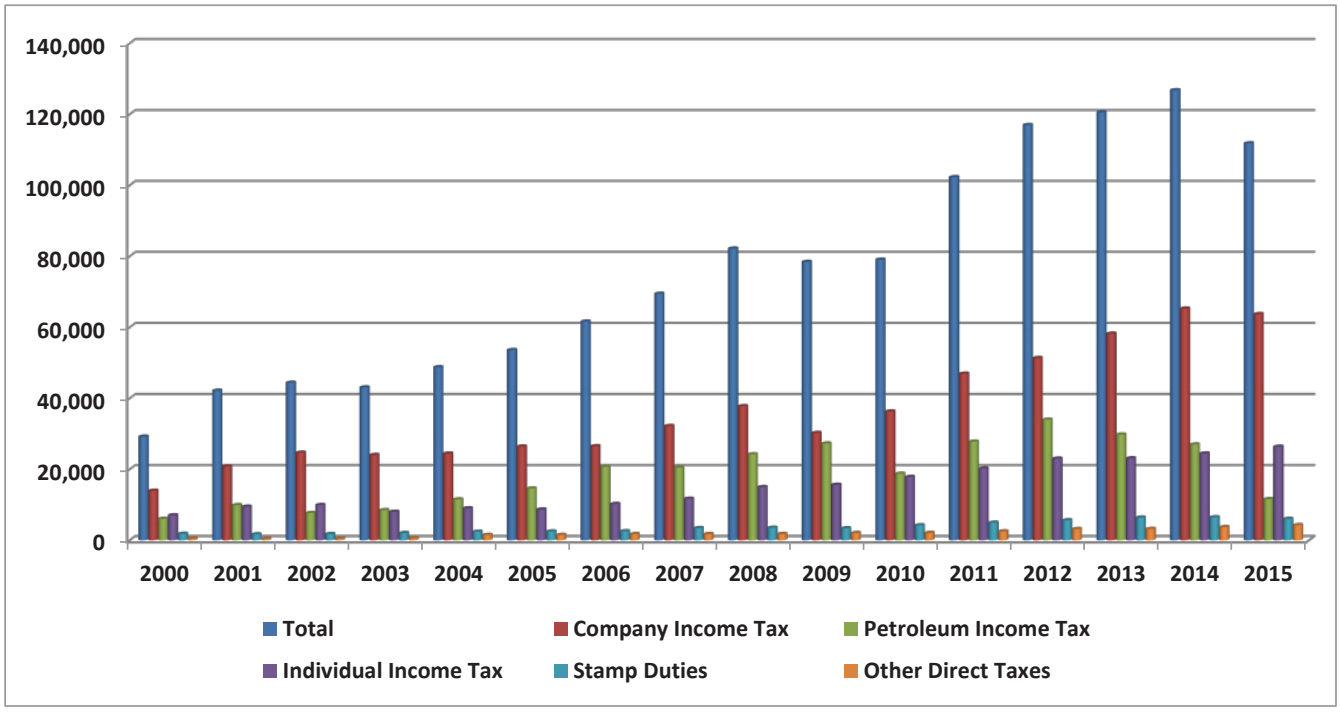
[42] Page 9.4, 11MP

Figure 5.1: Major categories of the federal government's revenue (RM million)



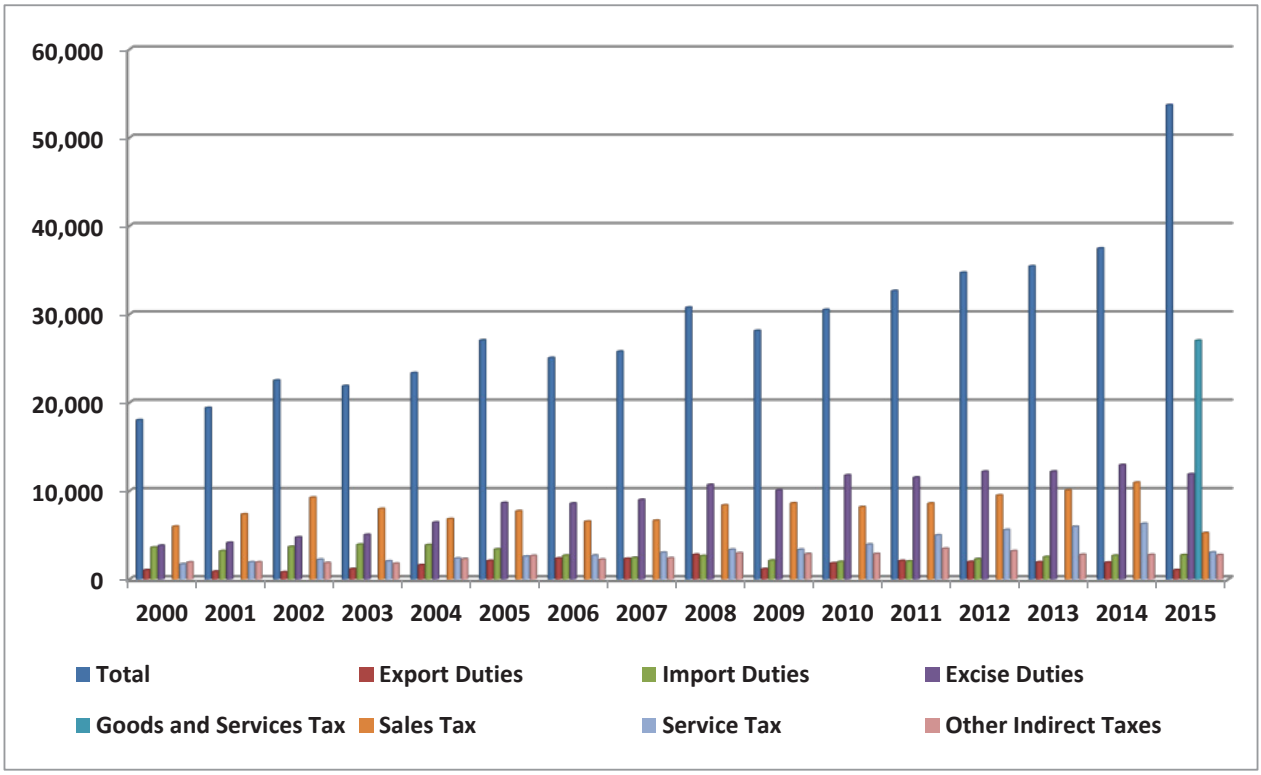
Source: MOF, BNM

Figure 5.2: The federal government's direct taxes (RM million)



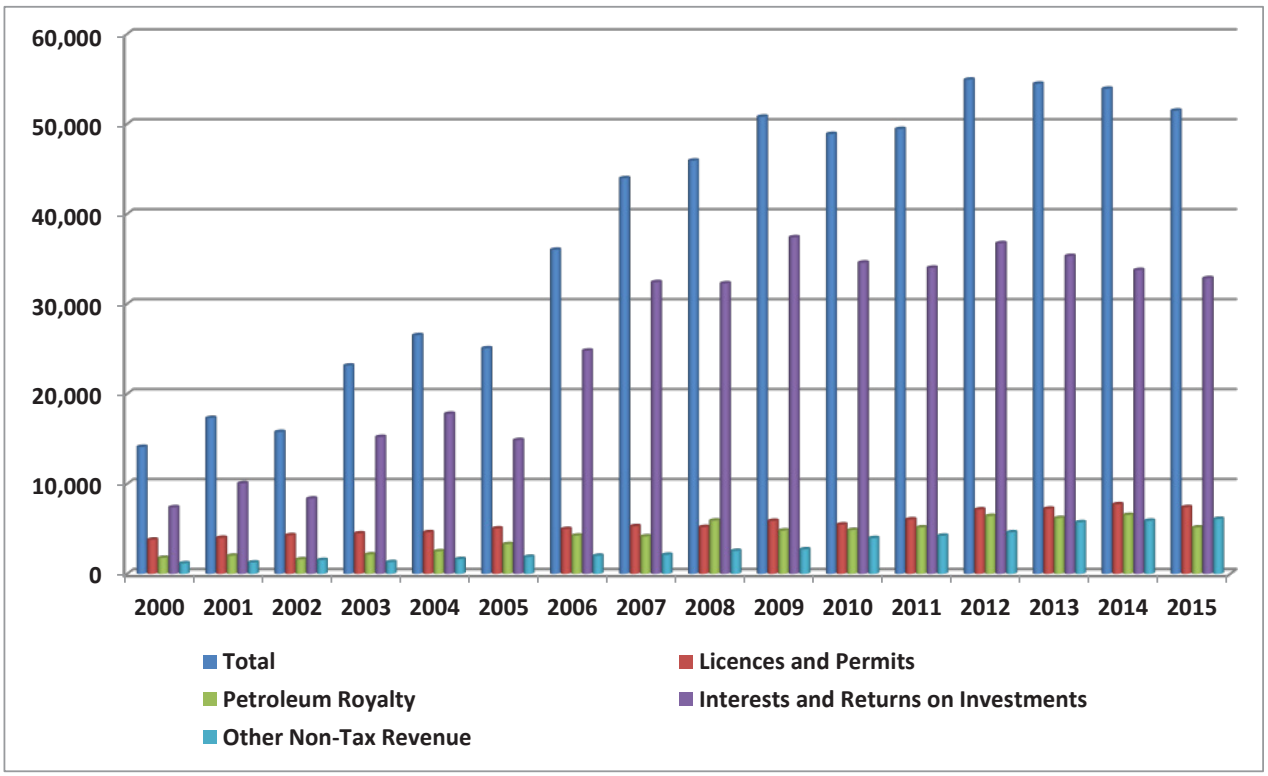
Source: MOF, BNM

Figure 5.3: The federal government's indirect taxes (RM million)



Source: MOF, BNM

Figure 5.4: The federal government's non-tax revenue (RM million)



Source: MOF, BNM

Apart from the possibility of deepening the taxable income base vis-à-vis IBS-related businesses and their workforce under the Tax Revenue category, a new source of revenue could be in the offing for the federal government in the form of specific registration and/or licensing fees. For instance, qualified manufacturers of IBS components and elements as well as of machineries and equipment specific for IBS purposes may be required to obtain specific licences or permits as a measure to control the quality of IBS components and elements as well as of machineries and equipment manufactured, not to mention as a quid pro quo for any tax and non-tax incentives granted.

While there were 207 IBS component manufacturers as at end November 2016 and 8,131 IBS contractors (construction companies using IBS products and components in their construction works and projects), consider this hypothetical scenario in the foreseeable future: Some 1,000 IBS component manufacturers and 100 manufacturers of various machineries and equipment specific for IBS purposes. Assuming RM15,000 and RM75,000 as the annual licensing fees for IBS component manufacturers and manufacturers of machineries and equipment, respectively, that would translate into a hypothetical annual revenue of RM22.5 million (RM15 million + RM7.5 million) for the federal government. This revenue item, which has a direct relationship with the number of businesses in operation and the fee level imposed, shall be reflected in the Licences and Permits sub-category under the Non-Tax Revenue category.

5.5 IBS Drives Harmonisation of Incentives

Incentives, either tax (fiscal) or non-tax (non-fiscal) can be defined as any enticement or attractive feature with a validity period offered by the government and/or relevant authorities to encourage all or selected groups of individuals and/or businesses to spend on or invest in certain areas or pockets of the economy (e.g. priority economic activities, targeted goods or services and/or special geographical zones) by making it easier for them to do so in a multidimensional approach - provision of a conducive and facilitative environment; provision of various forms of assistance, support, reliefs and special treatment, including subsidies and subventions; introduction of tax benefits; reduction of tax burdens and other liabilities, among others, that may influence economic behaviours and decisions.

The most common forms of tax incentives include reduced company and/or personal income tax rates; tax holidays (deduction of or exemption/exclusion from certain taxes for a limited period); investment credits or allowances; tax credit accounts; accelerated depreciation of capital assets; favourable deductibility for certain types of expenditure; special deductions or credits for reinvested profits; reduced rates of withholding tax on remittances to home countries; reductions in contributions to social security or pension funds; reductions in sales and/or services taxes and/or GST/VAT; reduction in tariffs for export, import, excise and/or customs duties; property tax-related reductions, other preferential tax rates and treatment, deferral of tax liabilities; and creation of special economic zones.

Besides tax considerations, economic decisions can also be influenced by non-tax factors, also known as non-tax incentives, including:

a. All aspects related to the operating environment such as the general macroeconomic policy framework in place; taxation system and foreign exchange rules and regulations; political stability; public administration with good governance; financial, legal, regulatory, supervisory and institutional

underpinnings and infrastructure; and dispute resolution mechanisms, among others

b. Accessibility to reasonably priced funding sources
c. Depth and breadth of the labour force or availability of skilled workforce at reasonable costs
d. Access to natural resources and raw materials at reasonable costs
e. Size and efficiency of output markets and distribution outlets
f. Size and purchasing power of the consumer base
g. Other forms of support and assistance

Apart from the rather limited role of correcting market failures, all these incentives are usually aimed at promoting domestic consumption and industries, investment flows (particularly FDIs in developing countries) and/or exports, all of which will ultimately stimulate the overall economic growth.

In the presence of a coherent and structured IBS agenda, we would effectively be able to lay out and further enhance the entire incentive package for the IBS industry that better reflects the overall industry needs, the industry's potential for long-term growth and competitiveness, each segment that is mapped with the nation's affordability (all for the purpose of promoting and anchoring the IBS culture), and accelerating the industry's growth across all segments.

Following a thorough review based on the criteria above, we will be able to identify which specific measures or incentives to introduce, expand further, extend the validity period or even terminate. Eventually, a similar exercise for other industries or sectors will go a long way in harmonising and streamlining the nation's tax and non-tax incentives.

Given today's increased mobility of capital, labour, goods and services amidst increasing trade and investment liberalisation, no country can design the taxation regime and dole out tax and non-tax incentives in isolation, hence the importance of keeping in step with international standards and best practices. Although these incentives, particularly tax incentives, could arguably bring about substantial benefits in various forms and do not require an actual government expenditure, they are not entirely without cost implications, especially if we take into consideration factors such as erosion of the tax base and foregone or unearned revenue for the government; distortionary effects of inefficient allocation of scarce resources, either too much in priority areas or too little in other non-favoured areas; enforcement and compliance costs; and the possibility of corruption and other rent-seeking behaviour, especially if the process is discretionary and based on subjective requirements.

5.6 Permanent Loss of One Revenue Source

One main benefit of full IBS adoption is the opportunity to reduce labour requirements, particularly the construction sector's on-site workers who are mostly low-skilled and low-paid foreign workers. Nonetheless, a lesser need for foreign workers would inevitably translate into a temporary reduction or even a permanent loss of one source of revenue for the federal government through annual levies imposed on registered foreign workers whose rates or tariffs currently vary according to sectors. Currently, this levy is deductible from wages of foreign workers.

As part of the restructuring of foreign workers' levy, the federal government announced on 31 December 2016 the quasi immediate implementation of the Employer Mandatory

Table 5.4: New tariffs of foreign worker levy effective 18 March 2016

	Previous Levy Regime		New Levy Regime		
	Category	Rates	Category	Final Rates	Initially Proposed Rates
Agriculture	2	RM410	2	RM640	RM1,500
Plantations	2	RM590	2	RM640	RM1,500
Manufacturing	1	RM1,250	1	RM1,850	RM2,500
Construction	1	RM1,250	1	RM1,850	RM2,500
Services	1	RM1,850	1	RM1,850	RM2,500

Source: MOHA

Commitment (EMC)[43] by 1 January 2017. Following an outcry from business associations, the mandatory imposition of foreign workers' levy on employers has been deferred to 1 January 2018. The one-year reprieve was granted to allow a major overhaul of the 'ecosystem', including the rights for employers to hire foreign workers direct from sources without going through agencies that act as middlemen, mechanisms of a security deposit on foreign workers, and elimination of other bureaucratic hurdles.

It has been established that increasing the levy tariffs and/or shifting the levy burden from foreign workers to employers could be an effective strategy to encourage mechanisation and automation, the core attributes of IBS, while scaling down the need for foreign workers. To hypothetically see through an environment of full IBS adoption or at least very high IBS usage, consider the following three assumptions:

a. The annual average reduction of 32.5% in labour requirements, especially for on-site works, which are dominated by foreign workers. This figure was derived from findings of the survey exercise for the CBA study (estimated figure of 20%) and An Introduction of Industrialised Building System - Manual for Developers (estimated figure of 40%–50%). However, the share of foreign workers out of the total employed persons in the construction sector hits 15%, the reduction rate used is 14.26%.

[43] The EMC aims to instill responsibility on employers for their foreign workers by making them pay for these annual levies. Armed with an undertaking letter that will spell out the roles and responsibilities to be fulfilled by employers from the application stage until the day the foreign workers return to their countries of origin, the EMC seeks to ensure the wellbeing and safety nets of foreign workers, including housing, proper registration and recording of foreign workers to prevent them from becoming illegal, as well as other rights.

Table 5.5: Selected foreign worker-related data

Year	Number of Foreign Workers with Valid and Active Foreign Workers' Temporary Employment Visit Pass (Pas Lawatan Kerja Sementara/PLKS)	Amount of Levy Collections
2011	1,573,061	RM1,807,559,238.97
2012	1,571,589	RM2,618,101,763.53
2013	2,250,322	RM2,423,003,405.28
2014	2,073,414	RM2,637,594,587.09
2015	2,135,035	RM2,254,148,205.66

Source: Written reply to a Parliamentary question on 27 October 2016

Table 5.6: Predicted amount of levy collection (RM'000) vs. 2015 levels

Reduction Rates	**-32.5%**	**-32.5%**	**-32.5%**	**-14.26%**	**-32.5%**
Number of Total Employed Persons ('000)	1.3099	1.3099	1.3099	1.3099	1.3099
Number of Foreign Workers Post Reduction	502,963	339,500	229,163	196,485	132,627
Share of Foreign Workers out of Total Employed Persons Post Reduction (%)	38.40	25.92	17.49	15.00	10.12
Levy Collection Amount at RM1,850 Post Reduction (RM million)	930,481,550	628,075,000	423,951,550	363,497,250	245,359,950
Variance Post Reduction (RM million)	932,200	302,406,550	204,123,450	60,454,300	118,137,300

Source: JSSB

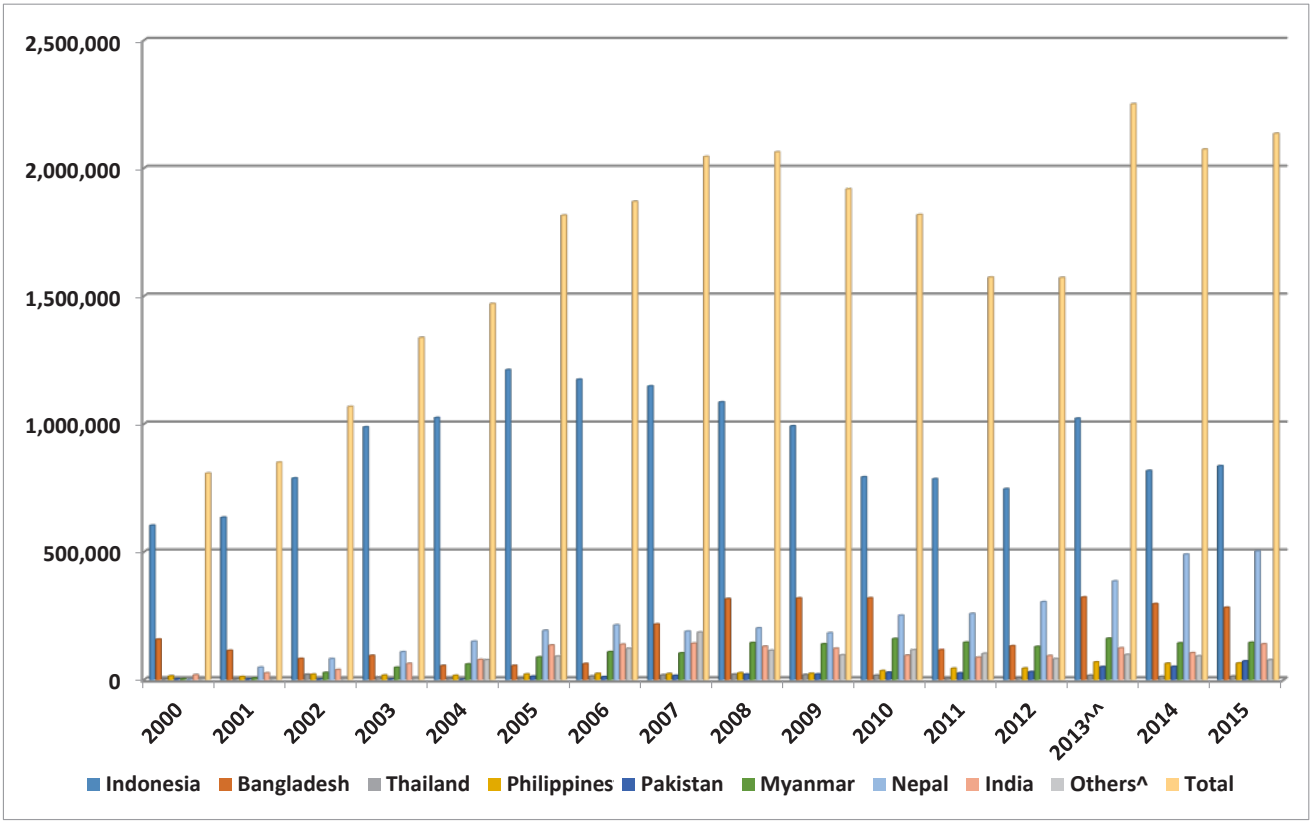
b. Anything beyond, namely another 32.5% reduction until the share of foreign workers out of the total employed persons in the construction sector nearly touches 10%, represents a stress test or stretch goal situation.

c. The number of total employed persons in the construction sector to stay constant at 1.3099 million people.

Using the number of documented foreign workers of 745,131 employed by the construction sector in 2015 as the basis, a 32.5% (and 14.26%) cutback would translate into employment of only 502,963, 339,500, 229,163 and 196,485 foreign workers, respectively. Assuming the new rate of RM1,850 as the per capita levy for foreign construction workers remains unchanged, the federal government would hypothetically obtain annual levy collection worth RM930,481,550 (502,963 workers x RM1,850), RM628,075,000 (339,500 x RM1,850), RM423,951,550 (229,163 x RM1,850) and RM363,497,250 (196,485 x RM1,850), respectively, equivalent to a cumulative potential revenue loss of RM567,916,500 or nearly a 61% plunge compared to the 2015 level of RM931,413,750.

On the other hand, the positive outcome behind this uninterrupted downtrend in annual levy collections is the continuous retreat in the number of foreign construction workers with the possibility of reaching the targeted 15% cap in the share of foreign workers out of the total labour force (or employed persons for simplification purposes) in the construction sector by as early as 2019.

Figure 5.5: Number of foreign workers in Malaysia by country of origin



Source: MOHA
Note: ^ denotes other significant sources of foreign workers such as Cambodia, China, Sri Lanka, Vietnam and Laos

5.7 Ramifications for International Diplomatic and Economic Relations

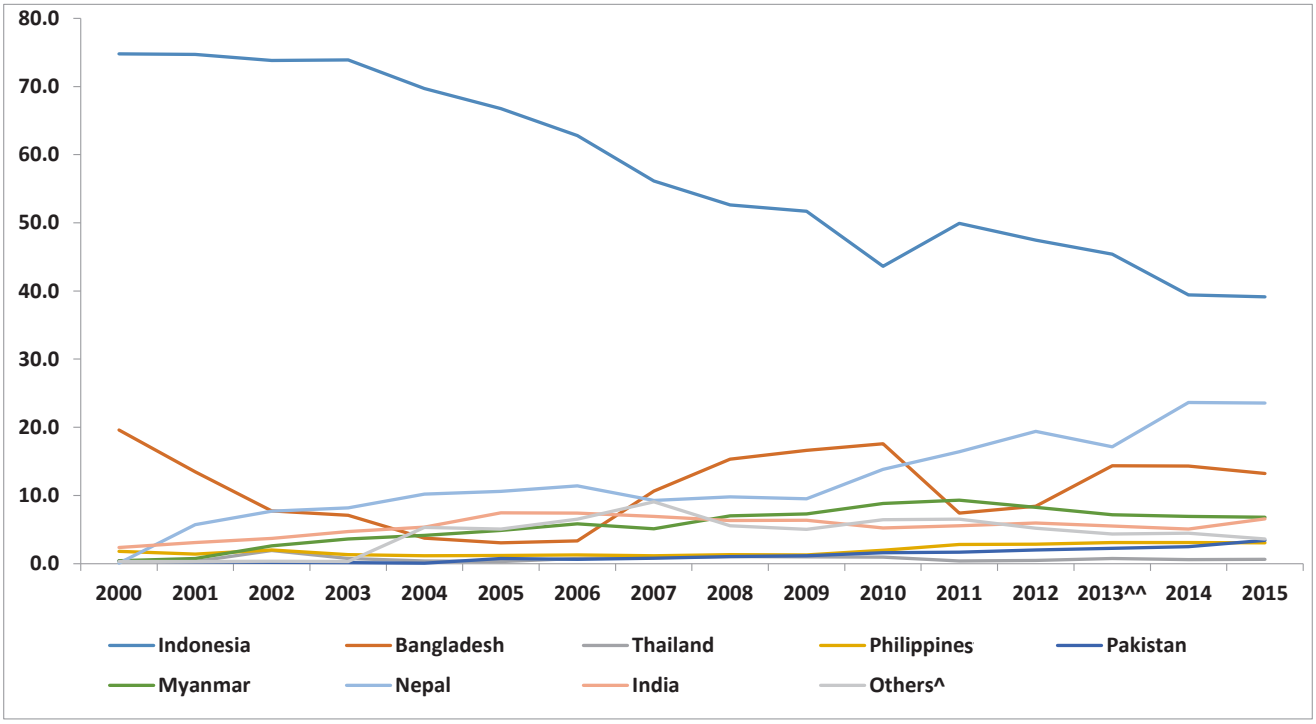
This section attempts to discover whether an explicit government policy to trim the presence of migrant workers in Malaysia, particularly by paring down the number of foreign new hires, could sour diplomatic ties with countries that provide migrant workers and to what extent the dynamics could have an impact on trade and investment relations with Malaysia.

While Indonesia has perennially remained Malaysia's largest supplier of foreign workers, albeit a dwindling share to ~40% since 2014 from close to 75% in the early 2000s, Bangladesh, Nepal, India and Myanmar have alternated positions 2, 3, 4 and 5 between themselves. After a huge spike in 2010, Nepal has occupied the no. 2 spot since 2011, followed by Bangladesh, Myanmar and India.

Trade-wise, among these top five foreign worker sources, only Indonesia, India and Myanmar make the cut to be considered in the league of Malaysia's major trading partners. While Malaysia has consistently enjoyed a trade surplus vis-à-vis India and Myanmar, it is not always the case with Indonesia. Since the bilateral trade with Myanmar is rather insignificant, the focus can be trained on Indonesia and India alone, with India being the larger export market for Malaysia most of the time.

The following assumptions are considered as a result of a hypothetical retaliation by Indonesia and India to changes in Malaysia's immigration and human resource policies, together with respective assumptions related to Malaysia-bound foreign worker inflows from Indonesia and India as well as Malaysian shipments to these countries:

Figure 5.6: Share of foreign workers out of total workers in Malaysia by country of origin (%)



Source: MOHA, JSSB
Note: ^ denotes other significant sources of foreign workers such as Cambodia, China, Sri Lanka, Vietnam and Laos
^^ denotes inclusion of foreign workers through the 6P Amnesty Programme[44]

a. Worst-case scenario: Reduction rate of Malaysian exports doubles that of foreign workers from Indonesia and India
b. Base-case scenario: Reduction rate of Malaysian exports matches that of foreign workers from Indonesia and India
c. Best-case scenario: Reduction rate of Malaysian exports halves that of foreign workers from Indonesia and India
d. Reduction rates of workers from Indonesia and India based on the terminology used to categorise behaviours and responses of IT systems and infrastructure under different circumstances: performance testing=10%, load testing=20% and stress testing=30%

As a rule of thumb, the impacts under the base-case scenario may be considered, whereby the combined Malaysian exports to Indonesia and India could decline by between RM6.0764 billion and RM18.2293 billion. It is noteworthy to stress that these simulated impacts on Malaysian exports are purely hypothetical and may not necessarily be the case in reality, given a multitude of other factors at play in making import-export decisions.

Since this is a conjectural guesstimate at best, the lower bound value of the range mentioned above, namely RM6.0764 billion, seems more reasonable and prudent to consider. This section does not attempt similar simulations for possible impacts on Malaysia-

[44] Launched in October 2011, the main objective was to resolve the long-standing issue of teeming undocumented foreign workers in Malaysia, including those who have overstayed their work permits, by registering and legalising them, allowing them to stay another two or three years in employment, depending on which sector they were involved in. When it ended in 2014, some 521,734 foreigners were reported to have been legalised under this programme.

bound FDIs since Indonesia and India (and to a lesser degree Myanmar) have never been among the big capital exporters to Malaysia, and the effects on diplomatic ties are not straightforward to quantify.

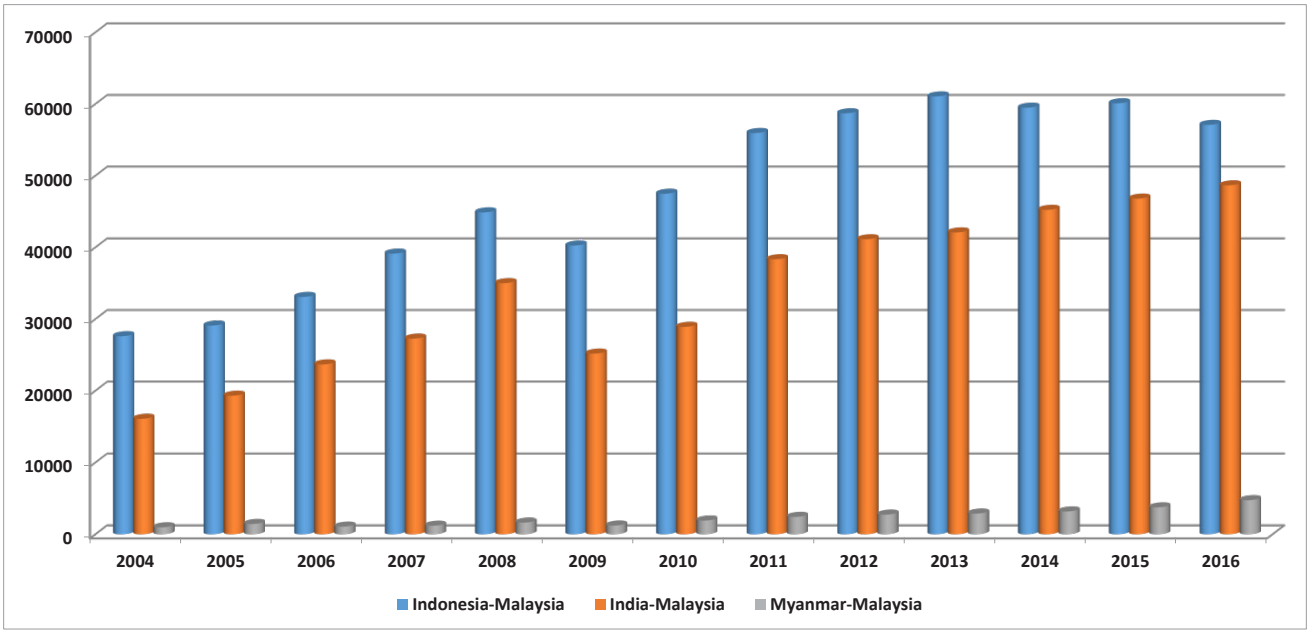
5.8 Excessively Onerous Compliance and Enforcement Costs

Regulatory costs applicable to industry players (compliance costs) and borne by regulators/supervisors (enforcement costs) refer to deployment of resources such as funds/budget allocations and workforce. This, in other words, means money, time and effort spent in conforming to a variety of laws, rules and regulations governing an industry and/or the production of merchandise or provision of services as well as a set of standards, guidelines, best practices and codes of conduct in place. In short, to industry players, regulatory costs comprise compliance, and direct and indirect socio-economic costs, while for regulators and supervisors, they include costs related to policy formulation, enforcement/policing, intervention and other general administration expenses.

These regulatory costs, which may vary across industries or sectors and jurisdictions, usually include (i) all costs to establish a framework of assessment criteria, (ii) paperwork and documentation, (iii) expenses related to planning, implementation (staff, systems, processes, procedures and technology, among others), administration, monitoring, investigation and reporting of such compliance and enforcement, payments of fines, penalties, damages and indemnities for breaches or violation of laws, and (iv) any other expenditure incurred in order to ensure adherence to such laws, rules and regulations, standards and best practices. Apart from costs in monetary terms, there could be impacts on reputation, brand, goodwill, reliability, credibility and authority, which are a lot more complicated and subjective to measure.

In the absence of attempts thus far to assess these regulatory costs or burdens to both industry players and regulators/supervisors in the Malaysian context, relevant statistics for the US economy are presented in this section to put things into perspective. In its 2015 Report to Congress on the Benefits and

Figure 5.7: Total trade volume vis-à-vis Indonesia, India and Myanmar (RM million)



Source: DOSM, BNM

Table 5.7: Bilateral trade vis-à-vis Indonesia, India and Myanmar (RM million)

Year	Indonesia			India			Myanmar		
	Gross Export	Gross Import	Trade Balance	Gross Export	Gross Import	Trade Balance	Gross Export	Gross Import	Trade Balance
2004	11,639	15,964	-4,325	11,457	4,631	6,826	568	405	164
2005	12,540	16,553	-4,013	15,137	4,169	10,968	930	506	424
2006	14,916	18,166	-3,250	18,783	4,884	13,899	607	459	147
2007	17,749	21,379	-3,630	20,204	7,067	13,137	721	476	244
2008	20,703	24,177	-3,475	24,728	10,278	14,450	1,042	584	458
2009	17,235	23,019	-5,784	17,306	7,872	9,433	723	497	226
2010	18,090	29,390	-11,300	20,934	7,978	12,956	1,181	732	448
2011	20,841	35,113	-14,272	28,154	10,191	17,963	1,710	715	995
2012	27,609	31,095	-3,486	29,325	11,803	17,522	2,176	567	1,610
2013	33,110	27,944	5,167	25,735	16,346	9,389	2,261	624	1,636
2014	31,758	27,728	4,029	31,893	13,340	18,553	2,634	547	2,087
2015	29,104	31,000	-1,896	31,660	15,139	16,521	3,065	687	2,378
2016	27,659	29,427	-1,769	32,006	16,647	15,358	3,925	824	3,101

Source: DOSM, BNM

Table 5.8: Predicted amount of Malaysian exports (RM million) in 2016 vs. 2015 to Indonesia and India with corresponding decreases in number of registered foreign workers

	-10%		-20%		-30%	
	Indonesia	India	Indonesia	India	Indonesia	India
Number of Foreign Workers	752,369	125,776	668,772	111,801	585,176	97,826
Worst-case Scenario						
Amount of Exports (RM million)	23,283.3	25,328.4	17,462.5	18,996.3	11,641.7	12,664.2
Variance (RM million)	5,820.8	6,332.1	11,641.7	12,664.2	17,462.5	18,996.3
Base-case Scenario						
Amount of Exports (RM million)	26,193.7	28,494.4	23,283.3	25,328.4	20,372.9	22,162.3
Variance (RM million)	2,910.4	3,166.0	5,820.8	6,332.1	8,731.2	9,498.1
Best-case Scenario						
Amount of Exports (RM million)	27,649.0	30,077.5	26,193.7	28,494.4	24,738.5	26,911.4
Variance (RM million)	1,455.2	1,583.0	2,910.4	3,166.0	4,365.6	4,749.1

Source: JSSB

Costs of Federal Regulations and Unfunded Mandates, the US Office of Management and Budget (OMB) pegged the cumulative costs of 120 selected major rules and regulations for industry players during the 2004–2014 period at between USD68.4 billion and USD102.9 billion (in 2010 USD). Other governmental assessments before and after the 21st century from the OMB, Government Accountability Office (GAO) and Small Business Administration (SBA) also suggested aggregate annual costs in the hundreds of billions of USD, some even in excess of USD1 trillion in today's USD. On the other hand, the National Association of Manufacturers (NAM) estimated total annual regulatory costs to industry players in the US economy to the tune of USD2.028 trillion (in 2014 USD) in its 2014 report based on 2012 data.

Notwithstanding other estimates of considerably higher than the NAM's USD2 trillion, the Competitive Enterprise Institute (CEI) came up with an estimate of USD1.886 trillion in across-the-board annual regulatory costs to industry players using a more conservative approach. The St. Louis, Missouri-based Weidenbaum Centre and the Washington D.C.-based Regulatory Studies Centre tabulated the annual regulatory agency enforcement costs at USD63 billion. Combined, both sides of regulatory costs would amount to USD1.949 trillion (USD1.886 + USD63 billion) in 2015. As a result, the combined tally of these US regulatory costs accounted for 10.8% of the US nominal GDP in 2015, estimated at USD18.0367 trillion[45] or 52.8% of the US federal government's expenditure in 2015 worth USD3.688[46] trillion. To complete the picture, the Mercatus Centre estimated that the 2012 US economy (nominal GDP worth USD16.155 trillion) would have been 25% or USD4.034 trillion larger had total regulatory burdens remained constant since 1980 based on a 'formal economic growth model from microeconomic foundations, particularly the influence of regulation on firms' investment choices'.

A series of regulatory and supervisory developments over the past few years, particularly in the aftermath of the Global Financial Crisis in 2008–2009, have conspired to redefine and radically change the compliance and enforcement landscape in many industries and across many jurisdictions. Arguably, overburdening an economy with even more regulatory mandates and restrictions carries the risks of curtailing economic growth and stifling job creation.

Over-regulation or too many unnecessary rules and regulations may jack up compliance costs, which could be too burdensome for industry players and to their budgets, staff, systems and even overall business strategies. Over-regulation or overly complex regulation could also make it harder for the relevant authorities to monitor and enforce, as opposed to adequately targeted regulatory and supervisory regimes, which may increase overall regulatory costs on taxpayers. For example, compliance and enforcement costs have a direct relationship with the complexity of the tax regime and the system of fiscal incentives (in terms of qualifying and reporting requirements and different schemes).

5.9 Strengths-Shortcomings Balance

Given its emphasis on the respect for the rule of law, IBS adoption will be an impetus for Malaysia to have an adequately designed and developed regulatory and supervisory environment. The CITP recommendation of decoupling IBS procurement from the main contract provides a good illustration of how IBS can help address leakage, wastage and other negative elements, especially in public administration. Many measures to encourage IBS adoption would eventually

[45] US Commerce Department's Bureau of Economic Analysis (BEA)

[46] US Office of Management and Budget

contribute to the general ease of doing business and enhance Malaysia's long-term competitiveness.

Apart from the possibility of deepening the taxable income base vis-à-vis IBS-related businesses and their workforce under the Tax Revenue category, registration and/or licensing fees could potentially become a new source of revenue for the federal government. Considering a hypothetical backdrop of the presence of some 1,000 IBS component manufacturers and 100 manufacturers of various machineries and equipment specific for IBS purposes in the foreseeable future while assuming RM15,000 and RM75,000 as the annual licensing fees for players of these two segments, respectively, the federal government would be able to generate new annual revenue stream worth at least RM22.5 million, which will be reflected under the Licences and Permits sub-category of the Non-Tax Revenue category.

With a coherent and structured IBS agenda, we would be able to lay out and further enhance the entire incentive package for the IBS industry that better reflects the overall industry needs and the potential for its long-term growth and competitiveness, and maps out each segment with the nation's affordability.

On the other hand, fewer new foreign hires as a result of lower labour requirements in the construction sector with an extensive IBS adoption could cause the federal government to temporarily or even permanently lose one source of revenue: the annual levies imposed on registered foreign workers. Assuming there is no change to the rate of per capita levy for foreign construction workers at RM1,850, the cumulative revenue losses could potentially be as high as RM567,916,500.

CHAPTER 6: SUSTAINABILITY, SAFETY AND HEALTH PERSPECTIVES

This chapter covers all issues in the areas of safety, health and environment as well as resource efficiency with regard to the usage of IBS in construction works and projects. Sections 6.1 to 6.5 intend to symbolise the strengths and opportunities brought about by IBS adoption, while Sections 6.6 to 6.8 attempt to depict the shortcomings and risks that may need to be overcome.

6.1 Respect for and Anchorage of Legal and Institutional Underpinnings

Players in all segments of the IBS industry are bound by law to comply with (i) a set of diverse acts and enactments, (ii) rules and regulations, (iii) orders and ordinances that are mandatory, (iv) guidelines, codes of conduct, standards and best practices that are more voluntary in nature domestically and internationally in respect to safety, health, environment friendliness and sustainability, among others.

The existence of well-established regulatory, supervisory and monitoring frameworks or regimes as well as other legal and institutional arrangements are crucial to ensure public confidence in the IBS industry and to safeguard its overall soundness and stability, particularly from the perspectives of public and employee safety and health; reliability, quality and effectiveness of goods produced and services rendered by the IBS industry; management of impacts that the IBS industry may cause on the environment and equilibrium; efficiency and cost-effectiveness of technologies used by the IBS industry, among others.

Apart from addressing concerns of various IBS stakeholders, in particular regulatory authorities, goods producers, service providers, consumers and the public at large, the federal government is able to aim its policy interests and overarching agenda on businesses in all segments of the IBS industry through such frameworks or regimes. Therefore, this regulatory, supervisory and monitoring oversight can contribute to a wide range of socio-economic, environmental and even political goals.

1. List of acts and enactments relevant to the IBS industry:

a. Factories and Machinery Act 1967 or Act 139

b. Factories and Machinery Act (Amended) 2006 or Act A 1268

c. Occupational Safety and Health Act 1994 (OSHA 1994) or Act 514

d. Petroleum (Safety Measures) Act 1984 or Act 302

e. Workers' Minimum Standards of Housing and Amenities Act 1990 or Act 446

2. List of rules and regulations relevant to the IBS industry:

a. Regulations under the Petroleum (Safety Measures) Act 1984

- Petroleum (Safety Measures) (Transportation of Petroleum by Pipelines) Regulations 1985

b. Regulations under the Factories and Machinery Act 1967

- Factories and Machinery (Steam Boiler and Unfired Pressure Vessel) Regulations 1970 (Amendment) 2014
- Factories and Machinery (Person-In-Charge) (Amendment) Regulations 2014
- Factories and Machinery (Special Scheme of Inspection) (Risk-Based Inspection) Regulations 2014

- Factories and Machinery (Noise Exposure) Regulations 1989
- Factories and Machinery (Mineral Dust) Regulations 1989
- Factories and Machinery (Asbestos) Regulations 1986
- Factories and Machinery (Building Operations and Works of Engineering Construction) (Safety) Regulations 1986
- Factories and Machinery (Leads) Regulations 1984
- Factories and Machinery (Compounding of Offences) Rules 1978
- Factories and Machinery (Compoundable Offences) Regulations 1978
- Factories and Machinery (Certificates of Competency Examinations) Regulations 1970
- Factories and Machinery (Administration) Regulations 1970
- Factories and Machinery (Notification of Fitness and Inspections) Regulations 1970
- Factories and Machinery (Electric Passenger and Goods Lift) Regulations 1970
- Factories and Machinery (Fencing of Machinery and Safety) Regulations 1970
- Factories and Machinery (Safety, Health and Welfare) Regulations 1970
- Factories and Machinery (Steam Boiler and Unfired Pressure Vessel) Regulations 1970
- Factories and Machinery (Person in Charge) Regulations 1970

c. Regulations under the OSHA 1994

- Occupational Safety and Health (Classification, Labelling and Safety Data Sheet of Hazardous Chemicals) Regulations 2013
- Occupational Safety and Health (Notification of Accident, Dangerous Occurrence, Occupational Poisoning and Occupational Disease) Regulations 2004
- Occupational Safety and Health (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulations 2000
- Occupational Safety and Health (Safety and Health Officer) Regulations 1997
- Occupational Safety and Health (Classification, Packaging and Labelling of Hazardous Chemicals) Regulations 1997 (Revoked)
- Occupational Safety and Health (Safety and Health Committee) Regulations 1996
- Occupational Safety and Health (Control of Industrial Major Accident Hazards) Regulations 1996
- Occupational Safety and Health (Employers' Safety and Health General Policy Statements) (Exception) Regulations 1995

3. List of orders and ordinances relevant to the IBS industry:

a. Orders under the Factories and Machinery Act 1967

- Factories and Machinery (Exemption to Petroliam Nasional Berhad) Order 2013
- Factories and Machinery (Exemption of Certificate of Fitness for Hoisting Machine) Order 2015

b. Orders under the OSHA 1994

- Occupational Safety and Health (Prohibition of Use of Substances) Order 1999
- Occupational Safety and Health (Safety and Health Officer) Order 1997

4. List of Codes of Practice relevant to the IBS industry:

a. For Chemical Management

- Industry Code of Practice On Chemicals Classification And Hazard Communication 2014
- Industry Code of Practice on Indoor Air Quality 2010

b. For Industrial Hygiene
   - Industry Code of Practice for Safe Working in a Confined Space 2010

c. For Occupational Health
   - Code of Practice on Prevention and Eradication of Drug, Alcohol and Substance Abuse in the Workplace 2005
   - Code of Practice on Prevention and Management of HIV/AIDS at the Workplace 2001

d. For Transportation
   - Code of Practice for Road Transport Activities 2010
   - Code of Practice on Safety, Health and Environment for Transportation Sector (SHE Code) 2007

5. List of guidelines relevant to the IBS industry:

a. For Building, Construction and Engineering Works
   - Guidelines For Approval of Design Scaffolding 2016
   - Calculation Loading of Scaffolding 2016
   - Guidelines for Public Safety and Health at Construction Sites 2007
   - Guidelines for the Prevention of Falls at Workplaces 2007
   - Guidelines on Trenching for Construction Safety 2000
   - Guidelines on Occupational Safety and Health in Tunnel Construction 1998

b. For Industrial Safety
   - Guidelines On Safe Use Of Press Machines 2015
   - Guidelines on the Safe Use of Lifts and Escalators 2010

c. For Occupational Health
   - Guidelines for the Protection of Employees Against the Effects of Haze at Workplaces 2013
   - Guidelines on Occupational Health Services 2005
   - Guidelines on Preventing and Responding to Drugs and Alcohol Problems in the Workplace 2004
   - Guidelines on First Aid in the Workplace (2nd Edition) 2004
   - Guidelines on Reproductive Health Policy and Programmes at the Workplace 2002
   - Guidelines on Medical Surveillance 2001
   - Guidance for the Prevention of Stress and Violence at the Workplace 2001

d. For HIRARC
   - Guidelines for Hazard Identification, Risk Assessment and Risk Control (HIRARC) 2008

6. List of rating systems, tools or certifications relevant to the IBS industry:

a. Green Building Index (GBI)

b. Malaysia Carbon Reduction and Environmental Sustainability Tool (MyCREST)

c. Safety and Health Assessment System in Construction (SHASSIC)

d. Quality Assessment System in Construction (QLASSIC)

e. Certifications issued by internationally recognised bodies such as the British Standards (BS) and International Standards Organisation (ISO) such as ISO 14000 for environmental management and ISO 9000 for quality standards, among others

Nonetheless, all these benefits brought about by effective regulatory, supervisory and monitoring regime must be adequately balanced with any associated costs. For instance, poorly designed, inconsistent, overly complex or excessive regulations tend to be implemented inefficiently or non-cost-effectively, failing to achieve their intended purposes. Such mediocre regulatory

and supervisory regimes could invariably result in unnecessary burdens on industry players in various ways such as higher costs, inefficiencies and delays, among others, which will eventually stifle their growth.

No two industries deserve a similar regulatory, supervisory and monitoring attention. Certain industries require more stringent and rigid regulation to reduce systemic risks that could be catastrophic to the entire system or market. Take the financial services industry as an example. Given the uniqueness of financial institutions and increasingly stiff competition among them across borders, high volatility of global financial markets, increased diversification of their range of products and services, this industry, which includes a variety of segments (banking, insurance, interbank, capital and derivatives markets are among the major ones) is heavily regulated and supervised in almost all jurisdictions. However, the IBS industry is completely different. It is virtually free from such systemic risks and most probably, can do without the same ironclad regulatory, supervisory and monitoring arrangements despite having to endure 21st century challenges, just like any other industry.

6.2 Greater Cleanliness, Safety, Health and Sustainability-related Accomplishments

IBS allows latitude for greater compliance with cleanliness, safety, health and green standards and practices, given less on-site non-building activities, especially wet works in the presence of:

a. Much-reduced labour requirements
b. More controlled working environment and much-improved living conditions[47]/ housekeeping practices at construction sites
c. Neater, cleaner, safer/less hazardous and more organised construction sites, especially during construction owing to, among others:
    - More effective and efficient construction site management
    - Less negative externalities on the surrounding locality and community due to construction works in the form of water, air and soil pollution as well as noise and traffic disturbances
    - Easier, more environment-friendly processes and procedures
    - Systematic storage and just-in-time (JIT) delivery of IBS components to construction sites, hence reduced risks of bulky and/or hazardous materials that could trigger accidents or catastrophes
    - Less usage of timber formworks or other materials at project sites and fewer on-site activities, hence less material wastage, pollution and other adverse environmental repercussions
    - Less on-site wet trades, especially when concreting is involved

With IBS, requirements for workers, especially for on-site works, could be reduced by at least 20% (compared to CBM), according to the average in the findings of the survey exercise among IBS value-chain participants conducted for the purpose of this CBA study, or by about 40%–50% according to An Introduction of Industrialised Building System – Manual for Developers published in 2014. Construction sites employing fewer workers are usually faced with lower risks of Occupational Safety and Health (OSH) issues, which could be very costly if they strike.

[47] Poor living conditions/bad housekeeping practices pose a threat to the public health in general, being a hotbed for vector-borne diseases such as dengue, Chikungunya, leptospirosis, Japanese encephalitis and malaria, among others.

Since any OSH risk may lead to downtime or even a definite stoppage of activities, IBS, which can ensure greater compliance with safety, health and sustainability regulations and guidelines, is what the construction sector needs, from the economic, business, socio-humanistic and socio-ecological perspectives. Although the usage of relatively new methods may to a certain extent increase the risks of human error at the design, manufacturing and installation/erection phases, this type of human error is not deadly in nature, unlike freak and fatal accidents at construction sites using CBM. This is in line with one of the CITP's targets to reduce worksite fatalities and injuries by 50% under the Quality, Safety and Professionalism Strategic Thrust.

As the Malaysian construction sector generates a lot of waste, of which little is recycled, the construction and demolition (C&D) waste aggravates the problem of rapidly depleting capacity of landfills. Illegal and irresponsible dumping by certain construction players has long been one of the major causes of environmental degradation. With IBS, wastage of timber, followed by cement, brick, soil and concrete, is estimated to be less than 5% of total materials used[48]. This will go a long way in reducing the contribution of construction waste to landfills, apart from addressing irresponsible dumping of C&D waste.

It is one of the CITP's goals to transform Malaysia's construction sector into an environmentally sustainable one, increasingly characterised by (i) sustainability-rated buildings and infrastructure[49], which are resilient to natural catastrophes, (ii) buildings with low carbon emissions[50] and energy usage, and (iii) low volume of C&D waste (particularly that ends in illegal and irresponsible dumping).

Once in place, the next step is for Malaysia's environmentally sustainable construction to become a model for the emerging world, particularly the ASEAN region with one key outcome - 100% of large infrastructure projects to exceed sustainability requirements with a 4 Mt CO_2-equivalent reduction per year[51]. After all, environmentally sustainable construction would appear as one of the most suitable performance criteria for IBS with green or eco-friendly buildings and infrastructure as the major upshot in the form of environmentally responsible, resource efficient and minimal waste structure as well as application of processes and appliances throughout a building's or infrastructure's life cycle from planning, design, construction, operation, maintenance, renovation/upgrade and demolition. Making IBS one of the underlying conditions in urbanisation and infrastructural building framework may indirectly help incorporate disaster risk management into the country's development planning.

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[48] Page 22, An Introduction of Industrialised Building System – Manual for Developers, published in 2014 by CIDB Malaysia

[49] Less than 2% of buildings and infrastructure in Malaysia are assessed for environmental sustainability with building rating systems such as the GBI. Among those assessed, less than 50% have been rated. Page 86, CITP 2016-2020

[50] Malaysia's CO_2-equivalent emissions are relatively high, with the ratio of GDP to CO_2 among the world's lowest. Malaysia's GDP per CO_2 tonne is USD1,500 vs. Singapore's USD3,700. Malaysia's growth in CO_2 of 5% is faster than most emerging economies: Indonesia's 4.6% and the Philippines' 1%. Page 87, CITP 2016-2020 publication

[51] Page 84, CITP 2016-2020 publication

Since IBS is a pathway to environmentally sustainable construction excellence, it is therefore part of the overall green and sustainability[52] agenda. Being highly technology driven, energy efficient, more carbon neutral and less-labour intensive, IBS is expected to play a significant role in achieving Malaysia's target of reducing per GDP emissions of greenhouse gases (GHGs)[53], especially carbon dioxide (CO_2), also known as the carbon emission intensity, by up to 40% by 2020 and 45% by 2030 against the 2005 levels, a commitment first pledged in December 2009 at the UN Climate Change Conference, dubbed the Copenhagen Summit, and subsequently reiterated at the same conference in New York in December 2014. The landmark Paris Agreement on Global Warming, negotiated through the UN and approved by 195 countries in December 2015, reaffirmed the global warming threshold of within 2°C (or 3.6°F), i.e. to prevent global average temperatures from rising more than 2°C above the levels before the dawn of the world's First Industrial Revolution.

After all, being among the world's largest users of energy and water as well as producers of emissions and waste, residential and commercial buildings bear heavy environmental responsibility. In Malaysia, they consume 15% of the total energy and are among key contributors to GHGs[54], which some estimates show as high as 40% as a result of fossil fuels used to generate electricity or direct use for building operations. It is also estimated that buildings produce 40% of global wastes and consume 16% of water sources[55].

Nonetheless, the acceptance and relevance of IBS as an integral part of the sustainability framework still leaves much to be desired in Malaysia, which warrants a thorough study into sustainability issues related to IBS design, operations, construction and maintenance of buildings and infrastructure towards developing holistic and systematic guidelines and performance criteria that incorporate sustainability concepts and objectives in all IBS applications.

The WEF's Global Risks Report 2016 named climate change as one of the biggest risks to life on Earth, estimating that climate change could wipe USD2.5 trillion off global financial assets under a business-as-usual track of GHGs and other man-made emissions, but that loss in value could be almost 10 times bigger, hitting USD24.2 trillion under a worst-case scenario. Fighting climate change effects is, therefore, urgent since it is estimated that global warming could cost the world more than USD2 trillion a year in lost productivity by 2030 as it becomes too hot to work in many economic sectors, making it harder for people to accomplish their jobs, especially in the world's poorest nations, notably the lowest paid and most heat-exposed occupations in construction and agriculture sectors, as revealed by the findings of Tord Kjellstrom, researcher for the Health and Environment International Trust

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[52] Efficient use and management of limited resources such as water, land, energy and natural resources as well as overall management of resulting waste, whether solid waste, effluents or emissions of air pollutants (hazardous gases, toxic metals, particulates, free radicals, radioactive pollutants, etc). The organising principle for sustainability is sustainable development, which comprises four interconnected domains, namely ecology, economics, politics and socio-culture. The Sustainable Development Goals (SDGs), officially known as Transforming our World: the 2030 Agenda for Sustainable Development is a set of 17 Global Goals with 169 targets covering a broad range of sustainable development issues. Spearheaded by the UN, the final document was adopted by its 193 member countries as a successor to the Millennium Development Goals in September 2015.

[53] Six main GHGs are carbon dioxide, methane, nitrous oxide, hydro fluorocarbons, per-fluorocarbons and sulphur hexafluoride.

[54] Page 87, CITP 2016–2020

[55] Du Plessis, 2002; Sisson et al., 2009; UNEP-SBCI, 2010b

New Zealand, in the Asia-Pacific Journal of Public Health in July 2016.

The International Energy Agency (IEA), together with the International Renewable Energy Agency (IRENA), estimated in a March 2017 report entitled Perspectives for the Energy Transition: Investment Needs for a Low-Carbon Energy Transition that the global transition towards a decarbonised energy environment - with efforts such as investments in renewable and clean energy to reduce carbon emission intensity by 85% in order to slow climate change to within 2°C of the world's pre-industrial levels - would yield annual economic benefits in the form of reduced negative externalities of up to USD10 trillion and eventually boost the world GDP by USD19 trillion while creating 6 million jobs worldwide by 2050.

6.3 IBS Embraces Resource Savings and Eco-friendly Solutions

With IBS, we can expect significant cost savings on better resource use as well as waste efficiency and management thanks to:

a. Naturally less usage of building materials at construction sites and probably off-site as well, hence potential minimisation of waste, particularly due to reduced on-site waste generation
b. Significant waste reduction, especially unnecessary C&D waste (dumped materials) given less on-site non-construction activities as materials are precast or prefabricated at IBS factories and hence lower expenditure on waste disposal and treatment as well as improved safety at construction sites
c. Execution of the principles of the 3R (reuse, recycle and reduce) concept
d. High degree of automation and machine utilisation in manufacturing IBS products, components, techniques and elements should help increase levels of precision and accuracy in terms of usage of materials and resources as well as better workmanship
e. Higher resource efficiency in terms of usage of energy and water
f. Low carbon emissions and carbon footprints as the factory setting to manufacture IBS products and components enables the use of renewable energy such as solar power and reduces overdependence on fossil fuel-generated energy

According to an article entitled Towards Adoption of Prefabrication in Construction published in the Building and Environment journal, a conventional project that involves concreting and bar bending work may cause average waste levels of 20% and 25%, respectively. In contrast, if the same project adopts IBS, the average waste level for both may drop to 2%, equivalent to a waste reduction of up to 90%.

Apart from helping to expedite rebuilding efforts, IBS could also help lower expenditure to reconstruct, repair and/or rehabilitate, especially basic infrastructure, public amenities and dwellings, after natural disasters. Owing to its superior resource and energy efficiency, lower material intensity and higher potential for the application of the 3R concept, IBS helps bring down expenditure on waste management, which entails collection, separation and categorisation, removal, transfer/transport, treatment and disposal of C&D waste towards reducing adverse effects of waste on safety, health, environment and general aesthetics.

With the removal of energy subsidies as part of the Subsidy Rationalisation Programme (SRP), a subsidy reform plan initiated in July 2010 to strengthen public finances and boost economic efficiency, IBS could provide the answer as far as solutions are concerned with energy-efficient features throughout the life

cycle of buildings. Higher levels of precision and accuracy brought about by IBS would also mean more efficient usage of materials and other resources (such as utilities, consumables and works done by third parties), which are part of intermediate input that typically makes up about 60% of total construction costs[56].

Coupled with IT-based material procurement and handling systems such as Material Requirement Planning (MRP), JIT, Total Quality Management (TQM), zero inventory, LEAN and a few others, effective and efficient material management should result in significant cost-savings and productivity gains. A study by MGI estimated that procurement best practices could lower costs by as much as 25%–30% across key spending categories, depending on the type of building materials.

As part of the nature preservation and environmental sustainability agenda, Malaysia is also blessed with greater opportunity to use sustainable materials, particularly in the production of IBS products and components and in construction activities such as usage of palm kernels as replacement aggregates for lightweight IBS blocks and bamboo formwork at construction

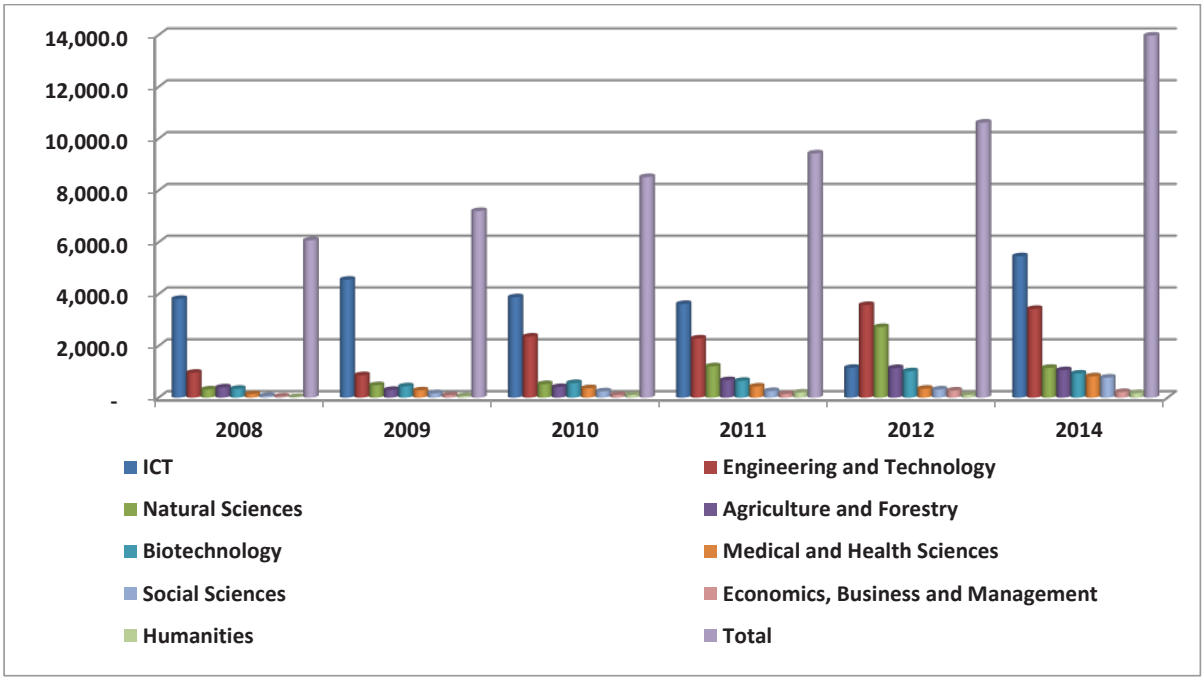
[56] Page 105, Productivity Report 2013/2014, published by MPC

Table 6.1: Malaysia's gross expenditure on R&D (GERD)-related data

Year	Current Expenditure (RM million)	Capital Expenditure (RM million)	Total GERD (RM million)	GERD-GDP Ratio (%)
2008	5,134.10	936.7	6,070.80	0.79
2009	5,873.90	1,326.00	7,199.90	1.01
2010	6,732.50	1,778.20	8,510.70	1.04
2011	6,674.00	2,748.00	9,422.00	1.03
2012	8,559.48	2,053.33	10,612.82	1.09
2014	10,265.06	3,706.50	13,971.56	1.26

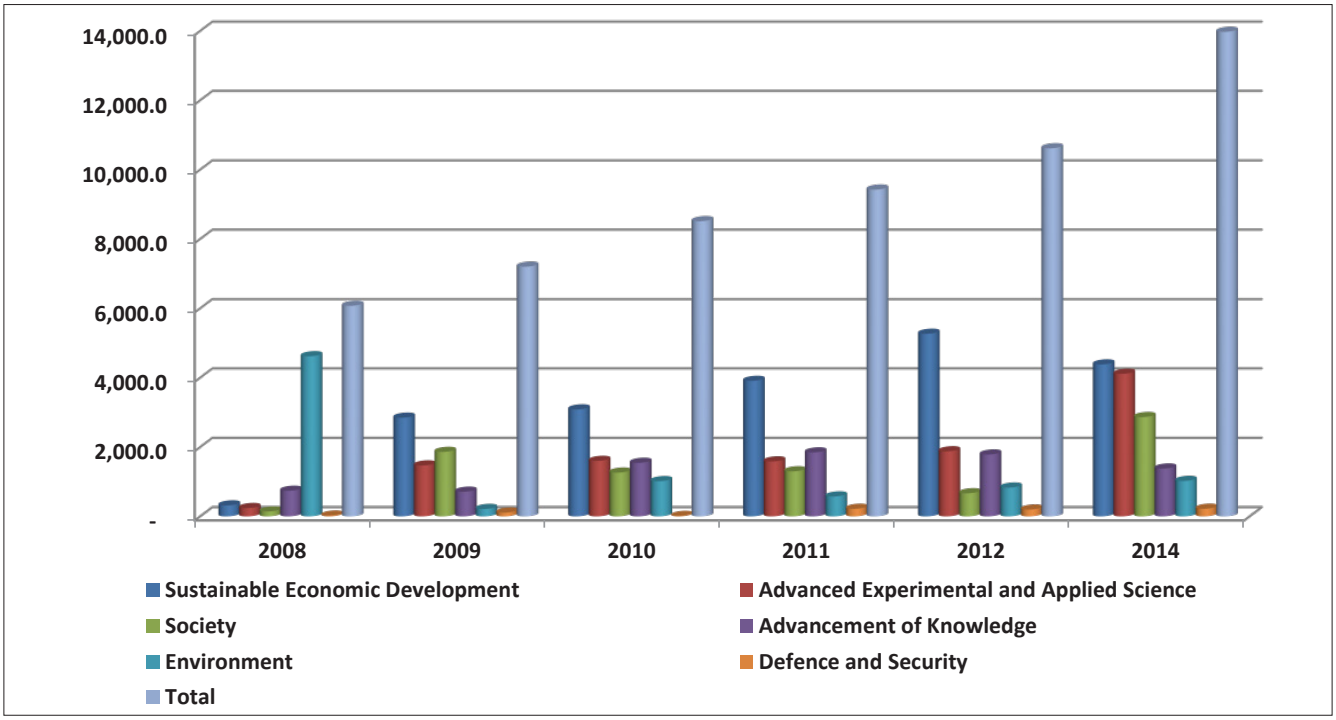
Source: MOSTI

Figure 6.1: Amount of GERD by field of research (RM million)



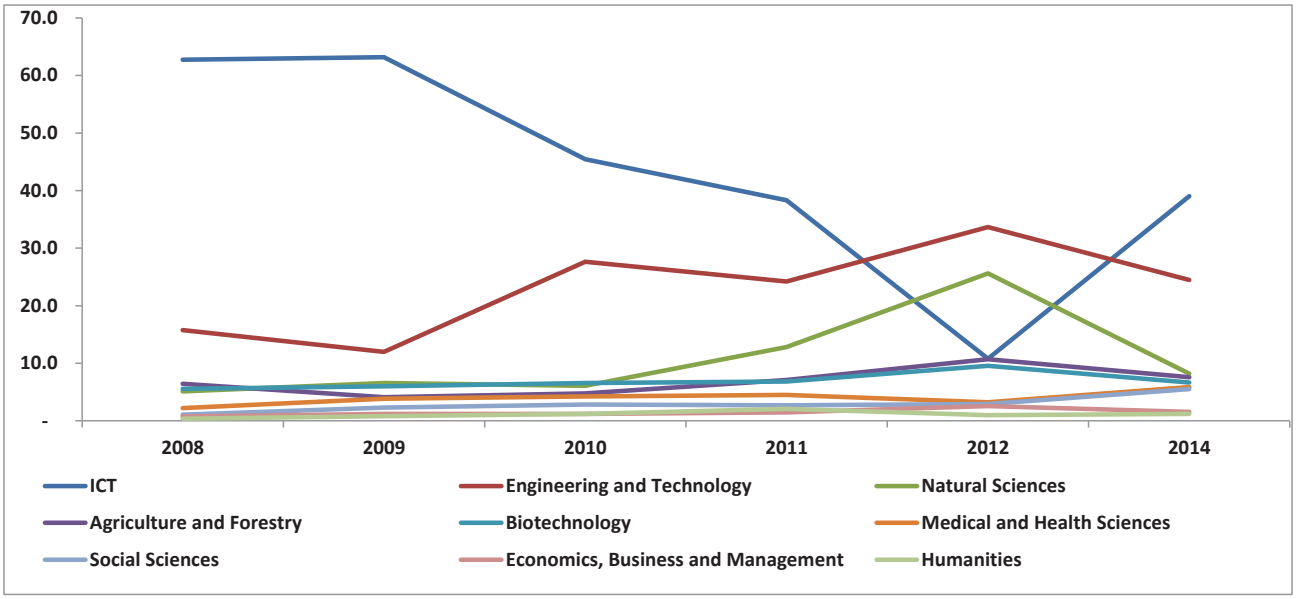
Source: MOSTI
*Figures for 2013 not available

Figure 6.2: Amount of GERD by socio-economic objectives (RM million)



Source: MOSTI
*Figures for 2013 not available

Figure 6.3: Share of GERD out of total field of research (%)



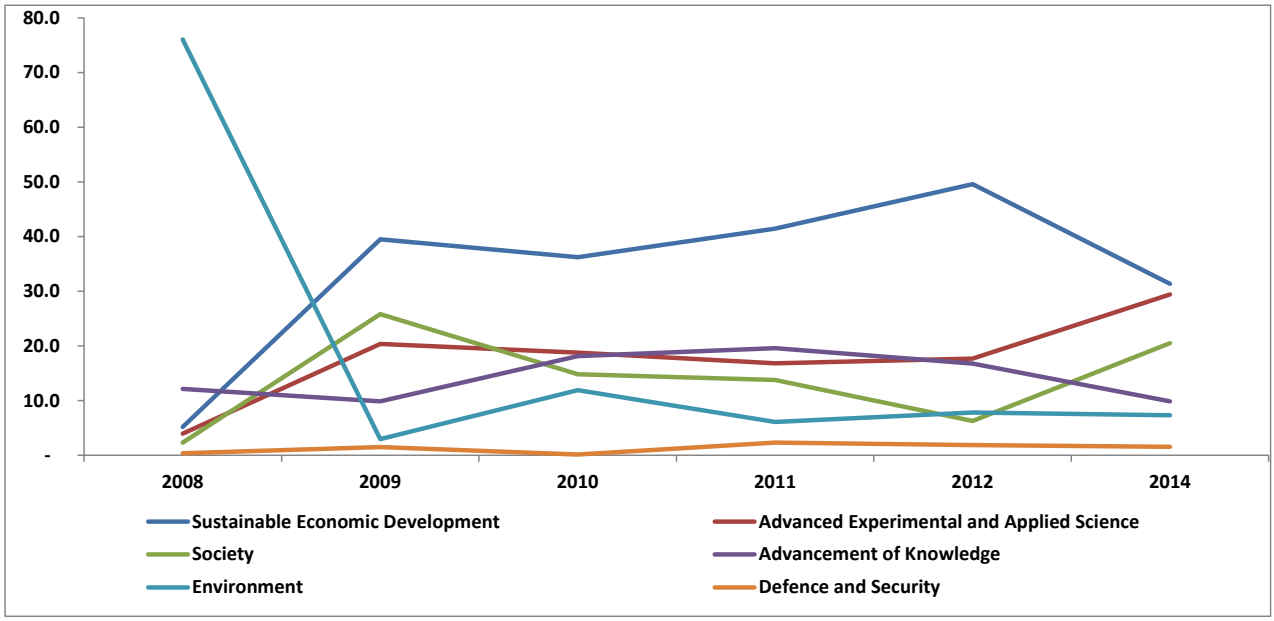
Source: MOSTI
*Figures for 2013 not available

sites. Indirectly, greater usage of sustainable materials would also help promote domestic R&D activities.

According to the IMD's WCY 2014, Malaysia has been ranked the world's no. 31 with a gross domestic expenditure on R&D (GERD)-to-GDP ratio of 1.26% compared to other Asian countries as follows:

a. South Korea at no. 1 with 4.29%
b. Japan at no. 3 with 3.59%
c. Singapore at no. 15 with 2.20%
d. Thailand at no. 51 with 0.48%
e. Philippines at no. 58 with 0.14%
f. Indonesia at no. 59 with 0.08%

Figure 6.4: Share of GERD out of total socio-economic objectives (%)



Source: MOSTI
*Figures for 2013 not available

Malaysia's annual GERD jumped 736% from RM1.6715 billion in 2000 to RM13.9716 billion in 2014. There are two ways to categorise GERD, namely by fields of research (FoR) and by socio-economic objectives (SEOs). The nine domains under the FoR category are as follows in a descending order of importance in terms of spending amount:

a. ICT
b. Engineering and Technology
c. Natural Sciences
d. Agriculture and Forestry
e. Biotechnology
f. Medical and Health Sciences
g. Social Sciences
h. Economics, Business and Management
i. Humanities

On the other hand, the SEO category consists of the following areas in a descending order of importance in terms of spending amount:

a. Sustainable economic development
b. Advanced experimental and applied sciences
c. Society
d. Advancement of knowledge
e. Environment
f. Defence and security

Although MOSTI does not provide the specific breakdown of GERD for both IBS and sustainable materials, it can be safely deduced that both form part of Engineering and Technology, the second largest domain of the annual GERD in 2014 based on the FoR category. Under the SEO category, on the other hand, both are likely to be found in two largest areas, namely Sustainable Economic Development and Advanced Experimental and Applied Sciences.

Assuming that roughly 10% of the annual R&D spending in the Engineering and Technology domain is allocated to areas related to IBS and sustainable materials combined, this would translate into a GERD worth RM342 million, equivalent to 2.45% of the total GERD in 2014. As an indication, the 11MP targets the overall GERD-GDP ratio of at least 2.0%[57] by 2020 from only 1.26% in 2014.

Under the 10MP and 11MP, the federal government has been financing and will continue to financially support a multitude

[57] Page 8.14, 11MP

of waste-to-wealth initiatives and projects related to sustainable materials using materials from renewable sources and the latest technology available. All these efforts will contribute a great deal towards preserving environmental equilibrium and ecosystem.

Timber, timber-based structures and other timber products, being one of the major categories of natural resources in the construction sector, have long been associated with sustainability and environment friendliness, safety/health and strength, sturdiness and flexibility as well as energy savings and aesthetics. Timber-based components and elements such as engineered timber products are ideal for 21st century construction with their high performance against natural catastrophes such as fire and earthquake, with timber's appropriate dimensions, superior strength to weight ratio, and aesthetic value with pleasant and warm effects. Among the advantages of timber and its products compared to other IBS-compliant components and elements include:

a. Abundance of timber sources in Malaysia's rainforests with 2,500 species in total, with just over 100 species used
b. It is the only 100% renewable raw material that stores carbon instead of emitting it
c. Manufacturing of wood-based products is less energy consuming than other types of building materials
d. Timber-based IBS is one of the most environment-friendly building systems and forms part of the Green Building Index (GBI)
e. Lightweight and easy to handle compared to other materials
f. High resistance to fire with little non-toxic smoke (in case of fire) as well as more solid in case of earthquakes compared to alternative materials such as stone, brick and concrete
g. It enables the use of engineered timber-based structural materials such as glulam and LVL
h. Timber has high intrinsic attractiveness (aesthetic values, warm feeling, etc.) and is flexible for designs and renovations

Little wonder that timber and its derived products are widely and effectively used as IBS-compliant materials in many developed nations such as North America, Europe, the UK, Australia, New Zealand and Japan. Conforming to the right specifications such as grades, species and dimensions as well as world-class quality assurance systems, guidelines and best practices, timber could prove a star material for IBS and any modular coordination approaches.

Timber frame systems remain popular among self-builders because they are fast, convenient and almost hassle free. As the main components are fabricated and assembled in the factory and then transported to construction sites under the IBS regime, roofs and walls are erected far quicker compared to a conventional masonry system.

Another major selling point of timber frame houses is the insulation aspect of the walls, especially the new standard dubbed by many timber farmers as super insulation. With a timber main frame, buildings are constructed using a sustainable resource, especially if the timber source is certified to have originated from renewable, carefully managed forests.

6.4 Better Working Environment and Living Conditions for Workers with Prefabricated Solutions

The usage of IBS components and prefabricated solutions has been proven to create better working environment and much-improved living conditions, particularly for the construction personnel owing to:

a. **Reduction of tools, equipment and materials (TEMs) at construction sites**
This is made possible with the application of simplified methods of construction based on prefabricated components as an alternative to in-situ methods. With reduced TEMs and required on-site measurements, wastages are also minimised. All these should lead to a cleaner and neater working environment.

b. **Presence of safer working platforms for site operations**
Once installed, prefabricated slab components can act as a sturdy working platform for construction workers to perform other trades and activities. In addition, IBS staircases, usually made of precast concrete or steel, offer faster, easier, sturdier and safer access in between floors during the construction stage.

c. **Usage of prefabricated solutions**
These include cabins, bathroom pods as well as lightweight steel structures and precast concrete buildings as part of the workers' quarters, mostly temporary structures at construction sites.

Utilisation of IBS facilitates the rapid and high-quality construction of facilities and amenities, which may include dwellings, restrooms, shelter sheds, seating, dining areas, access to drinking water, changing rooms, washing facilities, lockers and storage facilities for personal belongings, either as temporary or permanent structures. For illustration, MRT Corp's Centralised Labour Quarters (CLQs) were mainly constructed using IBS components. These CLQs have served their purpose of providing better working and living environment for site workers with facilities and amenities of higher standards. This is one of the 18 initiatives outlined by the CITP in Initiative Q2: Improve Workplace Safety and Workers' Amenities[58] under the Quality, Safety and Professionalism Strategic Thrust.

Prefabricated solutions, a facet of IBS, should help put in place a minimum set of standards to guarantee workers' safety, welfare and wellbeing, together with other more stringent OSH requirements. Better treatment of construction site workers, mostly foreigners, is one of the contributing factors towards ensuring public order, safety and peace of mind of the rakyat as a whole. Apart from integrating the construction sector into the coverage of the Workers' Minimum Standard of Housing and Amenities Act 1990 (Act 446), making usage of prefabricated solutions in providing housing and amenities for site workers mandatory should be considered.

[58] Page 69, CITP 2016–2020 publication

Box Article 3: Adapted from page 72, CITP 2016–2020 and news articles published by Bernama, The Star Online and The Sun Daily on 26 April 2017

CLQs for Workers for the Construction of SBK and SSP Lines

Company: Mass Rapid Transit Corporation Sdn. Bhd. (MRT Corp)

Total construction cost of CLQ complexes that have been or are currently being built: RM270 million

Total number and locations of CLQ complexes: 13, of which three are in Sungai Buloh, Selangor; one in Jalan Cochrane, Kuala Lumpur; and nine in Serdang, Selangor

Maximum capacity: 9,300 beds

Facilities: Spacious cabins, bathrooms, cafeterias, sundry shops, laundry services, clinics/nursing rooms for simple medical attention, mussola/prayer rooms, and entertainment and recreational facilities

Maximum number of workers in each cabin/ room: 5 to 6

Current number of workers at CLQ complexes: 600 people

Number of countries of origin of workers currently lodged at CLQs: 12, including Bangladesh (majority), Indonesia, Pakistan, China, Nepal and Myanmar, apart from a few Malaysian nationals

First introduced in 2012 to house workers for the construction of the MRT Sungai Buloh-Kajang (SBK) line that began in 2011 and on course to be completed by July 2017, MRT Corp continues with the CLQ concept for the construction of the Sungai Buloh-Serdang-Putrajaya (SSP) line, currently at 6.2% completion since the work resumed in September 2016, and is scheduled to be ready by July 2021, with full operations a year later.

MRT Corp's CLQ concept has set a good precedent and very high standard for all Malaysian construction companies to emulate, being the first of its kind in Malaysia with each complex containing not only proper accommodation but also facilities of a mini township. All 13 CLQs, which can accommodate up to 9,300 workers, are equipped with state-of-the-art security systems that require workers to pass through a 10-point facial recognition at the entrance. This is in addition to a safety manual for emergencies to ensure safety of the workers and CLQ complexes.

Following the adoption of the Malaysian Standard (MS) of Temporary Construction Site Workers' Amenities and Accommodation (MS 2593:2015), only up to five or six workers are assigned to each room or cabin at these CLQs for additional comfort instead of eight previously. Indeed, the MS used MRT's CLQ concept as its prime template in formulating the MS 2593:2015 before the Labour Department adopted it as a guideline effective January 2016.

The CLQ concept is considered as the best way to manage foreign construction site workers in Malaysia, providing them with workers' basic rights such as safe, clean, comfortable and convenient place of residence to rest and have recreational activities outside of working hours. Happy and well-rested workers will be able to work well, eventually raising the construction sector's productivity.

In view of the success of MRT's CLQ model, other construction companies are slowly implementing a similar concept for their construction works and projects. Most recent examples include Petronas for its Refinery and Petrochemical Integrated Development (RAPID) project in Pengerang, Johor.

Source: CITP 2016-2020 publication; Bernama's "MRT's Centralised Labour Quarters a Model for Other Construction Firms"; the Star Online's "Envoys Visit MRT Corp's Centralised Labour Quarters"; and the Sundaily's "Indonesian, Bangladesh Embassies Satisfied with New Centralised Labour Quarters".

6.5 Facilitating Greater Usage of Building Information Modelling (BIM)

As defined by the CIDB, BIM is a modelling technology and an associated set of processes to produce, communicate, analyse and use digital information models throughout the construction project and building life cycles, comprising various stages such as the Planning and/or Design (PD), Construction and Facility Management (FM); in short, from the earliest conceptions to demolition.

At the PD stage, BIM offers intelligent and effective transfers of information between project stakeholders. Therefore, similar to IBS, BIM offers greater certainty between design intent and the final constructed and operated building. During the Construction stage, BIM promotes better collaboration and coordination, thus reducing project risks, unbudgeted changes and (time and material) wastage, among others, while increasing productivity, speed, safety, quality and sustainability from the economic, social and environmental perspectives. At the FM stage, BIM provides a centralised database for the whole life cycle of asset management, hence offering a better formulation of a plan to maintain facilities in a more cost-efficient, safer and greener manner.

Despite its ability to reduce the need for rework and redundancies due to careful design, planning, selection and implementation, hence the potential for substantial cost savings and productivity gains, BIM adoption in Malaysia is still low. It is only at 10%, as opposed to 71% in the United States, 65% in Singapore and 39% in the United Kingdom, according to a CIDB survey conducted in 2014 and the 'Business Value of BIM for Construction in Major Global Markets: How Contractors Around the World Are Driving Innovation With Building Information Modelling', McGraw Hill Construction 2014[59].

The crux of the matter is, as a digital representation of physical and functional characteristics or shared knowledge resource for information of a facility or building, BIM can be considered as part and parcel of the highly mechanised and automated, technology-driven IBS. Under Initiative P4 of the CITP's Productivity Thrust, at least a 40% implementation rate of BIM Stage 2 (when two or more construction disciplines use the same digital model to collaborate in a project) has been set as a target for public projects valued above RM100 million. Subsequently, the same target will be gradually extended to private projects. The CITP also sets a target for the development of a standard BIM library containing IBS and other building components offered by local suppliers.

IBS, together with its componentised construction approach, can be expected to facilitate an increased usage of BIM within the Malaysian construction sector, as fundamentally, BIM is structured and geared towards usage of components and information.

[59] Page 112, CITP 2016-2020 publication

The parameters of a BIM project are a single file concept (sharing of a digital information model), intelligent building components (components with information), decision-making tools (changes easily identified for decision making), automated generation and updating of report (automatic project documentation) and data in the building models. Any BIM software that contains a library of IBS components with information will definitely simplify the model generation process and ultimately construction activities and post-construction operations.

6.6 Higher Usage of Utilities and Chemicals at IBS Component-making Plants and Impact on Overall Resource Savings and Waste Management

Conversion of raw materials and semi-finished goods into finished IBS components and elements at production plants as well as heavy-duty usage of machineries at construction sites may require high consumption of utilities, especially energy and water. As an illustration, the production of steel components for both hot-rolled and cold-formed steel requires massive energy consumption. Hot rolling involves forming steel billets at extreme temperatures, usually above 1000°C so that the steel can be formed into the required shapes and sizes. Hot-rolled steel is typically used as the I-shaped beams and columns for steel structures with long spans.

The production of cold-formed steel, on the other hand, involves another round of forming of the produced hot-rolled items. Even though this stage requires much lower energy consumption, as it is being done at room temperature, it also involves usage of heavy machineries during the process of shaping the flat steel sheets into the required C- or Z-shaped IBS cold-formed channels, usually used for roof trusses, and more recently in Malaysia, for walls and floor frames.

Production and assembly of some IBS components also use a significant amount of chemicals and chemical products. As a result, the non-environment-friendly wastage require proper and unique disposal methods that could have cost implications to a certain extent, notably for cash-strapped and less sophisticated IBS manufacturers.

Since the Malaysian construction sector is traditionally heavily inclined towards concrete as the base construction material, precast concrete is the most common IBS type, and mould oil, as an example, is an important material used in the production of IBS components in Malaysia. Mould oil is required as the release agent to prevent the cured concrete products from being attached to the formworks. Typically, the construction sector still uses two types of release agents - a physical barrier (mineral oil-based) and a chemical reactive (vegetable oil-based and other proprietary products). While vegetable-oil based products are biodegradable and non-toxic, mineral-oil based products can pollute the soil, water and air if not properly collected and disposed. The oil is also poor in biodegradability characteristics and technically hazardous to workers. Other potentially hazardous chemical wastes in IBS production include paint, lacquer and epoxy.

The application of JIT or Lean Management principles is crucial to ensure overall resource savings and reduction of wastage in the production of IBS components. Since IBS-based construction involves three main stages - production, transportation, and installation or erection - IBS components and elements will also be subjected to multiple handling processes using lorries, cranes and other heavy-duty lifting equipment.

As highlighted many times in various earlier sections, proper planning and coordination is very crucial for IBS projects to be successful. Production, transportation and installation or

erection must be properly planned in advance in order to avoid unnecessary additional handling processes. JIT implementation can help prevent double-handling at the plants, where IBS components are manufactured, and at the sites, where construction activities take place. For instance, double-handling may entail having to unload IBS components and shift to a temporary storage while waiting for the clearance to install components at a particular on-site area. No doubt, avoiding double-handling will help lower energy consumption by heavy machineries at construction sites.

6.7 Several Unresolved Accessibility, Connectivity and Logistics Issues in Rural Areas

IBS could prove to be more suitable and advantageous for projects in urban areas as opposed to rural areas. In other words, the location of construction sites and the availability of or accessibility to IBS components and elements may affect their demand, as a great deal depends on the communication and connectivity conditions (land, riverain and sea transportation network) and logistics. A study by Warszawski (1999) revealed that the suitable distance between the IBS fabrication plant and a construction site should be within the radius of 50km to 100km. The high cost of transporting IBS components and elements from manufacturing plants to construction sites could prove to be so prohibitive that it curtails the growth of the IBS industry. IBS manufacturing plants could be so far from construction sites that transportation, shipping and logistical costs would easily wipe out any potential savings gained from IBS adoption.

While the west coast of Peninsular Malaysia is well connected by the North-South Highway, high transportation cost is still an issue for construction projects in the east coast states such as Kelantan, Terengganu and Pahang, despite the completion of the East Coast Expressway Phase 2 (Lebuhraya Pantai Timur Phase 2). It is even more challenging for projects in Sabah and Sarawak to consider using IBS components given the unavailability of IBS manufacturers within reasonable distance. Rural areas in states where IBS manufacturing plants and facilities are few and far between have the least incentive to resort to IBS-based construction projects, as IBS does not only involve the transportation of bulky components but also mobilisation of cranes and other specialised lifting or hoisting of equipment to construction sites.

As at 31 March 2017, 52% of the IBS manufacturers registered with the IBS Centre under the Assessment of IBS Status (AIS) programme are located in Selangor and Johor. As such, it is not a surprise that workers with adequate experience and knowledge in IBS are concentrated in Selangor and Johor. This backdrop makes IBS-based projects more viable in Selangor and Johor than elsewhere in Malaysia. It is also worth noting that IBS plants in Selangor cater to demand in the Klang Valley comprising Selangor, Kuala Lumpur and Putrajaya as well as some parts of Melaka and Negeri Sembilan, while those in Johor count construction companies in Johor and Singapore as their major clients.

Some of the IBS components that are produced based on the Modular Coordination principles (increments of 300mm or 3 Modulor for horizontal dimensions) such as the lightweight wall panels (600mm typical width), hollow core slabs (1200mm typical width), and precast slabs (2400mm typical width), among others, are able to maximise the space in trailers, as the lorries themselves have been internationally set to carry 2400mm in maximum width. For non-standard components that differ greatly in sizing combinations such as beams and columns as well as full-height walls, the option could be rather limited.

In addressing the issue of a limited number of manufacturers in certain states, under CITP, the federal government is targeting more companies to venture into the IBS manufacturing segment equipped with AIS by offering financial and technical supports. One alternative solution is for builders to look into the possibility of organising on-site casting. With this approach, IBS manufacturing is undertaken on-site rather than at off-site permanent factories. Lifting equipment and trailers are still required with this option, but transportation and logistical costs can be minimised.

Instead of setting up a full-fledged and covered factory as well as using overhead or gantry cranes, casting of IBS components can be done in an open area and supported by mobile cranes. Ready-mixed concrete (RMC) suppliers can be good substitutes for concrete batching plants. This will reduce the costs of setting up on-site casting facilities, eliminating the requirement for skill batchers, concrete lab and aggregate bays. A study by the MPC in 2015 concluded that the breakeven quantity for an on-site casting facility is only 252 units of 20 x 70 terrace houses. It proves that for a medium-sized property development, the on-site casting is viable to be considered as an option. Nonetheless, manufacturing IBS components outside a factory still has limitations in terms of types of IBS components that can be produced on-site, relatively lower productivity, vulnerability to weather conditions and quality control issues.

6.8 Threats of Depletion of Finite Raw Materials and Natural Resources

Natural resources are resources that exist without actions of humankind as a separate entity such as air, atmosphere, raw fresh water, sunlight, land and minerals; living organisms such as vegetation and animals; and resources that must be processed beforehand such as metal ores, petroleum and most forms of energy. In fact, every man-made product is composed of natural resources at its fundamental level. Some natural resources, known as ubiquitous resources such as sunlight and air, can be found everywhere, although most resources are localised resources since they only exist in small sporadic areas. Natural resources can be further classified in different ways - inexhaustible vs. exhaustible/finite resources, renewable vs. non-renewable resources, biotic vs. abiotic resources, potential vs. actual vs. reserve, and stock resources, among others.

Although it is more commonly used in reference to farming, fishing, mining, water usage and fossil-fuel consumption, resource depletion typically occurs when the consumption or usage of a resource is faster than it can be replenished or when its rate of usage exceeds the rate of replacement. Threats of depletion of natural resources due to uncontrolled mining of base materials such as sand, granite and bauxite as well as the issues surrounding non-sustainable timber harvesting are real and present dangers for the continuity of the IBS industry.

Table 6.2: List of natural resources required by the construction sector facing risks of depletion and probability of occurrence

	Natural Resources Facing Depletion Risks	Probability of Occurrence	Remarks
1	Raw Water	Medium	Even with a high rainfall rate distribution of 971 billion cubic metres (BCM) and a surface precipitation rate of 494 BCM annually, water resources in Malaysia could be negatively affected if not managed properly. Long and severe droughts and extreme pollution could cause interruptions to the treated water supply.
2	Forest Ecosystem	High	Development, especially erection of infrastructure and buildings, in forest areas will affect the forest ecosystem with implications for sources of food, water, timber, herbal plants and carbon stock.
3	Forest Fauna Biodiversity in terms of species and genetics	High	Overdevelopment in forest areas can disrupt the natural habitat and lead to forest fragmentation, which in turn will bring down the fauna population due to changes in the environment and difficulty to obtain food.
4	Rock Aggregates	Low	Although reserves of rock aggregates are abundant, the resource sterilisation risk exists as a result of development in surrounding areas (where rock aggregates are mined) or reserves of rock aggregates sit on forest reserve and/or water catchment areas, which makes it almost impossible to extract.
5	Sand and Gravel	Low	Although reserves of sand and gravel are abundant, the resource sterilisation risk exists as a result of development in surrounding areas (where sand and gravel are mined) or sand and gravel reserves sit on forest reserve and/or water catchment areas, which makes it almost impossible to extract.
6	Limestone (for cement)	Low	Although limestone reserves for cement manufacturing are abundant, the resource sterilisation risk exists as a result of development in surrounding areas (where limestone is mined) or limestone reserves sit on forest reserve and/or water catchment areas, which makes it almost impossible to extract.

Source: Ministry of Natural Resources and Environment of Malaysia

6.9 Strengths-Shortcomings Balance

IBS can ensure greater compliance with safety, health and sustainability regulations and guidelines in line with one of the CITP's targets to reduce worksite fatalities and injuries by 50% under the Quality, Safety and Professionalism Strategic Thrust, as requirements for workers, particularly for on-site works, could be reduced from as low as 20% to as high as 40–50%, according to various studies. With IBS, wastage of timber, followed by cement, brick, soil and concrete is estimated to be less than 5% of the total materials used.

Since IBS is a pathway to environmentally sustainable construction excellence, it is therefore part of the overall green and sustainability agenda. Being highly technology driven, energy efficient, more carbon neutral and less labour intensive, IBS is expected to play a significant role in achieving Malaysia's target of reducing per GDP emissions of GHGs, especially CO_2, by up to 40% by 2020 and 45% by 2030 against the 2005 levels. Given its superior resource and energy efficiency, lower material intensity and higher potential for the application of the 3R concept, IBS helps bring down expenditure on waste management towards reducing adverse effects of waste on safety, health, environment and general aesthetics.

Assuming around 10% of the annual R&D spending in the Engineering and Technology domain is allocated to areas related to IBS and sustainable materials combined, that would translate into a GERD worth RM342 million, equivalent to 2.45% of total GERD in 2014. IBS is seen as an important enabler of the construction of high-quality facilities and amenities in record time, either as temporary or permanent structures, in tandem with one of the CITP's initiatives, namely Improve Workplace Safety and Workers' Amenities under the Quality, Safety and Professionalism Strategic Thrust.

CONCLUSION

The CBA originally sets out to provide an overall picture or a summary of quantified positive and negative consequences of a proposed project, programme or policy, both quantitative/tangible and qualitative/ intangible with appropriately estimated values. A CBA should, therefore, enable us to evaluate whether the present and/or future advantages of a project, programme or policy outweigh or trail its shortcomings (and by how much) as well as to rank various alternative projects, programmes or policies to the extent possible, once the individual cost-benefit ratio is established. The underlying idea is for the benefits to exceed costs for any difficulties faced and risks assumed to be worthwhile and to justify the decision taken. For this purpose, this particular CBA study for the IBS industry was conducted adopting both the macro-scale and micro-scale approaches by way of:

a. Literature reviews ranging from reading IBS- and construction sector-related articles, research reports, books and other publications, to digging of the archives of parliamentary hansards and reviews of websites of relevant organisations
b. A structured survey exercise, face-to-face interviews and focus group sessions to obtain primary data
c. Requests of statistics and information from selected federal ministries, government agencies and statutory bodies as well as access to their databases if available in public domain for secondary data analysis

While full or partial IBS adoption has to deal with several stumbling blocks - in particular related to cost and incentive considerations, addiction to cheap foreign labour, economies of scale, general industry preparedness and public acceptance - these obstacles are surmountable with the right balance of adequate government intervention and market-oriented mechanisms.

The time is now for the construction sector to realise that the low-cost business model is no longer tenable as Malaysia moves closer to join the league of developed economies. This means a different ballgame for Malaysia in virtually all industries and sectors. As we are at the dawn of the Fourth Industrial Revolution, to further improve our long-term competitiveness, cost-effectiveness, productivity gains and income enhancement, all sectors must embrace industrialisation, mechanisation, automation and robotisation. On the same token, an overly labour-intensive, resource-dependent and waste-laden methodology must make way for a plant-based, energy-efficient, resource-saving but new-age job-generating technology such as IBS in construction activities.

The interim difference between monetisable benefits and monetisable costs is estimated at RM2.8321 billion in the absence of the hypothetical boost to nominal private consumption worth RM18.979 billion, reflecting the impact of reduction in low-skilled foreign workers on the skilled labour pool, and consequently the salary structure among Malaysians. Nonetheless, the final positive difference ballooned to RM21.8111 billion once this desirable effect on consumer spending was added to the equation. Indeed, leaving aside the potential double-edged sword impacts of reduction in foreign workers on private consumption, the positive difference between monetisable benefits (RM84.5174) and monetisable costs (RM6.6443 billion) is at a staggering RM77.8731 billion. Still, judging from the monetisable outcomes alone without taking into account the quantifiable and qualitative outcomes, this CBA study has proven the superiority of IBS over any other building methods.

Overall Strengths-Shortcomings Balance

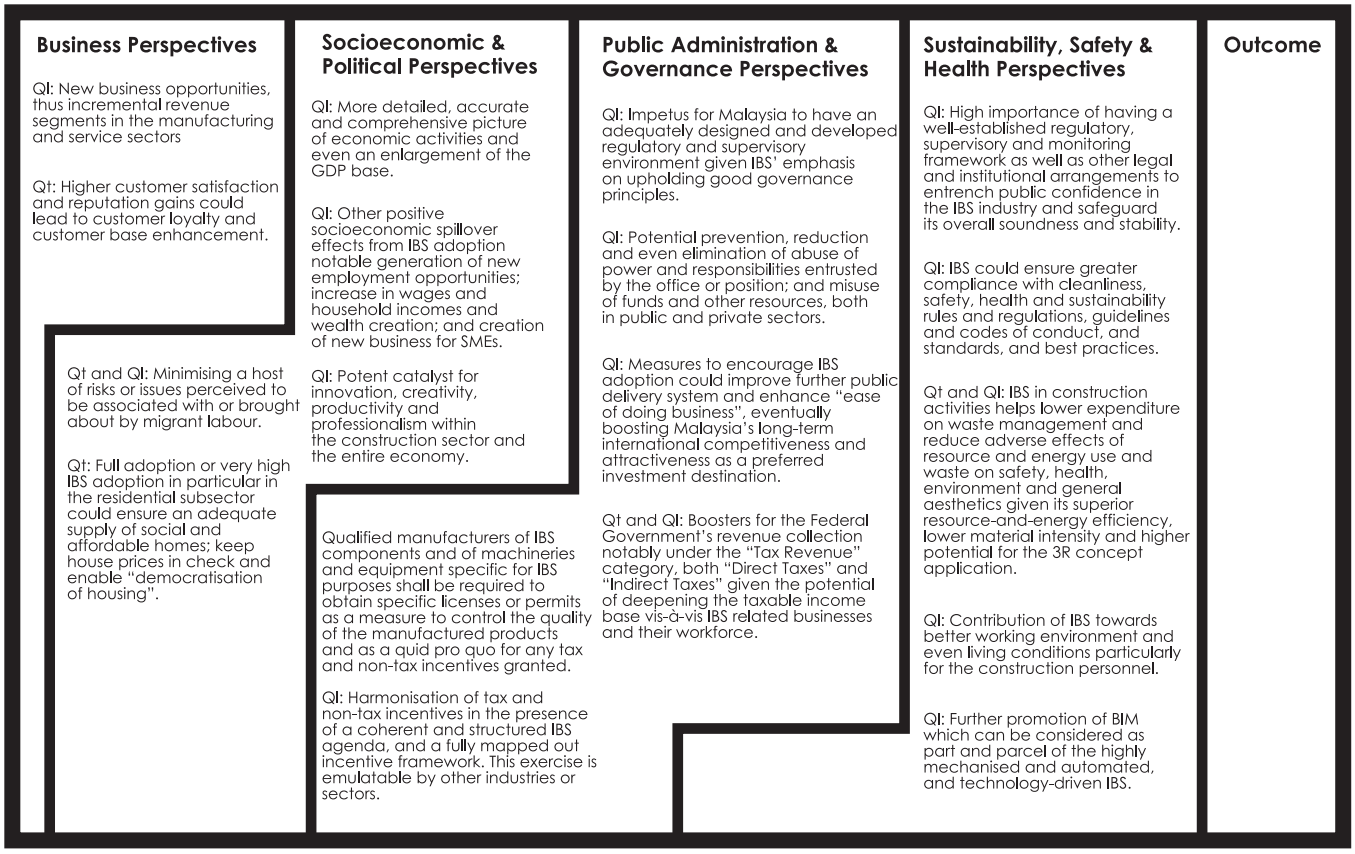
Summary of Monetisable Outcomes for the IBS Industry

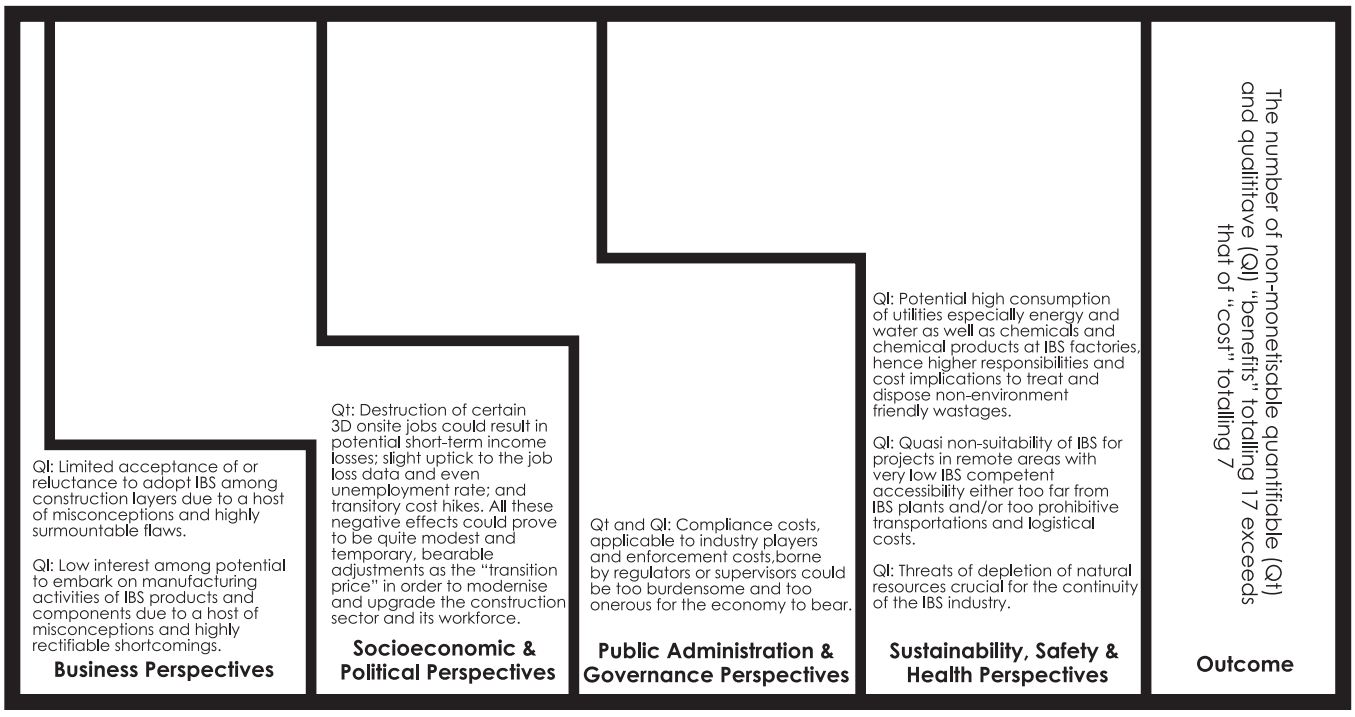
Benefits/Desirable Effects		Costs/Undesirable Effects	
Brief Descriptions	**Amount**	**Brief Descriptions**	**Amount**
Business Perspectives			
Potential cost savings that could be passed on to end-customers, all or partially.	RM30.4 billion	-	-
Subtotal	**RM30.4 billion**	**Subtotal**	**Nil**
Socio-economic and Political Perspectives			
Emergence of new and/ or sustainable expansion of existing sub-sectors in non-construction sectors, especially manufacturing and services sectors. Estimated size in 2016 of the manufacturing sub-sector of finished IBS products and components, equivalent to about 9.1% of the manufacturing sector.	RM25.0484 billion	Hypothetical decline in private consumption as a result of fewer foreign workers who form a sizeable consumer base in Malaysia.	RM75.041 billion
Hypothetical increase to the nominal private consumption amount as a result of reduction in low-skilled migrant workers, which should deepen the skilled labour pool and correspondingly boost salaries and wages for Malaysians, which is a catalyst for consumer spending.	RM18.979 billion	-	-
Export potential of the IBS industry, especially segments in manufacturing and services sectors, which implies a hypothetical increase in exports of manufactured goods.	RM14.1695 billion	-	-
Potential reduction in remittances with fewer foreign workers.	RM14.535 billion		
Subtotal	**RM72.7319 billion**	**Subtotal**	**RM75.041 billion**

Public Administration and Governance Perspectives			
Potential new source of revenue in the form of licensing fees in the near future, to be reflected under the Licences and Permits sub-category of the Non-Tax Revenue category.	RM22.5 million	Potential reduction in annual levy collection with fewer registered foreign workers, whether a temporary or even a permanent loss of one revenue source for the federal government, which implies a hypothetical cumulative plunge in revenue by almost 61% vs. the 2015 level.	RM0.5679 billion
		Potential decline in exports to Indonesia and India, Malaysia's two major foreign worker sources and trading partners in a hypothetical retaliation to changes in Malaysia's immigration and human resource policies.	RM6.0764 billion
Subtotal	**RM0.0225 billion**	**Subtotal**	**RM6.6443 billion**
Sustainability, Safety and Health Perspectives			
Potential R&D spending on IBS and sustainable materials, equivalent to 2.45% of total GERD in 2014.	**RM342 million**		
Subtotal	**RM0.342 billion**	**Subtotal**	**Nil**
Grand Total	**RM103.4964 billion**	**Grand Total**	**RM81.6853 billion**

Source: JSSB

Summary of Quantifiable and Qualitative Outcomes for the IBS Industry





Source: JSSB

Mapping with 18 CITP Initiatives

To steer the construction sector transformation, the CITP 2016–2020 outlined 18 core initiatives (and their specific recommendations) under four Strategic Thrusts, namely Quality, Safety and Professionalism (Q1 to Q4); Environmental Sustainability (E1 to E5); Productivity (P1 to P6); and Internationalisation (I1 to I3) as follows:

1. Increase emphasis on quality and implement quality assessments (Q1)

2. Improve workplace safety and workers' amenities (Q2)
   a. Regulate minimum level of construction workers' amenities
   b. Improve level of OSH at construction sites

3. Improve ease of doing business by addressing regulatory constraints (Q3)
   a. Streamline and enhance contractor registration
   b. Strengthen OSC for all construction permits/approvals
   c. Consider setting up a tribunal for construction permit dispute resolutions
   d. Enhance culture and practices by learning from decided construction cases

4. Promote and raise awareness of CITP initiatives (Q4)

5. Drive innovation in sustainable construction (E1)

6. Drive compliance with environmental sustainability ratings and requirements (E2)

7. Focus on public projects to lead the charge on sustainable practices (E3)

8. Facilitate industry adoption of sustainable practices (E4)

9. Reduce irresponsible waste during construction (E5)

10. Continue investment in human capital development in construction (P1)
    a. Streamline construction-related training programmes in Malaysia
    b. Strengthen reach, effectiveness and comprehensiveness of training

11. Enhance control and balance of workforce supply (P2)
    a. Implement regular industry manpower planning
    b. Introduce mechanisms to raise skills mix for intake of foreign workers

12. Accelerate adoption of IBS, mechanisation and modern practices (P3)
    a. Drive scale of IBS adoption via public-sector projects
    b. Propel IBS supply chain via economic mechanisms

13. Roll out technology advantage across project life cycle (P4)
    a. Facilitate BIM adoption in the construction industry via regulation
    b. Establish reference centre to support the development and adoption of BIM and modern methods
    c. Implement competency and learning management system

14. Enhance availability of strategic information via the National Construction Industry Information Centre (NCIIC) (P5)
    a. Enhance price and cost information on property resources
    b. Enhance awareness and certainty on upcoming construction demand
    c. Integrate construction-related data into the NCIIC

15. Advance SME/Bumiputera capacity and capability building (P6)

16. Internationalise construction practices and standards (I1)

a. Introduce a Malaysian standard for construction specifications

b. Heighten enforcement of compliance with mandatory material standards

c. Enhance and expand adoption of the Malaysian Civil Engineering Standard Method of Measurement (MyCESMM)

17. Strengthen access to financing for Malaysian industry champions going abroad (I2)

18. Support consortia formation and strengthen overseas market intelligence (I3)

a. Facilitate consortia formation to promote the scale of Malaysian players

b. Ensure focused targeting of high potential export markets

In the CITP 2016–2020, notwithstanding potential interrelationships with IBS in other chapters and initiatives, specific mention of IBS was only observed in the core initiative no. 12 according to the above list or the Initiative P3 under the Strategic Thrust entitled Productivity. More precisely, the areas that the Initiative P3 elaborates on are aligned with this CBA study as follows:

Linking the CBA Study to the CITP

	Productivity Strategic Thrust: Initiative P3	**Cost-Benefit Analysis for the IBS Industry in Malaysia**
1	CITP captures the essence similar to the Singapore benchmark without proposing changes to the IBS score calculation	Chapter 1: Introduction Section 1.2: The Context and Circumstances
2	Recommendation of decoupling IBS procurement, separating it from the main contract	Chapter 5: Public Administration and Governance Perspectives Section 5.1: IBS Upholds Good Governance Section 5.2: IBS Helps Reduce Wastages, Leakages and Other Negative Elements Section 5.3: IBS Boosts Ease of Doing Business
3	Introduction of economic mechanisms to improve viability of IBS	Conclusion Policy Recommendations
4	Alignment with national programmes, especially RMK11, towards raising productivity through greater adoption of automation - 2.5 times increase in productivity to USD16,500 per worker	Chapter 4: Socio-economic and Political Perspectives Section 4.5: Propelling Innovation, Creativity, Productivity and Professionalism
5	Heightened roles of key stakeholders and collaboration with the industry	Conclusion Policy Recommendations
6	Undertaking a CBA to encourage IBS adoption	The purpose of this CBA study
7	Finalising a variety of tax incentive proposals	Conclusion Policy Recommendations

Source: CITP 2016–2020, JSSB

Policy Recommendations

We can never emphasise enough the importance of convincing and securing the buy-in from private-sector players, in particular on the demand side of the equation since the private sector typically takes up more than 60% of the total value of construction projects and works in any given year. After years of pushing for voluntary adoption of IBS, perhaps it is about time for the federal government to consider introducing compulsory elements where possible, especially when it involves private-sector players. After all, it is imperative for the demand of IBS products and components to reach a critical mass in order for the setting up of IBS plants throughout the country to be a viable and sustainable business venture in the long run.

Apart from this private sector-driven prerequisite for the IBS agenda to meaningfully succeed, it is also crucial to reformulate and reframe a blueprint specific for the IBS industry and all its segments by making it more policy oriented, holistic and all-encompassing, complete with ambitious but attainable, measurable goals and a strategic action plan on how to achieve them over the short, medium and long term. The overarching vision is to build a highly solid, competent, reliable and sustainable IBS industry across all segments for a more effective contribution to the Malaysian economy as a whole.

Goals and initiatives may include:

1. Whetting further the appetite for and catapulting the 'superiority' of IBS solutions, especially aimed at boosting the demand side of the equation with emphasis on private-sector players by:
   a. Making it mandatory for all public-private partnership[60] (PPP or 3P) projects worth at least RM50 million to achieve a minimum of 70 IBS score, in addition to targets recommended by the Initiative P3: Accelerate Adoption of IBS, Mechanisation and Modern Practices under the CITP 2016–2020; any potential adverse effects on stock levels and prices should be addressed by the strategic stockpiling framework, at least in the short term
   b. Making a minimum level of IBS score as one of the prerequisites vis-à-vis builders, real estate developers and contractors, particularly from the private sector, for:
      - Issuance of Development Order (DO), Certificates of Completion and Compliance (CCCs) and/or Certificates of Practical Completion (CPCs)
      - Project financing applications from financial institutions
      - Compliance with environmental sustainability ratings and requirements
   c. Devising a comprehensive framework for stockpiling strategies to mitigate the construction sector's boom-bust cycle, including the establishment of a strategic national stockpile or a national repository of critical building raw materials such as sand, cement, granite and steel as well as IBS components themselves that will help adjust and regulate the stock of IBS components and ensure prices of IBS components remain within orderly and stable ranges, preventing excessive

[60] Financing and operational arrangements, typically long-term in nature, between the public authority and one or more private-sector parties whereby the latter completes a public project or provides a public service while assuming substantial funding, technical, operational and other types of risks. As such, PPP can be closely related to concepts such as privatisation and contracting out/outsourcing of government services.

out-of-equilibrium conditions due to sudden jump in demand or sudden shortage of IBS components and vice versa

d. Introducing tax breaks, specifically for purchasers of IBS-based buildings and properties, valued at above a certain amount and reducing further stamp duties charged on these transactions; and a tax holiday for IBS manufacturers expanding existing and/or building new qualifying IBS manufacturing plants[61], among others

e. Harmonising all tax and non-tax incentives for the entire IBS industry, in particular if the threshold levels of compulsory IBS adoption are increased

f. Introducing more ease of doing business measures such as fast-track approvals for IBS projects, in particular applications with an IBS score of 70; regulatory, supervisory and monitoring simplifications to avoid stifling over-regulation but not to the extent of an absolute oversight-free environment, including elimination of overly complex and unnecessarily burdensome rules and regulations; and reduction of bureaucratic hurdles related to cross-state border transportation of raw materials for IBS component manufacturing, among others

g. Tightening the safety, health and sustainability processes, procedures and requirements with specific manuals, guidelines, codes of conduct, standards and best practices for all segments of the IBS industry, especially manufacturing and production, transportation and installation of finished IBS components and elements

2. Heightened roles and responsibilities of key stakeholders while ensuring effective collaboration and coordination between:

a. The Ministry of Works (MOW) and all other relevant ministries and government agencies in the driving seat, since the IBS industry cuts across a variety of industries in all five major economic sectors and given the strong interconnectedness between these sectors and construction activities

b. The CIDB-CREAM in an enabling and facilitative role as well as IBS industry players, professional associations, research institutes and academia

3. Developing the entire value and supply chain of the IBS industry from production of raw materials and semi-finished goods right up to manufacturing of finished IBS products and components with a holistic and extensive supply-chain development framework through enhanced vendor development, consortia formation[62], overseas market intelligence (including market entry strategies) and access as well as provision of a highly conducive and facilitative operating environment and other competiveness strengthening efforts. To further improve and sustain the conducive operating environment, especially for direct users (demand perspectives) and producers (supply perspectives) of IBS products, components, techniques and elements, measures may focus a great deal on how to lower costs of doing business across the IBS value and supply chain related to:

[61] Page 124, CITP 2016-2020 publication

[62] Higher scale and synergies can be derived through formation of consortia and other collaborative models between domestic and overseas players, SMEs and large companies alike thanks to pooling of resources, sharing or transfer of expertise and technology and division of focus areas, among others.

a. Accessibility to cost-effective capital via soft loans, easy financing schemes, revolving funds and special grants, among others, to facilitate the establishment of new startups, defray the liquidity burden on contractors who have to provide upfront deposit or advance payment for IBS component procurement[63], purchase of expensive machineries and equipment, among others
b. Accessibility to reasonably priced IBS products and components for direct IBS users, in particular builders, real estate developers and contractors
c. Accessibility to reasonably priced machineries and equipment, especially for direct IBS producers such as component manufacturing companies and providers of all IBS-related services by aggressively undertaking recommendation no. 4 below or lowering import duties[64] on qualifying machineries and equipment[65], making it cheaper either for new business ventures to buy new ones or existing business establishments
to replace outworn and obsolete ones, all of which will help improve productivity, effectiveness and efficiency
d. Accessibility to abundant and affordable natural resources, raw materials and semi-finished inputs
e. Sourcing of skilled or at least semi-skilled workers at reasonable costs
f. Accessibility to transportation, logistics, storage, maintenance and other related services at reasonable costs

4. As part of the heavy industry[66] agenda aggressively pushing for the creation and expansion of a high value-added manufacturing sub-sector of producing machineries and equipment with an extensive and highly SME-friendly value and supply chain, especially for use in:
a. The processing and transformation of raw materials and semi-finished goods into finished IBS products, components, techniques and elements
b. The transportation, installation/erection and other services of finished IBS products, components, techniques and elements onto structures at construction sites

5. Intensifying boosters, specifically to further strengthen the IBS component manufacturing segment, in particular to increase accessibility to and availability of finished IBS products, components, techniques and elements for the construction sector in rural areas in Peninsular Malaysia as well as large parts of Sabah and Sarawak with efforts such as:
a. Provision of easy financing schemes by financial institutions and special grants and/or soft loans by relevant government agencies
b. Introduction of tax breaks or tax holidays on profits of IBS component manufacturers beyond a certain threshold and/or purchases of raw materials and semi-finished inputs and/or purchases of machineries and equipment
c. Establishment of a one-stop centre (OSC) for registered IBS component manufacturers
d. Accreditation and certification of IBS manufacturer

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[63] Page 125, CITP 2016–2020 publication

[64] Effective 11 June 2015, import duties for three tariff codes, namely HS 8429.51.000, HS 8430.41.000 and HS 8431.43.00 have been slashed to 5% from 10%, although import duties for the remaining seven tariff codes as requested by MBAM to remain between 20%-30%.

[65] Page 124, CITP 2016–2020 publication

[66] While it helps an economy to move up the value chain and achieve the developed nation status, a heavy industry can be more cyclical in nature, particularly in terms of capital investments and employment.

e. Streamlining the payment methods, processes and procedures to reduce risks of cash flow crunch and other causes of business failure among IBS manufacturers

f. Increasing standardisation of designs and finished IBS products, components, techniques and elements

6. Invigorating R&D activities by:

a. Offering specific incentives in the form of grants and/or tax breaks for IBS-oriented R&D activities to develop new technologies and techniques that will spur further creativity, innovation and productivity

b. Forging collaboration and cooperation with other centres of research excellence, research institutes and think tanks

7. Encouraging usage of salvageable, recyclable and reusable (SRR) and part- recycled materials for construction such as aggregates, plastics, glass, pulverised fuel ash, wood-based products, cardboard, plasterboard, gypsum, concretes, metals (in particular steel, aluminium and copper), organics, newspapers, bottle bricks and shipping (steel) containers, among others, as well as sustainable materials that can be grown on a large scale in plantations or found in abundance in the Malaysian and regional tropical forests such as timber, bamboo and kenaf, among others, by:

a. Introducing a specific bonus or reward system in construction-related certifications, especially the GBI, to ensure the construction of energy-efficient, low carbon and economically, socially and environmentally sustainable buildings and infrastructure

b. Formulating specific government policies that recommend or require usage of SRR, part-recycled and sustainable materials in construction projects and works, accompanied with more rigorous rules and regulations

c. Developing and setting a certain threshold for the content of SRR, part-recycled and/or sustainable materials as an eligibility condition for soft loans, easy financing schemes, revolving funds and special grants

d. Introducing taxation mechanisms on excessive C&D waste beyond certain thresholds to be determined to 'force' usage of SRR, part-recycled and sustainable materials

e. Establishing dedicated recycling plants for C&D waste on a standalone basis or in collaboration with existing landfill operators, both public and private

8. Developing, up-skilling and deepening the domestic pool of IBS talents and professionals by:

a. Devising a detailed and forward-looking manpower framework and planning specific for the IBS industry in all segments to enable effective resource allocations and development of demand-responsive, requirement-matching and world-class training modules and curriculum contents; and to minimise labour demand-supply mismatches, among others

b. Constantly reviewing current requirements for manpower and skills sets, and anticipating future needs across all segments of the IBS industry

c. Incentivising IBS-related training and skills development efforts undertaken for the workforce of all categories of stakeholders and value-chain participants, in particular those involved in IBS-related construction, manufacturing and services activities, including lowering the costs of securing official accreditation and certification for staff

d. Encouraging structured and specialist apprenticeship programmes jointly developed by the CIDB, industry players and academia
e. Introducing an inter-company secondment programme across the IBS industry
f. Imposing stricter rules and regulations related to the hiring of foreign workers and making it much costlier in order to push businesses to seek higher productivity and efficiencies in technology-based and advanced approaches such as IBS as well as to give priority to citizen workers in building their workforce

9. Revolutionising the Malaysian economy as a whole by industrialising, mechanising and automating further its base and structure across all sectors, characterised by an even greater usage of futuristic and green technology and cyber-physical systems for long-term sustainability instead of short-term gains, as the world is at the dawn of the Fourth Industrial Revolution[67] in order to:

a. Accelerate Malaysia's climb upwards the global value chain
b. Achieve higher material and resource optimisation as well as energy and waste efficiency in order to help:
    - Lower overall operating and production costs (a contributing factor towards keeping inflation in check)
    - Minimise wastages and leakages in all aspects
    - Lessen carbon emissions, carbon footprints and other adverse impacts on the environment
c. Ensure cleaner, safer and more conducive business, working and living environments with higher quality of life
d. Reduce Malaysia's overdependence on foreign labour, especially unskilled workers, while ensuring minimal migration from one sector to another
e. Step up national productivity to be on par with the developed world
f. Upgrade the knowledge and skills of the Malaysian workforce
g. Boost the national wage structure and ultimately household incomes

[67] According to the WEF, the First Industrial Revolution leveraged on water and steam power to mechanise production. The Second Revolution resorted to electric power and division of labour to enable mass production. The Third Revolution capitalised on electronics and IT to automate production. Building on the foundations strengthened by the Third Revolution, especially the digital revolution, the Fourth Revolution will perfect that revolution and intermix and amalgamate a variety of technologies into one, blurring the lines further between physical, biochemical and digital spheres while disrupting even further many aspects and approaches in business and human life.

APPENDIX 1: QUESTIONNAIRE FOR CATEGORY 1

Questionnaire for Construction-related Companies

I. BACKGROUND INFORMATION

1. Full business or establishment name as well as date(s) of establishment/incorporation and commencement of operations.

2. List of ALL core activities and/or products and services that your organisation undertakes and/or sells and provides.

3. Geographical (Malaysia and/or abroad) and spatial (urban and/or rural) distribution in terms of value (RM) and/or percentage (%) of your organisation:

(a) core activities _____
(b) products and/or services _____
(c) turnover _____

4. Total number of headcount at your organisation as at 31 July 2016 or the latest possible date (to be indicated).

5. Breakdown of your organisation's workforce in numbers and percentage (%) as at 31 July 2016 or the latest possible date (to be indicated) for:

(a) executive/management vs. non-executive/unionised staff _____
(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____
(c) citizens vs. foreigners _____

6. The average IBS score of your organisation's construction works and projects for the last five (5) years as at 31 July 2016 or the latest possible date (to be indicated) according to the CIDB's most updated IBS content scoring system.

II. FINANCIAL PERFORMANCE AND CUSTOMER RELATIONS

1. Indicate changes (+/-) in general that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%) for:

(a) order book or outstanding customer orders _____

(b) cash flows _____

(c) turnover _____

(d) gross earnings _____

(e) tax incentives (the exact type(s) and amount to be specified) _____

(f) net earnings _____

(g) specific efficiency and effectiveness metrics (to be specified) _____

(h) specific project risks (to be specified) _____

(i) overall business risks _____

2. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%) for:

(a) order book or outstanding customer orders _____

(b) cash flows _____

(c) turnover _____

(d) gross earnings _____

(e) tax incentives (the exact type(s) and amount to be specified) _____

(f) net earnings _____

(g) specific efficiency and effectiveness metrics (to be specified) _____

(h) specific project risks (to be specified) _____

(i) overall business risks _____

3. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%) for:

(a) staff costs/payroll including salaries, allowances and benefits _____

(b) costs of utilities - water, electricity, sewerage, telecommunications, Internet _____

(c) debt payments or loan servicing _____

(d) insurance and legal costs _____

(e) promotional, marketing and advertising costs _____

(f) purchase of machineries and equipment _____

(g) maintenance, depreciation and amortisation costs of machineries and equipment _____

(h) rental payments on lease of machineries and equipment _____

(i) purchase of or rental payments for premises _____

(j) costs of building materials including raw materials, natural resources and semi-finished goods _____

(k) overall construction costs _____

(l) others, if any (to be specified) _____

4. Indicate your organisation's pricing structure components for construction works and projects in terms of percentage (%).

5. In the event of indiscriminate incorporation by IBS manufacturers, assemblers, importers and distributors of all costs involved into their pricing structure, indicate:

(a) instances when your organisation has to bear the brunt

(b) the impact on your overall construction costs and delivery costs to customers or final prices for customers in value (RM) and/or percentage (%)

6. Acquisition and retention of your organisation's customers thanks to IBS in terms of:

(a) value (RM), frequency (number of times) and number of customers for new orders _____

(b) value (RM), frequency (number of times) and number of customers for repeat orders _____

7. Comparing IBS to Conventional Building Method (CBM), indicate your organisation's estimated satisfaction for:

(a) quality of construction and finishings in value (RM) and/or percentage (%) _____

(b) risks of defects on buildings and infrastructure in value (RM) and/or percentage (%) _____

(c) longevity of buildings and infrastructure in number of years _____

8. With the adoption of IBS, indicate the value (RM) and/or percentage (%) on average of your organisation's:

(a) savings of overall construction costs which are transferable to customers _____

(b) reduction in project risks _____

9. With the adoption of IBS, indicate your organisation's record vis-à-vis respect of project completion and customer delivery schedules in terms of:

(a) reduction in average time (weeks or months) for each on-site activity and total on-site activities of construction projects _____

(b) percentage (%) of ahead-of-schedule and on-time completed and customer delivered projects out of total _____

10. With the adoption of IBS, indicate estimates of your organisation's understanding of customer needs and requirements in terms of percentage (%) out of 100%.

11. Based on your organisation's customer feedback, indicate estimates of public satisfaction towards IBS-based vs. CBM-based infrastructure and buildings in terms of value (RM) and/or percentage (%) for the following aspects:

(a) overall quality of infrastructure and buildings _____

(b) probability of cracks and leakages _____

(c) degree of aesthetic value in architecture and designs _____

(d) economicality and flexibility of undertaking renovations/changes _____

(e) suitableness and responsiveness to creativity and innovation _____

III. SOCIOECONOMICS

1. Was your organisation established to bank on any opportunities within the IBS industry? If YES, detail out these opportunities as well as your progress and success stories since inception.

2. Detail out statistics each year from 2010 through 2015 of your organisation's dealings with small- and medium-enterprises (SMEs):

(a) number of establishments _____

(b) segments, industries or sectors within which these SMEs operate _____

(c) nature of transactions/dealings _____

(d) average value (RM) of transactions/dealings _____

3. Indicate estimates in value (RM) the potential of overseas demand for your organisation's products and/or services, if any.

4. Indicate estimates in value (RM) the potential of creativity and innovation for your organisation's products and/or services, if any.

5. Indicate estimates for the reduction in prices of infrastructure, buildings and properties completed by your organisation for customer delivery thanks to usage of IBS products, components, techniques and elements in terms of:

(a) value (RM) _____

(b) percentage (%) _____

IV. HUMAN CAPITAL: MINDSET, KNOWLEDGE, EXPERTISE AND EXPERIENCE

1. Indicate the optimal and average number of workers at your construction site(s) according to the size of project(s).

2. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in the workforce size for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

3. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in the workforce's mean and median monthly salary for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

4. With the adoption of IBS, detail out either at your organisation specifically or observed in the country in general:

(a) all types of new occupations or professions created

(b) all types of new occupations or professions destroyed

5. Indicate your organisation's estimates of changes (+/-) in value (RM) and/or percentage (%) for the impact of 4 (a) and (b) above on:

(a) sources of income of Malaysian and foreign workers _____

(b) Malaysia's overall labour force and employment _____

6. With the adoption of IBS, indicate estimates of currently observed total labour savings or labour reduction on average at your organisation in terms of:

(a) value (RM) _____

(b) number of workers _____

(c) percentage (%) for (a) and (b) _____

7. With the adoption of IBS, indicate projections of total labour savings or labour reduction on average at your organisation in the medium term, in terms of:

(a) value (RM) _____

(b) number of workers _____

(c) percentage (%) for (a) and (b) _____

8. With the adoption of IBS, provide the breakdown of currently observed labour savings or labour reduction on average at your organisation in terms of value (RM) and number of workers for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

9. Indicate your organisation's estimates of changes (+/-) in terms of value (RM) and percentage (%) for:

(a) currently observed productivity and professionalism _____

(b) projected productivity and professionalism in the medium term _____

10. Indicate your organisation's estimates for risks of human errors at the design, manufacturing and installation/erection phases in terms of value (RM) and probability.

11. Indicate your organisation's estimates of changes (+/-) for the impact on IBS acceptance and ultimately usage in terms of value (RM) and/or percentage (%) due to:

(a) lack of familiarity with, knowledge of and awareness about IBS _____

(b) shortage of IBS trained construction professionals at reasonable wages _____

(c) misperceptions that IBS could lead to higher overall construction costs and project risks (and list the real causes of such misperceptions) _____

(d) general resistance to change _____

V. CORPORATE GOVERNANCE AND COMPETITIVE FORCES

1. Indicate estimates for annual contributions of IBS on average at your organisation in terms of value (RM) to:

(a) the conduct of good corporate governance _____

(b) the reduction of wastages, leakages and other negative elements in construction works and projects _____

2. With the adoption of IBS, indicate estimates of the reduction in your organisation's construction works and projects in terms of value (RM), number of man-days and percentage (%) for:

(a) variation orders and/or additional rectification works _____

(b) construction period _____

(c) incidences of delays _____

3. Indicate in what way the IBS implementation contributes to the nation's public delivery enhancement and your organisation's estimates of this contribution in terms of value (RM) and percentage (%).

4. With the adoption of IBS, indicate changes (+/-) to the amount of levies on foreign workers that your organisation has paid from 2010 through 2015, i.e. in the last calendar (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and percentage (%).

5. With the adoption of IBS, indicate the amount of expenses in value (RM) that your organisation has to incur in order to:

(a) outline an implementation framework to ensure consistency with international standards and best practices _____

(b) comply with all relevant rules and regulations _____

6. Describe levels of competition within your segment of the IBS industry in Malaysia:

(a) total number of competitors, specifying whether domestic or foreign _____

(b) top 3 segment leaders and their headquarters or centre(s) of activities _____

(c) barriers to entry - startup costs, capital intensity, tax restrictions, regulatory burden and other government constraints, intellectual property, agreements with distributors and/or suppliers, etc _____

(d) balance of supply - inventory management, price-setting powers - economies of scale, supply adequacy, cut-throat competition, etc _____

VI. SAFETY, HEALTH AND ENVIRONMENT

1. List all international and domestic guidelines, standards and best practices as well as acts and enactments related to safety, health and environment that your organisation has to comply with.

2. Indicate estimates in value (RM) the extent to which IBS enables your organisation to comply better with cleanliness, safety, health, sustainability and "green" guidelines, standards and best practices while specifying how it works.

3. List all IBS products and components made of sustainable materials (relevant certifications shall be indicated) that your organisation uses in construction works and projects as well as indicate estimates of their usage in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of overall construction costs _____

4. Indicate your organisation's overall spending on research and development (R&D) and R&D spending on sustainable materials in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total expenditure or overall R&D spending respectively _____

5. Indicate cost savings on resource use and waste management that your organisation currently enjoys in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total operating expenditure _____

6. Indicate your organisation's spending on prefabricated solutions in providing high-standard facilities and amenities for workers in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total operating expenditure _____

7. Comparing IBS to CBM, list all machineries and equipment that your organisation works with and indicate estimates of the impact of their usage on health, safety and sustainability aspects in terms of value (RM) and percentage (%)

8. Comparing IBS to CBM, indicate differences in usage of utilities by your organisation notably energy and water in terms of:

(a) value (RM) _____

(b) respective measurement metrics _____

9. Indicate differences between urban and rural areas for your organisation's IBS-based construction works and projects in terms of:

(a) value (RM) _____

(b) ratio (%) _____

10. List all natural resources used by your organisation that are faced with depletion threats and indicate estimates in terms of value (RM) and probability of risks of natural resource depletion.

APPENDIX 2: QUESTIONNAIRE FOR CATEGORY 2

Questionnaire for Producers, Importers, Suppliers and/ or Distributors of Raw Materials, Natural Resources and Semi-Finished Goods for the Purpose Of IBS Manufacturing and Production

I. BACKGROUND INFORMATION

1. Full business or establishment name as well as date(s) of establishment/incorporation and commencement of operations.

2. List of ALL core activities and/or products and services that your organisation undertakes and/or sells and provides.

3. Geographical (Malaysia and/or abroad) and spatial (urban and/or rural) distribution in terms of value (RM) and/or percentage (%) of your organisation:

(a) core activities _____

(b) products and/or services _____

(c) turnover _____

4. Total number of headcount at your organisation as at 31 July 2016 or the latest possible date (to be indicated).

5. Breakdown of your organisation's workforce in numbers and/or percentage (%) as at 31 July 2016 or the latest possible date (to be indicated) for:

a) executive/management vs. non-executive/unionised staff _____

b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

c) citizens vs. foreigners _____

6. Minimum amount (RM) of initial investments/capital outlay to reach reasonable economies of scale as well as number of years to break even and/or recoup investments.

II. FINANCIAL PERFORMANCE AND CUSTOMER RELATIONS

1. Indicate changes (+/-) in general that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%) for:

(a) order book or outstanding customer orders _____

(b) cash flows _____

(c) turnover _____

(d) gross earnings _____

(e) tax incentives (the exact type(s) and amount to be specified) _____

(f) net earnings _____

(g) specific efficiency and effectiveness metrics (to be specified) _____

(h) overall business risks _____

2. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%) for:

(a) order book or outstanding customer orders _____

(b) cash flows _____

(c) turnover _____

(d) gross earnings _____

(e) tax incentives (the exact type(s) and amount to be specified) _____

(f) net earnings _____

(g) specific efficiency and effectiveness metrics (to be specified) _____

(h) overall business risks _____

3. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%) for:

(a) staff costs/payroll including salaries, allowances and benefits _____

(b) costs of utilities - water, electricity, sewerage, telecommunications, Internet _____

(c) debt payments or loan servicing _____

(d) insurance and legal costs _____

(e) promotional, marketing and advertising costs _____

(f) purchase of machineries and equipment _____

(g) maintenance, depreciation and amortisation
costs of machineries and equipment _____

(h) rental payments on lease of machineries and equipment _____

(i) purchase of or rental payments for premises _____

(j) costs of raw materials, natural resources and semi-finished goods _____

(k) others, if any (to be specified) _____

4. Acquisition and retention of your organisation's customers thanks to IBS in terms of:

(a) value (RM), frequency (number of times)
and number of customers for new orders _____

(b) value (RM), frequency (number of times)
and number of customers for repeat orders _____

III. SOCIOECONOMICS

1. Was your organisation established to bank on any opportunities within the IBS industry? If YES, detail out these opportunities as well as your progress and success stories since inception.

2. Detail out the following statistics each year from 2010 through 2015 of your organisation's dealings with small- and medium-enterprises (SMEs):

(a) number of establishments _____

(b) segments, industries or sectors within which these SMEs operate _____

(c) nature of transactions/dealings _____

(d) average value (RM) of transactions/dealings _____

3. Indicate estimates in value (RM) the potential of overseas demand for your organisation's \ products and/or services, if any.

4. Indicate estimates in value (RM) the potential of creativity and innovation for your organisation's products and/or services, if any.

IV. HUMAN CAPITAL: MINDSET, KNOWLEDGE, EXPERTISE AND EXPERIENCE

1. Indicate your organisation's optimal and average number of workers.

2. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in the workforce size for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

3. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in the workforce's mean and median monthly salary for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

4. With the adoption of IBS, detail out either at your organisation specifically or observed in the country in general:

(a) all types of new occupations or professions created _____

(b) all types of existing occupations or professions destroyed _____

5. Indicate your organisation's estimates of changes (+/-) in value (RM) and/or percentage (%) for the impact of 4 (a) and (b) above on:

(a) sources of income of Malaysian and foreign workers _____

(b) Malaysia's overall labour force and employment _____

6. Indicate your organisation's estimates of changes (+/-) in terms of value (RM) an/or percentage (%) for:

(a) currently observed productivity and professionalism _____

(b) projected productivity and professionalism in the medium term _____

7. Indicate your organisation's estimates for risks of human errors at the design, manufacturing and installation/erection phases in terms of value (RM) and probability.

8. Indicate your organisation's estimates of changes (+/-) for the impact on IBS acceptance and ultimately usage in terms of value (RM) and/or percentage (%) due to:

(a) lack of familiarity with, knowledge of and awareness about IBS _____

(b) shortage of IBS-trained construction professionals at reasonable wages _____

(c) misperceptions that IBS could lead to higher overall construction costs and project risks (and list the real causes of such misperceptions) _____

(d) general resistance to change _____

V. CORPORATE GOVERNANCE AND COMPETITIVE FORCES

1.Indicate estimates for annual contributions of IBS on average at your organisation in terms of value (RM) to:

(a) the conduct of good corporate governance _____

(b) the reduction of wastages, leakages and other negative elements _____

2. Indicate in what way the IBS implementation contributes to the nation's public delivery enhancement and your organisation's estimates of this contribution in terms of value (RM) and/or percentage (%).

3. With the adoption of IBS, indicate changes (+/-) to the amount of levies on foreign workers that your organisation has paid from 2010 through 2015, i.e. in the last calendar (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%).

4. With the adoption of IBS, indicate the amount of expenses in value (RM) that your organisation has to incur in order to:

(a) outline an implementation framework to ensure consistency with international standards and best practices _____

(b) comply with all relevant rules and regulations _____

5. Describe levels of competition within your segment of the IBS industry in Malaysia:

(a) Total number of competitors, specifying whether domestic or foreign _____

(b) Top 3 segment leaders and their headquarters or centre(s) of activities _____

(c) Barriers to entry - startup costs, capital intensity, tax restrictions, regulatory burden and other government constraints, intellectual property, agreements with distributors and/or suppliers, etc _____

(d) Balance of supply - inventory management, price-setting powers - economies of scale, supply adequacy, cut-throat competition, etc _____

VI. SAFETY, HEALTH AND ENVIRONMENT

1. List all international and domestic guidelines, standards and best practices as well as acts and enactments related to safety, health and environment that your organisation has to comply with.

2. Indicate estimates in value (RM) the extent to which IBS enables your organisation to comply better with cleanliness, safety, health, sustainability and "green" guidelines, standards and best practices while specifying how it works.

3. List all sustainable materials (relevant certifications shall be indicated) that your organisation works with and indicate estimates of their usage in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total expenditure _____

4. Indicate your organisation's overall spending on research and development (R&D) and R&D spending on sustainable materials in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total expenditure or overall R&D spending respectively _____

5. Indicate changes (+/-) to your organisation's spending on natural resources and waste management from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total operating expenditure _____

6. Indicate your organisation's spending on prefabricated solutions in providing high-standard facilities and amenities for workers in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total operating expenditure _____

7. Comparing IBS to Conventional Building Method (CBM), list all machineries and equipment that your organisation works with and indicate estimates of the impact of their usage on health, safety and sustainability aspects in terms of value (RM) and percentage (%).

8. Comparing IBS to CBM, indicate differences in usage of utilities by your organisation notably energy and water in terms of:

(a) value (RM) _____

(b) respective measurement metrics _____

9. List all natural resources used by your organisation that are faced with depletion threats and indicate estimates in terms of value (RM) and probability of risks of natural resource depletion.

APPENDIX 3: QUESTIONNAIRE FOR CATEGORY 3

Questionnaire for Manufacturers, Importers, Distributors and/or Lessors of Machineries and Equipment for IBS Manufacturing and Production

I. BACKGROUND INFORMATION

1. Full business or establishment name as well as date(s) of establishment/incorporation and commencement of operations.

2. List of ALL core activities and/or products and services that your organisation undertakes and/or sells and provides.

3. Geographical (Malaysia and/or abroad) and spatial (urban and/or rural) distribution in terms of value (RM) and/or percentage (%) of your organisation:

(a) core activities _____

(b) products and/or services _____

(c) turnover _____

4. Total number of headcount at your organisation as at 31 July 2016 or the latest possible date (to be indicated).

5. Breakdown of your organisation's workforce in numbers and percentage (%) as at 31 July 2016 or the latest possible date (to be indicated) for:

(a) executive vs. non-executive staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

6. Minimum amount (RM) of initial investments/capital outlay to reach reasonable economies of scale as well as number of years to break even and/or recoup investments.

II. FINANCIAL PERFORMANCE AND CUSTOMER RELATIONS

1. Indicate changes (+/-) in general that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%) for:

(a) order book or outstanding customer orders _____

(b) cash flows _____

(c) turnover _____

(d) gross earnings _____

(e) tax incentives (the exact type(s) and amount to be specified) _____

(f) net earnings _____

(g) specific efficiency and effectiveness metrics (to be specified) _____

(h) overall business risks _____

2. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%) for:

(a) order book or outstanding customer orders _____

(b) cash flows _____

(c) turnover _____

(d) gross earnings _____

(e) tax incentives (the exact type(s) and amount to be specified) _____

(f) net earnings _____

(g) specific efficiency and effectiveness metrics (to be specified) _____

(h) overall business risks _____

3. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%) for:

(a) staff costs/payroll including salaries, allowances and benefits _____

(b) costs of utilities - water, electricity, sewerage, telecommunications, Internet _____

(c) debt payments or loan servicing _____

(d) insurance and legal costs _____

(e) promotional, marketing and advertising costs _____

(f) purchase of machineries and equipment _____

(g) maintenance, depreciation and amortisation
costs of machineries and equipment _____

(h) rental payments on lease of machineries and equipment _____

(i) purchase of or rental payments for premises _____

(j) costs of raw materials, natural resources and semi-finished goods _____

(k) others, if any (to be specified) _____

4. Acquisition and retention of your organisation's customers thanks to IBS in terms of:

(a) value (RM), frequency (number of times)
and number of customers for new orders _____

(b) value (RM), frequency (number of times)
and number of customers for repeat orders _____

III. SOCIOECONOMICS

1. Was your organisation established to bank on any opportunities within the IBS industry? If YES, detail out these opportunities as well as your progress and success stories since inception.

2. Detail out the following statistics each year from 2010 through 2015 of your organisation's dealings with small and medium enterprises (SMEs):

(a) number of establishments _____

(b) segments, industries or sectors within which these SMEs operate _____

(c) nature of transactions/dealings _____

(d) average value (RM) of transactions/dealings _____

3. Indicate estimates in value (RM) the potential of overseas demand for your organisation's products and/or services, if any.

4. Indicate estimates in value (RM) the potential of creativity and innovation for your organisation's products and/or services, if any.

IV. HUMAN CAPITAL: MINDSET, KNOWLEDGE, EXPERTISE AND EXPERIENCE

1. Indicate your organisation's optimal and average number of workers.

2. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in the workforce size for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

3. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in the workforce's mean and median monthly salary for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

4. With the adoption of IBS, detail out either at your organisation specifically or observed in the country in general:

(a) all types of new occupations or professions created _____

(b) all types of existing occupations or professions destroyed _____

5. Indicate your organisation's estimates of changes (+/-) in value (RM) and/or percentage (%) for the impact of 4 (a) and (b) above on:

(a) sources of income of Malaysian and foreign workers _____

(b) Malaysia's overall labour force and employment _____

6. Indicate your organisation's estimates of changes (+/-) in terms of value (RM) and/or percentage (%) for:

(a) currently observed productivity and professionalism _____

(b) projected productivity and professionalism in the medium term _____

7. Indicate your organisation's estimates for risks of human errors at the design, manufacturing and installation/erection phases in terms of value (RM) and probability.

8. Indicate your organisation's estimates of changes (+/-) for the impact on IBS acceptance and ultimately usage in terms of value (RM) and/or percentage (%) due to:

(a) lack of familiarity with, knowledge of and awareness about IBS _____

(b) shortage of IBS trained construction professionals at reasonable wages _____

(c) misperceptions that IBS could lead to higher overall construction costs and project risks (and list the real causes of such misperceptions) _____

(d) general resistance to change _____

V. CORPORATE GOVERNANCE AND COMPETITIVE FORCES

1. Indicate estimates for annual contributions of IBS on average at your organisation in terms of value (RM) to:

(a) the conduct of good corporate governance _____

(b) the reduction of wastages, leakages and other negative elements _____

2. Indicate in what way the IBS implementation contributes to the nation's public delivery enhancement and your organisation's estimates of this contribution in terms of value (RM) and/or percentage (%).

3. With the adoption of IBS, indicate changes (+/-) to the amount of levies on foreign workers that your organisation has paid from 2010 through 2015, i.e. in the last calendar (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%).

4. With the adoption of IBS, indicate the amount of expenses in value (RM) that your organisation has to incur in order to:

(a) outline an implementation framework to ensure consistency with international standards and best practices _____

(b) comply with all relevant rules and regulations _____

5. Describe levels of competition within your segment of the IBS industry in Malaysia:

(a) total number of competitors, specifying whether domestic or foreign _____

(b) top 3 segment leaders and their headquarters or centre(s) of activities _____

(c) barriers to entry - startup costs, capital intensity, tax restrictions, regulatory burden and other government constraints, intellectual property, agreements with distributors and/or suppliers, etc _____

(d) balance of supply - inventory management, price-setting powers, economies of scale, supply adequacy, cut-throat competition, etc _____

VI. SAFETY, HEALTH AND ENVIRONMENT

1. List all international and domestic guidelines, standards and best practices as well as acts and enactments related to safety, health and environment that your organisation has to comply with.

2. Indicate estimates in value (RM) the extent to which IBS enables your organisation to comply better with cleanliness, safety, health, sustainability and "green" guidelines, standards and best practices while specifying how it works.

3. List all sustainable materials (relevant certifications shall be indicated) that your organisation works with and indicate estimates of their usage in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total expenditure _____

4. Indicate your organisation's overall spending on research and development (R&D) and R&D spending on sustainable materials in terms of:

(a) value (RM) _____

(b) percentage(%), i.e. share of total expenditure or overall R&D spending respectively _____

5. Indicate changes (+/-) to your organisation's spending on natural resources and waste management from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total operating expenditure _____

6. Indicate your organisation's spending on prefabricated solutions in providing high-standard facilities and amenities for workers in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total operating expenditure _____

7. Comparing IBS to conventional building method (CBM), list all machineries and equipment that your organisation produces, supplies and/or works with as well as indicate estimates of the impact of their usage on health, safety and sustainability aspects in terms of value (RM) and/or percentage (%).

8. Comparing IBS to CBM, indicate differences in usage of utilities by your organisation notably energy and water in terms of:

(a) value (RM) _____

(b) respective measurement metrics _____

9. List all natural resources used by your organisation that are faced with depletion threats and indicate estimates in terms of value (RM) and probability of risks of natural resource depletion.

APPENDIX 4: QUESTIONNAIRE FOR CATEGORY 4

Category 4: Questionnaire for Manufacturers, Assemblers, Importers and/or Distributors of Finished IBS Products, Components, Techniques and Elements

I. BACKGROUND INFORMATION

1. Full business or establishment name as well as date(s) of establishment/incorporation and commencement of operations.

2. List of ALL core activities and/or products and services that your organisation undertakes and/or sells and provides.

3. Geographical (Malaysia and/or abroad) and spatial (urban and/or rural) distribution in terms of value (RM) and/or percentage (%) of your organisation:

(a) core activities _____

(b) products and/or services _____

(c) turnover _____

4. Total number of headcount at your organisation as at 31 July 2016 or the latest possible date (to be indicated).

5. Breakdown of your organisation's workforce in numbers and percentage (%) as at 31 July 2016 or the latest possible date (to be indicated) for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

6. Minimum amount (RM) of initial investments/capital outlay to reach reasonable economies of scale as well as number of years to break even and/or recoup investments.

II. FINANCIAL PERFORMANCE AND CUSTOMER RELATIONS

1. Indicate changes (+/-) that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/ or percentage (%) for:

(a) order book or outstanding customer orders _____

(b) cash flows _____

(c) turnover _____

(d) gross earnings _____

(e) tax incentives (the exact type(s) and amount to be specified) _____

(f) net earnings _____

(g) specific efficiency and effectiveness metrics (to be specified) _____

(h) overall business risks _____

2. Indicate changes (+/-) that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/ or percentage (%) for:

(a) staff costs/payroll including salaries, allowances and benefits _____

(b) costs of utilities - water, electricity, sewerage, telecommunications, Internet _____

(c) debt payments or loan servicing _____

(d) insurance and legal costs _____

(e) promotional, marketing and advertising costs _____

(f) purchase of machineries and equipment _____

(g) maintenance, depreciation and amortisation costs of machineries and equipment _____

(h) rental payments on lease of machineries and equipment _____

(i) purchase of or rental payments for premises _____

(j) costs of raw materials, natural resources and semi-finished goods _____

(k) others, if any (to be specified) _____

3. Indicate your organisation's pricing structure components for ex-factory IBS products and elements in terms of percentage (%).

4. Acquisition and retention of your organisation's customers thanks to IBS in terms of:

(a) value (RM), frequency (number of times) and number of customers for new orders _____

(b) value (RM), frequency (number of times) and number of customers for repeat orders _____

5. Indicate estimates of your organisation's understanding of customer needs and requirements in terms of percentage (%) out of 100%.

6. Based on your organisation's customer feedback, indicate estimates of public satisfaction towards IBS-based infrastructure and buildings in terms of value (RM) and/or percentage (%) for the following aspects:

(a) overall quality of infrastructure and buildings _____

(b) probability of cracks and leakages _____

(c) degree of aesthetic value in architecture and designs _____

(d) economicality and flexibility of undertaking renovations/changes _____

(e) suitableness and responsiveness to creativity and innovation _____

III. SOCIOECONOMICS

1.Was your organisation established to bank on any opportunities within the IBS industry? If YES, detail out these opportunities as well as your progress and success stories since inception.

2. Detail out statistics each year from 2010 through 2015 of your organisation's dealings with small- and medium-enterprises (SMEs):

(a) number of establishments _____

(b) segments, industries or sectors within which these SMEs operate _____

(c) nature of transactions/dealings _____

(d) average value (RM) of transactions/dealings _____

3. Indicate estimates in value (RM) the potential of overseas demand for your organisation's products and/or services, if any.

4. Indicate estimates in value (RM) the potential of creativity and innovation for your organisation's products and/or services, if any.

5. Indicate estimates for the reduction in prices of completed infrastructure, buildings and properties for customer delivery taking into account prices of IBS products, components, techniques and elements manufactured by your organisation in terms of:

(a) value (RM) _____

(b) percentage (%) _____

IV. HUMAN CAPITAL: MINDSET, KNOWLEDGE, EXPERTISE AND EXPERIENCE

1. Indicate your organisation's optimal and average number of workers.

2. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in the workforce size for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

3. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in the workforce's mean and median monthly salary for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

4. With the adoption of IBS, detail out either at your organisation specifically or observed in the country in general:

(a) all types of new occupations or professions created _____

(b) all types of existing occupations or professions destroyed _____

5. Indicate your organisation's estimates of changes (+/-) in value (RM) and/or percentage (%) for the impact of 4 (a) and (b) above on:

(a) sources of income of Malaysian and foreign workers _____

(b) Malaysia's overall labour force and employment _____

6. Indicate your organisation's estimates of changes (+/-) in terms of value (RM) and/or percentage (%) for:

(a) currently observed productivity and professionalism _____

(b) projected productivity and professionalism in the medium term _____

7. Indicate your organisation's estimates for risks of human errors at the design, manufacturing and installation/erection phases in terms of value (RM) and probability.

8. Indicate your organisation's estimates of changes (+/-) for the impact on IBS acceptance and ultimately usage in terms of value (RM) and/or percentage (%) due to:

(a) lack of familiarity with, knowledge of and awareness about IBS _____

(b) shortage of IBS trained construction professionals at reasonable wages _____

(c) misperceptions that IBS could lead to higher overall construction costs and project risks (and list the real causes of such misperceptions) _____

(d) general resistance to change _____

V. CORPORATE GOVERNANCE AND COMPETITIVE FORCES

1. Indicate estimates for annual contributions of IBS on average at your organisation in terms of value (RM) to:

(a) the conduct of good corporate governance _____

(b) the reduction of wastages, leakages and other negative elements _____

2. Indicate in what way the IBS implementation contributes to the nation's public delivery enhancement and your organisation's estimates of this contribution in terms of value (RM) and/or percentage (%).

3. Indicate changes (+/-) to the amount of levies on foreign workers that your organisation has paid from 2010 through 2015, i.e. in the last calendar (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%).

4. With the adoption of IBS, indicate the amount of expenses in value (RM) that your organisation has to incur in order to:

(a) outline an implementation framework to ensure consistency with international standards and best practices _____

(b) comply with all relevant rules and regulations _____

5. Describe levels of competition within your segment of the IBS industry in Malaysia:

(a) total number of competitors, specifying whether domestic or foreign _____

(b) top 3 segment leaders and their headquarters or centre(s) of activities _____

(c) barriers to entry - startup costs, capital intensity, tax restrictions, regulatory burden and other government constraints, intellectual property, agreements with distributors and/or suppliers, etc _____

(d) balance of supply - inventory management, price-setting powers - economies of scale, supply adequacy, cut-throat competition, etc _____

VI. SAFETY, HEALTH AND ENVIRONMENT

1. List all international and domestic guidelines, standards and best practices as well as acts and enactments related to safety, health and environment that your organisation has to comply with.

2. Indicate estimates in value (RM) the extent to which IBS enables your organisation to comply better with cleanliness, safety, health, sustainability and "green" guidelines, standards and best practices while specifying how it works.

3. List all chemicals and chemical products, and sustainable materials (relevant certifications shall be indicated) that your organisation uses to manufacture/produce IBS products, components, techniques and elements as well as indicate estimates of their usage in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total expenditure _____

4. Indicate your organisation's overall spending on research and development (R&D) and R&D spending on sustainable materials in terms of:

(a) value (RM) _____

(b) percentage(%), i.e. share of total expenditure or overall R&D spending respectively _____

5. Indicate changes (+/-) to your organisation's spending on natural resources and waste management from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total operating expenditure _____

6. Indicate your organisation's spending on prefabricated solutions in providing high-standard facilities and amenities for workers in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total operating expenditure _____

7. List all machineries and equipment that your organisation works with and indicate estimates of the impact of their usage on health, safety and sustainability aspects in terms of value (RM) and/or percentage (%).

8. Indicate changes (+/-) to your organisation's spending on or usage of utilities notably energy and water from 2010 through 2015, i.e. in the last calendar (e.g. 2015) vs. the previous year (e.g. 2014) in terms of:

(a) value (RM) _____

(b) respective measurement metrics _____

9. List all natural resources used by your organisation that are faced with depletion threats and indicate estimates in terms of value (RM) and probability of risks of natural resource depletion.

APPENDIX 5: QUESTIONNAIRE FOR CATEGORY 5

Questionnaire for Providers of Transportation, Storage, Installation and Other Services for Use by Ex-Factory IBS Products, Components, Techniques and Elements

I. BACKGROUND INFORMATION

1. Full business or establishment name as well as date(s) of establishment/incorporation and commencement of operations.

2. List of ALL core activities and/or products and services that your organisation undertakes and/or sells and provides.

3. Geographical (Malaysia and/or abroad) and spatial (urban and/or rural) distribution in terms of value (RM) and/or percentage (%) of your organisation:

(a) core activities _____

(b) products and/or services _____

(c) turnover _____

4. Total number of headcount at your organisation as at 31 July 2016 or the latest possible date (to be indicated).

5. Breakdown of your organisation's workforce in numbers and percentage (%) as at 31 July 2016 or the latest possible date (to be indicated) for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

6. Minimum amount (RM) of initial investments/capital outlay to reach reasonable economies of scale as well as number of years to break even and/or recoup investments.

II. FINANCIAL PERFORMANCE AND CUSTOMER RELATIONS

1. Indicate changes (+/-) in general that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%) for:

(a) order book or outstanding customer orders _____

(b) cash flows _____

(c) turnover _____

(d) gross earnings _____

(e) tax incentives (the exact type(s) and amount to be specified) _____

(f) net earnings _____

(g) specific efficiency and effectiveness metrics (to be specified) _____

(h) overall business risks _____

2. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%) for:

(a) order book or outstanding customer orders _____

(b) cash flows _____

(c) turnover _____

(d) gross earnings _____

(e) tax incentives (the exact type(s) and amount to be specified) _____

(f) net earnings _____

(g) specific efficiency and effectiveness metrics (to be specified) _____

(h) overall business risks _____

3. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%) for:

(a) staff costs/payroll including salaries, allowances and benefits _____

(b) costs of utilities - water, electricity, sewerage, telecommunications, Internet _____

(c) debt payments or loan servicing _____

(d) insurance and legal costs _____

(e) promotional, marketing and advertising costs _____

(f) purchase of machineries and equipment _____

(g) maintenance, depreciation and amortisation costs of machineries and equipment _____

(h) rental payments on lease of machineries and equipment _____

(i) purchase of or rental payments for premises _____

(j) costs of raw materials, natural resources and semi-finished goods _____

(k) others, if any (to be specified) _____

4. Acquisition and retention of your organisation's customers thanks to IBS in terms of:

(a) value (RM), frequency (number of times) and number of customers for new orders _____

(b) value (RM), frequency (number of times) and number of customers for repeat orders _____

5. Indicate estimates of your organisation's understanding of customer needs and requirements in terms of percentage (%) out of 100%.

6. Based on your organisation's customer feedback, indicate estimates of public satisfaction towards IBS-based infrastructure and buildings in terms of value (RM) and/or percentage (%) for the following aspects:

(a) overall quality of infrastructure and buildings _____

(b) probability of cracks and leakages _____

(c) degree of aesthetic value in architecture and designs _____

(d) economicality and flexibility of undertaking renovations/changes _____

(e) suitableness and responsiveness to creativity and innovation _____

III. SOCIOECONOMICS

1. Was your organisation established to bank on any opportunities within the IBS industry? If YES, detail out these opportunities as well as your progress and success stories since inception.

2. Detail out statistics each year from 2010 through 2015 of your organisation's dealings with small- and medium-enterprises (SMEs):

(a) number of establishments _____

(b) segments, industries or sectors within

which these SMEs operate _____

(c) nature of transactions/dealings _____

(d) average value (RM) of transactions/dealings _____

3. Indicate estimates in value (RM) the potential of overseas demand for your organisation's products and/or services, if any.

4. Indicate estimates in value (RM) the potential of creativity and innovation for your organisation's products and/or services, if any.

5. Indicate estimates for the reduction in prices of completed infrastructure, buildings and properties for customer delivery taking into account tariffs of your organisation's rendered services in terms of:

(a) value (RM) _____

(b) percentage (%) _____

IV. HUMAN CAPITAL: MINDSET, KNOWLEDGE, EXPERTISE AND EXPERIENCE

1. Indicate your organisation's optimal and average number of workers.

2. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in the workforce size for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

3. Indicate changes (+/-) brought about by IBS that your organisation has experienced from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in the workforce's mean and median monthly salary for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

4. With the adoption of IBS, detail out either at your organisation specifically or observed in the country in general:

(a) all types of new occupations or professions created _____

(b) all types of existing occupations or professions destroyed _____

5. Indicate your organisation's estimates of changes (+/-) in value (RM) and/or percentage (%) for the impact of 4 (a) and (b) above on:

(a) sources of income of Malaysian and foreign workers _____

(b) Malaysia's overall labour force and employment _____

6. Indicate your organisation's estimates of changes (+/-) in terms of value (RM) and percentage (%) for:

(a) currently observed productivity and professionalism _____

(b) projected productivity and professionalism in the medium term _____

7. Indicate your organisation's estimates for risks of human errors at the design, manufacturing and installation/erection phases in terms of value (RM) and probability.

8. Indicate your organisation's estimates of changes (+/-) for the impact on IBS acceptance and ultimately usage in terms of value (RM) and/or percentage (%) due to:

(a) lack of familiarity with, knowledge of and awareness about IBS _____

(b) shortage of IBS trained construction professionals at reasonable wages _____

(c) misperceptions that IBS could lead to higher overall construction costs and project risks (and list the real causes of such misperceptions) _____

(d) general resistance to change _____

V. CORPORATE GOVERNANCE AND COMPETITIVE FORCES

1. Indicate estimates for annual contributions of IBS on average at your organisation in terms of value (RM) to:

(a) the conduct of good corporate governance _____

(b) the reduction of wastages, leakages and other negative elements _____

2. Indicate in what way the IBS implementation contributes to the nation's public delivery enhancement and your organisation's estimates of this contribution in terms of value (RM) and/or percentage (%).

3. With the adoption of IBS, indicate changes (+/-) to the amount of levies on foreign workers that your organisation has paid from 2010 through 2015, i.e. in the last calendar (e.g. 2015) vs. the previous year (e.g. 2014) in terms of value (RM) and/or percentage (%).

4. With the adoption of IBS, indicate the amount of expenses in value (RM) that your organisation has to incur in order to:

(a) outline an implementation framework to ensure consistency with international standards and best practices _____

(b) comply with all relevant rules and regulations _____

7. Describe levels of competition within your segment of the IBS industry in Malaysia:

(a) total number of competitors, specifying whether domestic or foreign _____

(b) top 3 segment leaders and their headquarters or centre(s) of activities _____

(c) barriers to entry - startup costs, capital intensity, tax restrictions, regulatory burden and other government constraints, intellectual property, agreements with distributors and/or suppliers, etc _____

(d) balance of supply - inventory management, price-setting powers - economies of scale, supply adequacy, cut-throat competition, etc _____

VI. SAFETY, HEALTH AND ENVIRONMENT

1. List all international and domestic guidelines, standards and best practices as well as acts and enactments related to safety, health and environment that your organisation has to comply with.

2. Indicate estimates in value (RM) the extent to which IBS enables your organisation to comply better with cleanliness, safety, health, sustainability and "green" guidelines, standards and best practices while specifying how it works.

3. List all sustainable materials (relevant certifications shall be indicated) that your organisation uses to transport, store, install and erect IBS products, components, techniques and elements as well as indicate estimates of their usage in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total expenditure _____

4. Indicate your organisation's overall spending on research and development (R&D) and R&D spending on sustainable materials in terms of:

(a) value (RM) _____

(b) percentage(%), i.e. share of total expenditure or overall R&D spending respectively _____

5. Indicate changes (+/-) to your organisation's spending on natural resources and waste management from 2010 through 2015, i.e. in the last calendar year (e.g. 2015) vs. the previous year (e.g. 2014) in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total operating expenditure _____

6. Indicate your organisation's spending on prefabricated solutions in providing high-standard facilities and amenities for workers in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total operating expenditure _____

7. List all machineries and equipment that your organisation works with and indicate estimates of the impact of their usage on health, safety and sustainability aspects in terms of value (RM) and percentage (%).

8. Indicate changes (+/-) to your organisation's spending on or usage of utilities notably energy and water from 2010 through 2015, i.e. in the last calendar (e.g. 2015) vs. the previous year (e.g. 2014) in terms of:

(a) value (RM) _____

(b) respective measurement metrics _____

9. Indicate differences between urban and rural areas for your organisation's transportation, storage, installation and erection services of IBS components and elements in terms of:

(a) value (RM) _____

(b) ratio (%) _____

10. List all natural resources used by your organisation that are faced with depletion threats and indicate estimates in terms of value (RM) and probability of risks of natural resource depletion.

APPENDIX 6: QUESTIONNAIRE FOR CATEGORY 6

Questionnaire for End-customers

I. BACKGROUND INFORMATION

1. Full business or establishment as well as name date(s) of establishment/incorporation and commencement of operations.

2. List of ALL core activities and/or products and services that your organisation undertakes and/or sells and provides.

3. Geographical (Malaysia and/or abroad) and spatial (urban and/or rural) distribution in terms of value (RM) and/or percentage (%) of your organisation:

(a) core activities _____

(b) products and/or services _____

(c) turnover _____

4. Total number of headcount at your organisation as at 31 July 2016 or the latest possible date (to be indicated).

5. Breakdown of your organisation's workforce in numbers and percentage (%) as at 31 July 2016 or the latest possible date (to be indicated) for:

(a) executive/management vs. non-executive/unionised staff _____

(b) unskilled vs. semi-skilled vs. skilled/specialised workers _____

(c) citizens vs. foreigners _____

6. The content of IBS products, components, techniques and elements in your organisation's infrastructure, buildings and real estate properties as at 31 July 2016 or the latest possible date (to be indicated) according to the CIDB's most updated IBS content scoring system.

II. CUSTOMER SATISFACTION AND LOYALTY

1. In the event of indiscriminate incorporation by IBS manufacturers, assemblers, importers and distributors of all costs involved into the pricing structure of factory-produced building components and elements, indicate the impact on delivery prices to your organisation and/or final prices for the public in terms of:

(a) value (RM) _____

(b) percentage (%) _____

2. Comparing IBS to Conventional Building Method (CBM), indicate your organisation's levels of satisfaction in percentage (%) out of 100 for:

(a) overall quality and durability of infrastructure and buildings _____

(b) prevalence of defects (cracks, leakages, etc) on infrastructure and buildings _____

(c) degree of aesthetic value in architecture and designs _____

(d) understanding of and knowledge about customer needs and requirements _____

(e) speed of construction works and projects _____

(f) respect for project completion and customer delivery schedules _____

(g) cost-effectiveness and value-for-money in pricing of infrastructure and buildings _____

(h) economicality and flexibility to undertake renovations/changes _____

(i) suitableness and responsiveness to creativity and innovation _____

III. SOCIOECONOMICS

1. Among all five (5) identified core segments of the IBS industry, indicate the Top 2 that your organisation deems will emerge as or command:

(a) the largest share within the industry and/or growth leaders in the near future, the reason(s) of these views and the breakdown into clusters respectively _____

(b) the most export potential _____

2. Acknowledging that the IBS industry cuts across various industries in all five (5) major sectors, indicate your organisation's estimates for:

(a) the size of the IBS industry (RM billion) _____

(b) the share (%) of the IBS industry of the Malaysian economy or its contribution to the GDP _____

3. Detail out statistics each year from 2010 through 2015 of your organisation's dealings with small- and medium-enterprises (SMEs):

(a) number of establishments _____

(b) segments, industries or sectors within which these SMEs operate _____

(c) nature of transactions/dealings _____

(d) average value (RM) of transactions/dealings _____

4. Indicate your organisation's estimates in terms of value (RM) and/or percentage (%) or number of workers arising from the impact of full IBS implementation on:

(a) requirements for foreign labour _____

(b) social stability and equilibrium, and domestic political landscape _____

IV. HUMAN CAPITAL: MINDSET, KNOWLEDGE, EXPERTISE AND EXPERIENCE

1. Indicate your organisation's optimal and average number of workers.

2. With the adoption of IBS, detail out either at your organisation specifically or observed in the country in general:

(a) all types of new occupations or professions created _____

(b) all types of existing occupations or professions destroyed _____

3. Indicate your organisation's estimates of changes (+/-) in value (RM) and/or percentage (%) for the impact of 2 (a) and (b) above on:

(a) sources of income of Malaysian and foreign workers _____

(b) Malaysia's consumer spending/private consumption _____

(c) Malaysia's overall labour force and employment _____

4. Indicate your organisation's estimates of changes (+/-) in terms of value (RM) and percentage (%) for:

(a) currently observed productivity and professionalism _____

(b) projected productivity and professionalism in the medium term _____

5. Indicate your organisation's estimates in value (RM) and probability of risks of human errors at the design, manufacturing and installation/erection phases.

6. Indicate your organisation's estimates of changes (+/-) for the impact on IBS acceptance and ultimately usage in terms of value (RM) and/or percentage (%) due to:

(a) lack of familiarity with, knowledge of and awareness about IBS _____

(b) shortage of IBS trained construction professionals at reasonable wages _____

(c) misperceptions that IBS could lead to higher overall construction costs and project risks (and list the real causes of such misperceptions) _____

(d) general resistance to change _____

V. CORPORATE GOVERNANCE AND COMPETITIVE FORCES

1. Indicate estimates for annual contributions of IBS on average at your organisation in terms of value (RM) to:

(a) the conduct of good corporate governance _____

(b) the reduction of wastages, leakages and other negative elements _____

2. Indicate in what way the IBS implementation contributes to the nation's public delivery enhancement and your organisation's estimates of this contribution in terms of value (RM) and/or percentage (%).

3. With the adoption of IBS, indicate the amount of expenses in value (RM) that your organisation has to incur in order to:

(a) outline an implementation framework to ensure consistency with international standards and best practices _____

(b) comply with all relevant rules and regulations _____

VI. SAFETY, HEALTH AND ENVIRONMENT

1. List all international and domestic guidelines, standards and best practices as well as acts and enactments related to safety, health and environment that your organisation has to comply with.

2. Indicate estimates in value (RM) the extent to which IBS enables your organisation to comply better with cleanliness, safety, health, sustainability and "green" guidelines, standards and best practices while specifying how it works.

3. List all sustainable materials (relevant certifications shall be indicated) that your organisation focuses on as well as indicate estimates of their usage in terms of:

(a) value (RM) _____

(b) percentage (%), share of total expenditure _____

4. Indicate cost savings on resource use and waste management that your organisation currently enjoys in terms of:

(a) value (RM) _____

(b) percentage (%), i.e. share of total operating expenditure _____

5. Comparing IBS to CBM, indicate differences in your organisation's spending on or usage of utilities notably energy and water in terms of:

(a) value (RM) _____

(b) respective measurement metrics _____

6. List all natural resources used by your organisation that are faced with depletion threats and indicate estimates in terms of value (RM) and probability of risks of natural resource depletion

GLOSSARY

ACEM	Association of Consulting Engineers Malaysia
ASEAN	Association of Southeast Asian Nations
BEM	Board of Engineers Malaysia
BIM	Building Information Modelling
BMDAM	Building Materials Distributors Association of Malaysia
BNM	Bank Negara Malaysia
BOP	Balance of Payments
BQSM	Board of Quantity Surveyors Malaysia
BS	British Standards
CAP	Consumers Association of Penang
CBA	Cost-Benefit Analysis
CBM	Conventional Building Method
CCC	Certificate of Completion and Compliance
CCD	Contractor Continuous Development
CIDB	Construction Industry Development Board
CIMP	Construction Industry Master Plan 2006–2015
CISCM	Cast-In-Situ Construction Method
CITP	Construction Industry Transformation Programme
CMUs	Concrete Masonry Units
CREAM	Construction Research Institute of Malaysia
CPC	Certificate of Practical Completion
CPI	Corruption Perceptions Index
CSIS	Centre for Strategic and International Studies
CWD	Construction Works Done
C&D	Construction and Demolition
DO	Development Order
DOSM	Department of Statistics Malaysia
DOSH	Department of Occupational Safety and Health
EMC	Employer Mandatory Commitment
EPF	Employees Provident Fund
EPU	Economic Planning Unit
ERA	Education and Research for Consumers Malaysia
EU	European Union
FM	Facility Management
FOMCA	Federation of Malaysian Consumers Associations
FOMEMA	Foreign Workers Medical Examination Monitoring Agency
FTA	Free Trade Agreement
GBI	Green Building Index
GDP	Gross Domestic Product
GLCs	Government-Linked Companies
GLICs	Government-Linked Investment Companies
GNI	Gross National Income

GST	Goods and Services Tax
IBS	Industrialised Building System
ICT	Information and Communications Technology
IEA	International Energy Agency
IEM	Institution of Engineers Malaysia
IRB	Inland Revenue Board
IRENA	International Renewable Energy Agency
ISO	International Organization for Standardization
JIT	Just-in-Time
JKR/PWD	Public Works Department
JSSB	Jasmiza Solutions Sdn. Bhd.
KPIs	Key Performance Indicators
LAM	Board of Architects Malaysia
LRT	Light Rail Transit
MACC	Malaysian Anti-Corruption Commission
MAMPU	Malaysian Administrative Modernisation and Management Planning Unit
MATRADE	Malaysia External Trade Development Corporation
MBAM	Master Builders Association Malaysia
MDTCC	Ministry of Domestic Trade, Cooperatives and Consumerism
MEPA	Malaysian Energy Professionals Association
MGI	McKinsey Global Institute
MIDA	Malaysian Investment Development Authority
MISIF	Malaysian Iron and Steel Industry Federation
MITI	Ministry of International Trade and Investment
MOA	Ministry of Agriculture and Agro-Based Industry
MOF	Ministry of Finance
MOFA	Ministry of Foreign Affairs
MOH	Ministry of Health
MOHA	Ministry of Home Affairs
MOHR	Ministry of Human Resources
MOSTI	Ministry of Science, Technology and Innovation
MOW	Ministry of Works
MMC	Modern Method of Construction
MPC	Malaysia Productivity Corporation
MRP	Material Requirement Planning
MRT	Mass Rapid Transit (Malaysia)
MTEM	Majlis Tindakan Ekonomi Melayu
MTIB	Malaysian Timber Industry Board
MUWHLG	Ministry of Urban Wellbeing, Housing and Local Governments
MyCREST	Malaysia Carbon Reduction and Environmental Sustainability Tool
NRE	Ministry of Natural Resources and Environment
HBA	National House Buyers Association
NGOs	Non-Governmental Organisations
NCCC	National Consumer Complaints Centre

OECD	Organisation for Economic Coordination and Development
OC	Off-site Construction
OHSAS	Occupational and Safety Management Systems
OSC	One-Stop Centre
PAM	Malaysian Institute of Architects
PC	Prefabricated Construction
PPIM	Muslim Consumers Association of Malaysia
PwC	PricewaterhouseCoopers
QLASSIC	Quality Assessment System in Construction
R&D	Research and Development
REHDA	Real Estate and Housing Developers' Association
RISM	Royal Institution of Surveyors Malaysia
RM	Ringgit Malaysia
RMC	Ready-Mixed Concrete
RMK11/11MP	Rancangan Malaysia Kesebelas or 11th Malaysia Plan
SC	Securities Commission
SCC	Self-Compacting Concrete
SHASSIC	Safety and Health Assessment System in Construction
SMEs	Small and Medium-sized Enterprises
SME Corp	SME Corporation Malaysia
SOCSO	Social Security Organisation
TEEAM	The Electrical and Electronics Association of Malaysia
TFP	Total Factor Productivity
TI	Transparency International
TQM	Total Quality Management
WBG	World Bank Group
WIPO	World Intellectual Property Organisation
UBBL	Uniform Building By-Laws
UN	United Nations
USD	United States Dollar
WEF	World Economic Forum

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