ACHIEVING SUSTAINABLE CAMPUS THROUGH INTEGRATED PROJECT DELIVERY IN NORTHERN REGION HIGHER EDUCATION INSTITUTION

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ABSTRACT

The sustainability commitment of a nation can be reflected in how much attention is given to the sustainability development of youth and future leaders. Higher Education Institutions (HEIs) are one of the main players in producing the nation's future leaders by emulating the sustainability agenda into the curriculum and physical infrastructures. Therefore, it is crucial that sustainable campuses are designed to fulfil the educational needs of these future leaders. However, due to the nature of construction development, campuses are being developed in the traditional methods which are burdened by many challenges such as project delay, fragmented processes and high construction waste. To overcome these challenges, many scholars have proposed the Integrated Project Delivery (IPD) as a method that is beneficial for sustainable development. Accordingly, this research investigated a novel approach to sustainable campus development by identifying how IPD can be applied in the physical development of campuses specifically within the Malaysian northern region HEIs. Semi-structured interviews were conducted with 6 participants who were the experts or main decision- makers in the respective HEIs. The qualitative data was analysed using the Template Analysis method with the aid of Nvivo10 software. The findings indicate that although the participants were aware of the importance of sustainability development, most of them were unfamiliar with most of the IPD practices in campus development. Nevertheless, some of the IPD practices were applied by the participants. The guideline developed at the end of this research highlights the current practices which overlap the IPD principles and suggests the additional aspects of IPD that can be merged with sustainable campus development activities. Some limitations of the study are also indicated, suggesting opportunities for future research.

Keywords: Sustainable construction, sustainable campus development, Integrated Project Delivery, Higher Education Institution.

ABSTRAK

Sesebuah negara yang beriltizam ke arah kemampanan dapat dilihat melalui kepekaan pembangunan mampan golongan belia dan bakal pemimpin negara tersebut. Institusi Pengajian Tinggi (IPT) adalah salah satu daripada peneraju utama yang berperanan untuk melahirkan generasi kepimpinan negara. Justeru, ia seharusnya mencerap agenda mampan melalui kurikulum dan prasarana fizikal. Oleh itu, adalah penting kampus mampan direka bentuk bagi memenuhi keperluan pengajian bakal pemimpin pada masa hadapan. Walau bagaimanapun, disebabkan perkembangan pembangunan yang sebegitu rupa, kampus-kampus dibangunkan berdasarkan konsep binaan secara konvensional, iaitu dibelenggu dengan pelbagai masalah seperti kelewatan projek, pembangunan yang tidak sekata dan juga pembaziran bahan binaan. Bagi mengatasi cabaran-cabaran ini, ramai cendikiawan mencadangkan kaedah *Integrated Project Delivery* (IPD) sebagai kaedah pembinaan yang berkesan ke arah pembangunan mampan. Maka, melalui kajian ini, pembangunan kampus mampan akan dikaji dengan mengenal pasti kaedah penerapan dalam pembangunan fizikal kampus, terutamanya dalam lingkungan IPT di utara Semenanjung Malaysia. Kaedah temu bual separa berstruktur telah dijalankan dalam kalangan 6 orang responden yang merupakan pakar atau pembuat dasar di IPT terbabit. Data kualitatif dianalisa dengan menggunakan *Template Analysis* dengan bantuan perisian *Nvivo 10*. Dapatan kajian menunjukkan bahawa walaupun responden yang ditemubual menyedari akan kepentingan pembangunan mampan, namun kebanyakan mereka tidak menyedari akan kebanyakan amalan IPD dalam pembangunan kampus. Walau bagaimanapun, terdapat beberapa amalan IPD yang diterapkan oleh peserta kajian dalam kampus masing-masing. Panduan yang dibangunkan pada akhir kajian ini adalah dengan mengetengahkan amalan-amalan terkini yang bertindih dengan prinsip-prinsip IPD dan mencadangkan aktiviti-aktiviti tambahan yang boleh digabungkan dengan pembangunan kampus yang mampan. Beberapa kekangan dalam kajian ini dinyatakan dan mencadangkan peluang bagi penyelidikan pada masa hadapan.

Kata kunci: Pembinaan mampan, pembangunan kampus mampan, *Integrated Project Delivery*, Institusi Pengajian Tinggi.

To my heart and soul,

Faizatul Akmar

Afwan Daniel and Auni Maisara

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TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURE

LIST OF ABBREVIATIONS

A/E	Architect/ Engineer
ADR	Alternative Dispute Resolution
AIA	American Institute of Architect
AIACC	American Institute of Architect California Council
AV	Audio Visual
BAS	Building Auto Systems
BIM	Building Information Modelling
BOT	Build Operate and Transfer
BOOT	Build Own Operate and Transfer
CE	Concurrent Engineering
CM	Construction Manager
CMR	Construction Management at Risk
CTK	*Cadangan Teknik dan Kewangan* (Finance and Technical Proposal)
DB	Design and Build
DBB	Design Bid and Build
DBFO	Design Build Finance Operate
DBOM	Design Build Operate Maintain
DESD	Decade of Education for Sustainable Development
EPU	Economic Planning Unit
GBI	Green Building Index
GC	General Contractor
GMP	Guaranteed Maximum Price

HEI	Higher Education Institution
IBS	Integrated Building System
ICT	Information and Communication Technologies
ICUN	International Conference of United Nation
IPD	Integrated Project Delivery
KJR	*Jabatan Kerja Raya* (Department of Maintenance)
JPP	*Jabatan Pengurusan dan Pembangunan* (Department of Management and Development)
KPM	*Kementerian Pelajaran Malaysia* (Malaysian Education Ministry)
Kwh	Kilo watt per-hour
LCC	Life Cycle Cost
LED	Light Electronic Diod
LEED	Leadership in Energy Environmental Design
LESTARI	Institute of Environment and Development
MP	Multi-Prime
NHS	National Health Services
PM	Project Manager
RM	Ringgit Malaysia
SCM	Supply Chain Management
SPN	*Seksyen Pengurusan Nilai* (Value Management Section)
UK	United Kingdom
UKCG	United Kingdom Construction Group
UKM	Universiti Kebangsaan Malaysia
UM	Universiti Malaya

UMT	Universiti Malaysia Terengganu
UN	United Nations
UNCED	United Nation Conference Environment and Development
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UniMAP	Universiti Malaysia Perlis
UPM	Universiti Pertanian Malaysia
US	United State
USA	United State of America
USGBC	United State Green Building Council
USM	Universiti Sains Malaysia
UUM	Universiti Utara Malaysia
VM	Value Management

CHAPTER ONE

INTRODUCTION

1.1 Introduction

The first chapter enlightens nine parts which are: (i) background of the study, (ii) problem statement, (iii) research questions, (iv) research objective, (v) scope of the research (vi) research process, (vii) significance of the study, (viii) structure of research (ix) summary.

1.2 Background of the Research

The significance of sustainable campus development is really crucial in developing the younger generation as the university is a place to create new future leaders of the world (Alshuwaikhat & Abubakar, 2008). Students from all over continent gathered in university to absorb knowledge's formally and in-formally trough the classes and the environment (Cortese, 2003; Razak, 2008). Based on this pedagogy, the ideology to prepare the future leaders must be start at the foundation of the institutions (Cortese, 2003; Robert & Westville, 2008).

According to Finlay (2010), in order to encourage the sustainable campus development the participation from the entire user from inside the campus area and the surrounding area is required to ensure the energy and water consumptions can be reduced. Concurrently, efforts can be made to minimise the carbon footprint to achieve the sustainability within the area. Furthermore, Mat et al. (2009), mentioned that to succeed in developing the sustainable campus there are several physical factors

to be considered. It is important to have better natural lighting surrounding in the buildings, as well as having the right temperature control with improved ventilation system for better air quality indoor (Sutton, 2004; Bekoff & Bexell, 2010; Finlay, 2010; Osman, Udin & Salleh, 2012). All of these factors leading to the healthier environment which is by cutting down the pollutions in the building that can cause the respiratory disease around the campus (Yeang, 2008). There are shown the evidence that the sustainable building campus can provide the betterment of financial expenditure to the building owner and resident (Sharp, 2002; Sharp, 2009; Finlay 2010).

Sustainable campus developments typically have an energy efficiency that is reducing the energy, water, maintenance and other operating yearly cost. Therefore, the reduction of cost can balance the high initial cost of the green technology implemented. Osman (2013), had mentioned that the integrated design as a basis of the sustainable or green materials and equipment. Many argued that the cost to implement or to construct a sustainable building can incur higher cost while there are others who said the cost is similar if not lower than the cost of the traditional construction (Syphers, et al, 2003; Pulaski, 2006; Jernigan, 2007; Sharp, 2009; Osman, 2013). There are certain sustainable building on campus designed with a feature that has a greater initial marginal cost, but Finlay (2009) has mentioned that the investment of the green buildings always can obtain the return in a short period as their life cycle cost are extremely lower than the maintenance cost of any traditional buildings constructed. Jernigan (2007) explains that the existing research has shown the impact of the Life Cycle Cost (LCC) of the building as it is has a priority decisions in occurring through in the initial stages of designing the building.

Therefore, to achieve an ecological and sustainable future, the design process needs to be multidisciplinary (Yeang, 2008).

In the process of maintaining the sustainable campus development, related efforts must show consideration through the preservation of the resources, material recycling and management restructuring that can ensure energy efficiency and resource conservation (Mat et al 2009; Sharp 2009; Shriberg & Harris 2012). In the matter of preserving the resources, as an example; rain water can be collected and conserving the water using smart irrigation landscape design. To ensure the good ecosystem of the green landscape is planned with the drought-resistant native plants and grasses included with integrated support of pest management without using any chemicals (Pulaski, 2006; Jernigan, 2007; Sharp, 2009; Osman, 2013).

Furthermore, generally the traditional buildings consume high amount of the resources such as water and non-renewable energy that affect the economy. On the other hand, conserving the resources through recycling the used bottles, plastic, papers, aluminium materials and steel can encourage the student and staff in campus to help the environment (Jernigan, 2007; Sharp, 2009). The energy efficiency is providing the campus building the huge potential of keeping a promising to the range of challenges as shown in table 1.0 below;

Table 1.1: ***The Potential of Energy Efficiency for Environment.***

	Potential of Energy Efficiency
1	The possible high cost of electric power in the near future.
2	Pending water shortage and waste disposal matters.
3	Growing concern over the cost of global warming.
4	The health and productivity of workers.
5	Increasing expenses of maintaining and operating state facilities over time.

For the further explanation, this this sustainable campus development outcome should have the minimum amount of energy consumption, efficient waste elimination and low water usage (Pulaski, 2006; Jernigan, 2007; Sharp, 2009; Osman, 2013). Other fiscal advantages for the sustainable campus development includes lower cost for environmental, emissions, operations and maintenance (Pulaski, 2006; Jernigan, 2007). All of this lowered cost and money savings is increasing many of social productivity and increasing the body mind wellness. These benefits range from being somewhat predictable to relatively uncertain benefits (Sutton, 2004; Sharp, 2002). Yet, campus sustainability inventiveness currently encounters many obstacles from implementing the programs within the campus although most of these issues somehow relate to the low priority of environmental events on the campus agenda (Sharp, 2009; Adomssent, Godemann & Michelsen, 2007). Furthermore, these delinquent are compounded by a lack of coordination among stakeholders involved during the conception and construction stage towards sustainable practice (Adomssent, Godemann & Michelsen, 2007).

1.3 Problem Statement

The construction and development process are constantly associated with the issues of ecological that are affecting to the sustainability of the biological system in the surrounding area (Pulaski, 2006; Jernigan, 2007; Sharp, 2009; Osman, 2013). Construction of buildings, road, and irrigation channels in the name of urbanization are the main reason why the ecosystem is abused. The Northern Region HEI are the Malaysian public universities own by the Malaysian Government and operate under the Ministry of Education. Therefore, the methods of procurement, construction,

tendering and contracting are based on traditional system as the construction projects are controlled by JKR. The nature of traditional construction methods are known to have little if no integration between the key participants and the stakeholders. The separations of the participant known as over the wall syndrome is creating the cost incline to the project as the problem in communication, manpower, authority then, become a huddle of barriers for cost saving and sustainability. This will influence to other problems such as delay, rework, wastage, trash pile and under-manpower that leads to cost overrun in the HEI campus development project. The sustainability of the development project is very important to create a sustainable environment to the HEI. Undeniably, it is impossible to implement the sustainable development within the traditional construction methodology.

Although some of the new construction projects have the elements of sustainable in their design, but the way of the project being executed is still within the traditional construction process which is leading into those traditional construction problems that will be discussed future more in Chapter Two. The integration among construction parties is not as transparent between them. In traditional methods, those parties keep their barriers and gaps in between them and this situation will lead into the huge issues of fragmentation in communication and information (Nawi, 2013; Nifa 2013).

At the same time, this research will focus on exploring and structuring existing best integrated practices in order to develop a guideline for improving the HEI sustainability development, particularly in the early stage (planning and design) of HEI construction projects. It is believed that the outcome or result of this research will meet and support the requirement of construction, maintenance and operation process for HEI towards sustainable campus development in the future.

As a response to the challenges, and consistent with the needs of the construction industry, this research, therefore, investigates how the delivery team, responsible for the design and construction of a project, can be integrated to work together more efficiently and effectively. The process will involve a comprehensive review of secondary sources of data that including reports, principles, tools and guidelines that particularly relate to the Integrated Project Delivery (IPD) as the IPD practice has been highlighted by numerous of scholars as a best practice to gain sustainable to the construction, environment and humans (Baiden, 2010; Raisbeck, 2010; Kratz, 2014; Nifa, 2015; Nawi, 2013; Jones, 2014)

1.4 Research Questions

- What are the current practices of design, construction and development process in the northern region HEI campus?
- What are the key factors that are crucial to the effectiveness of an integrated team delivery to achieve sustainable campus development?
- How can IPD assist in enabling sustainable design in campus physical developments?

1.5 Research Objectives

- To investigate the current practice of design, construction and development process in the northern region HEI campuses;
- To identify the key factors that significantly influence the effectiveness of an integrated team delivery to achieve sustainable campus development;

- To propose a guideline towards the IPD practice and construction process in sustainable campus development.

1.6 Scope of the Research

This research is focused on identifying the enablers for sustainable campus development. It is just limited to the planning phase and project delivery related physical campus development in the northern region HEI namely UUM, UNIMAP and USM. The area of the research will be conducted within the campus internal building construction and the participants will be the personnel that has the direct authority to campus development project on campus.

This research is conducted in three northern region's public universities are known as the Higher Education Institution (HEI) are Universiti Sains Malaysia (USM) in Pulau Pinang, Universiti Utara Malaysia (UUM) in Kedah and Universiti Malaysia Perlis (UniMAP) in Perlis. The varieties of location, type of buildings and building era among these HEI are the comparative subject of this research to configure the sustainability of the new development surrounding and retrofitting of the building itself. In the meantime, this research will be able to understand the new construction projects that are held in the HEI area. However, some HEI has a mixture of retro and modern building design, but certain of historical buildings has gone through the refurbishment and retrofitting process into the new internal layout that more to achieve the sustainable and greener buildings.

1.7 Research Process

Philips & Pugh (2005) indicate that the research is a process of finding something you don't know trough a systematic method (Amaratunga et. al., 2002) in order to ensure that this research is conducted by following the right procedure to achieve the main objective, there are some step of procedures need to be followed where is, this methodology has been developed specifically for this research and throughout the course. Clearly, this research is separated into four typical topic phases as in figure 1.1 below;

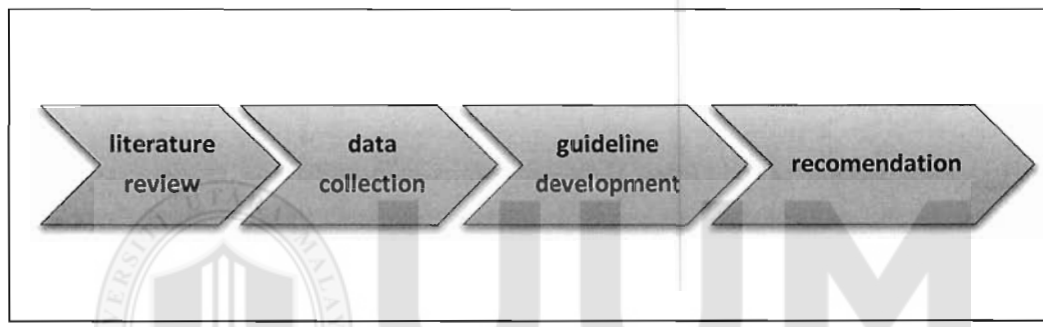


Figure 1.1: *The Typical of Process Phase of the Research*

At the beginning of this research, the extensive literature review phase will commence. For the first part of this research, the initial process is developing the understanding of integrated project delivery, integrated team, collaborative project, sustainable design, sustainable campus development, Malaysian construction industry, university campus development, northern region HEI, and other method of project delivery.

To begin, it is crucial to understand all of those factors mentioned, this fact has to be included to identify the current awareness of these concepts and to what level these concepts are applied in practice. The second part of the research phase is to set and to

justify what are the current practices of northern region HEI specifically in terms of sustainable campus design for physical development. The entire research process is depicted in the following Figure 1.2.

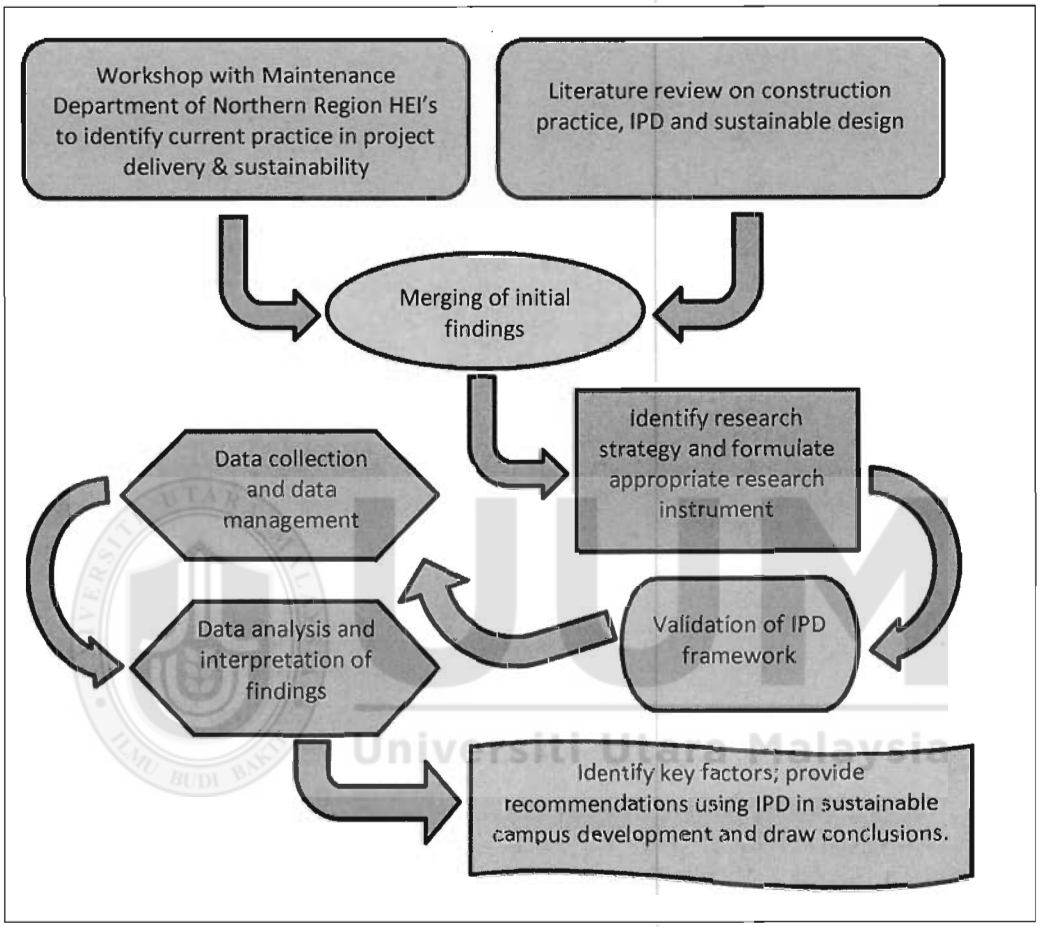


Figure 1.2: *Research Process Diagram*

The process of this research will include several types of data from some sort sources that related to the circle scope of research. Primarily, this research will be conducted using the qualitative method where a set of open ended interview will be used for the selected candidates who are experts in their field. The other data to support the information from the interview will be retrieved from reports, documents, charts, and

observation of the project cites, also other sorts of secondary data and information from the site workers.

1.8 Significance of Research

This research provides an insight into the current issues faced by the HEI in enabling a sustainable campus development through the IPD methods from the designing and planning stage towards the execution of the development projects. The IPD for sustainable campus development is established in previous research will be validated and revised for the implementation of IPD for sustainable campus development in northern region HEI physical campus development. The findings from this research would also be beneficial in assisting HEI for sustainable campus development guideline as has been practiced by some of the top universities worldwide.

1.9 Structure of the Research

The research is divided into five chapters to create a clear flow from start to end. A brief breakdown of the chapters and what the researcher hopes to address in each chapter are as follows:

Chapter 1 Introduction

This chapter provides the background of the research, the research problems, aim of the research and research objectives as well as the relevant research questions which will be the foundation for all discussions in the following chapters. Accordingly, the achievements of this research are also briefly mentioned besides the scope of this research. Finally the structure of the report is presented at the end of the chapter.

Chapter 2 Literature Review

This chapter will address the definition and overall perspective of integrated project delivery (IPD) in Malaysia and abroad, as well as the awareness on sustainable campus design and development. An exploration of current and past literatures pertaining to the issues of the construction industry, integrated project delivery (IPD) and sustainable design as well as campus development is included in this chapter. The awareness, categories, and current practices are explored extensively in this chapter. This chapter proceeds with the background of UUM, USM and UNIMAP campus and the role of maintenance and development department in the campus physical development. This chapter ends with a summary of key findings, which directs the decisions for the coming stages in this research.

Chapter 3 Research Design and Methods

This chapter highlights the design and methodology that selected for this research. Firstly, the research methodology that adopted in the research is deliberate in this chapter. The subsequent part of this chapter discusses the formulation and design of data collection approaches engaged in this research. The explanation and justification of verdicts made relating to research design and the selected methodology is correspondingly comprised in this research.

Chapter 4 Qualitative Data Analysis

This chapter deliberates the result and the data gained from the participant interviewed from the northern region HEI campuses. The discussion will be based on the research questions and objectives in order to gain the understanding of current issues and practices with regards to campus project planning, procurement and the

applications. The NVivo 10 software will be used as the tools to manage the data and information that gain from the participant to place it into the template form. This research analysis will be using the template analysis to analyse the data and the information. The interview data that gathered from the participant will be discussed in this chapter as well.

Chapter 5 Discussion and Conclusion

This chapter will discuss the result of the chapter 4 as the analysis will be consolidating the data in the literature. The result found in NVivo 10 will be discussed further to gain more correlation in between literature and interview data to ensure the understanding of the issue can be clearer. In this chapter also will summarise the research findings at the end including the research limitation, contribution of the knowledge and recommendations for future work.

1.10 Chapter Summary

Overall, this chapter highlighted the main intention of the researcher to gain the objective at the end of this research and the background of the research. This chapter briefed the flow of the research start with the research objectives, questions, and methodological steps. In this research it is important conclude in deep of the literature review as this research is an exploratory research, and the literature reviews are conducted to obtain fully understanding of the research area for sufficient information's and knowledge's. The following chapter will review the current literature related to this research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The development of campus creates many impacts to the surrounding area. In Malaysia, most of the newly-built campuses are located in the rural area. This campus construction and developments are creating many changes that impact to the community, ecosystem, carbon footprint, economy, social and environment (Keller, 2015). Accordingly, this research is focusing in to the physical development of the campus buildings that impact to the area in the aspect of environmental sustainability trough the integrated construction solution. Many scholars highlighted the important of sustainability within the campus area (Alshuwaikhat & Abubakar, 2008; Barlett & Chase, 2004; Simpson, 2003; Thomashow, 2014; James & Card, 2012; Wright, 2002; Moore et. al. 2005).

There are many ways to construct and develop the campus area and surrounding, in Malaysian development context within the system that is approved by the *Jabatan Kerja Raya* (JKR) and Malaysian government. Therefore, this literature review main scope is to tie the construction and development in the northern region HEI with the sustainable development to the campus area. Accordingly, in developing the campus, the only method is through the construction project to build the structures. As has been mentioned in Chapter One, the Malaysian construction industry has many issues which problem started form the designing stages, constructing phase and delivering the projects to the clients.

2.2 Sustainable Development: The Worldwide Awareness

A sustainable development is a "development which meets the needs of the present without compromising the ability of future generations to meet their own needs" if denoted by Brundland Report in (Vouvaki & Anastasios, 2008). The core of the sustainability concept is to 'continuously using through the time', Accordingly, Heinberg (2010) define the term of sustainable as "that which can be maintained over time." but the main definition of sustainable development that widely used and widely accepted are;

> *"Humanity has the ability to make the development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their needs" (P. Raskin et al 2002)*

This tag line was creating the awareness for local and global institutions, governments and society to involve into sustainable developments. According to (Adam, 2006; Kates et al., 2005; and Dresner, 2002) from the last World War II, most of the major city was affected by the destruction of the war and this destruction has propelled the awareness towards the environment. This awareness was addressed by the world leaders attending the Stockholm conference of Human Environment in 1972 which primary aim was to define the thin line between the environments and development. Subsequently, from the Stockholm conference, the world commission on environment and development had introduced a common assemblage in United Nations 1982 as intention to producing a report entitled "Our Common Future" (Kates et al., 2005).

There is a definition of sustainable development by the U.S. National Research Council, Policy Division, Board on Sustainability Development, in Our Common

Journey: A Transition towards Sustainability (Washington, DC: National Academy Press, 1999) shown in table 2.1;

Table 2.1: *Definition of Sustainable Development*

WHAT IS TO BE SUSTAINED	FOR HOW LONG	WHAT IS TO BE DEVELOPED
	25 years "Now and in the future" Forever	
NATURE Earth Biodiversity Ecosystem		**PEOPLE** Child Survival Life expectancy Education Equality Equal opportunity
LIFE SUPPORT Ecosystem service Resources Environment	**LINKED BY** Only Mostly But And Or	**ECONOMY** Wealth Productive Sectors Consumption
COMMUNITY Cultures Groups Place		**SOCIETY** Institutions Social capital States Region

The main understandings of the sustainable design are to ensure the triple bottom lines are covered the Environmental, Social and Economic aspects of development. Adam (2006) explains the bottom line as the pillars, overlapping circles, and interlocking circles. This model referred by most of the scholars in the sustainability area. Many sustainable literatures Mensah, et al., (2012), Murray, et al., (2006),

Bullen & Love, (2011) and Presley & Meade, (2010) are among the researchers that referring to Adam (2006) triple bottom line of sustainability model. This model has been published in International Conference of United Nation (ICUN) at The World Conservation Union in January (2006). The three main core of the sustainability is interlocked with each other or overlapped to each other or separated to each other's. The overlapping or interlocking or the pillar shows how the theory of sustainability and the reality of the sustainability. Figure 2.1 below will show the difference of the reality and the theory of the sustainability:

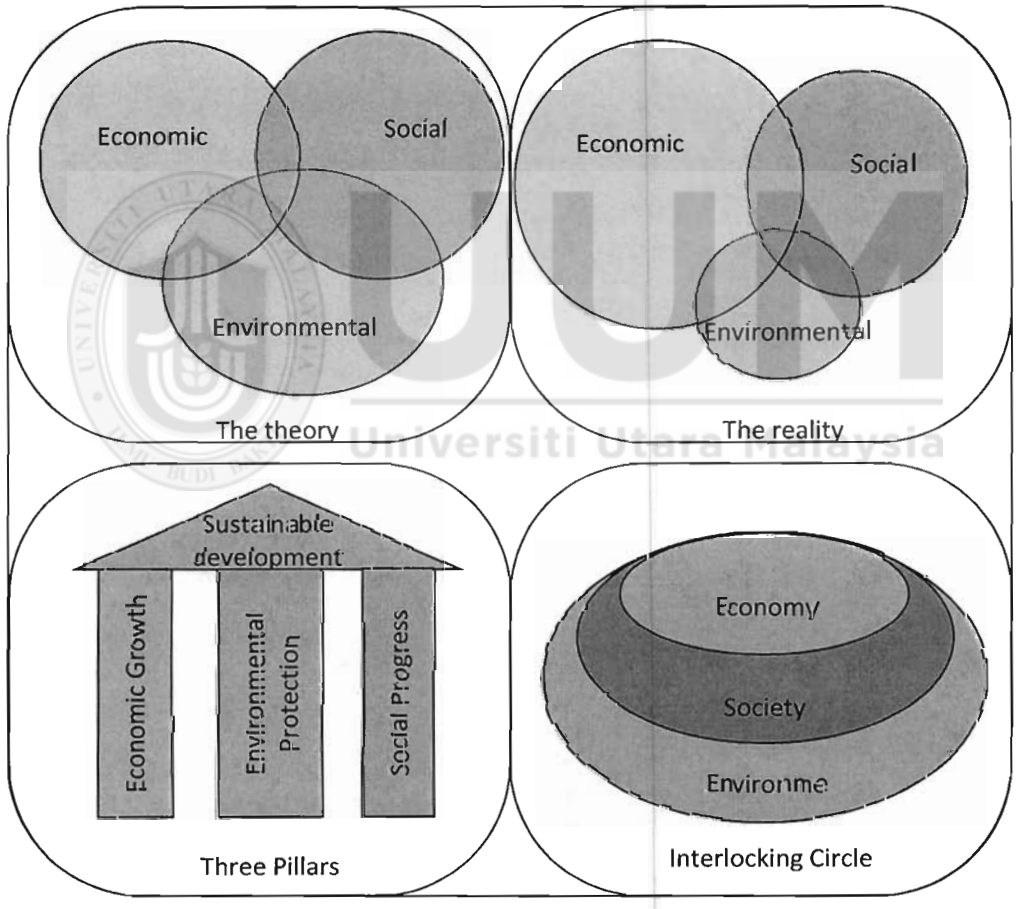


Figure 2.1: *The Triple Bottom Line of Sustainable Development* (Adam, 2006)

In between human and environment, there is a relationship that can be determined by some factors (Adam 2006). The environment change, (Valipor, et al., 2011; MPC, 2010; Finlay, 2010 and Salama, 2010) can give positive or negative impact to the human or contributing to the change. This can be seen in the Figure 2.7 where the ideally economic, social and environmental has to be balanced with each other's. The relationship between humans and their environment is determined by a number of factors (Du Plessis, 2004).

Conference and declaration in environmental issue had proposed new ideas as guidance for the country to follow in their efforts to achieve the sustainable development. The 1973 Stockholm Declaration, Sohn, (1973) was aimed at creating the awareness on sustainable environment. From the awareness and understanding of the sustainable environment, the sustainable development of a country can be more guided.

2.3 Declarations on Sustainability

The sustainable higher education has been voiced out in United Nations Educational, Scientific and Cultural Organization 1972, (UNESCO) in Stockholm. The Stockholm Declaration 1972, cited in Wright (2002) has become the first reference to the sustainable environment for higher education. The guideline of the sustainability has clearly focused on human development and environment for present and future generations. There are 26 principles recommended by the UNESCO in the conference to achieve the environmental sustainability in every country. The higher education becomes the platform to start the environmental sustainability because the educated person from the universities, institute or college will be a basis of the development in

the country for the brighter future. Table 2.2 below shows the chronology of declaration.

Table 2.2: *Declaration Chronology* (Source: Wright, 2002)

Year	Declaration
1972	The Stockholm Declaration on the human environment
1977	Tbilisi Declaration
1990	Universiti Presidents for a sustainable future: the Tallories declaration
1991	The Halifax Declaration
1992	Report of the United Nations Conference on environment and development – Chapter 36, Promoting education, public awareness and training
1993	Ninth International Association of Universities Round Table: The Kyoto Declaration
1993	Association of Commonwealth Universities' Fifteenth Quinquennial Conference: Swansea Declaration
1994	CE-Copernicus charter
1997	International Conference on Environment and Society – Education and Public Awareness for Sustainability: declaration of Thessaloniki

The real starting point of sustainable evolution is in The Tbilisi Declaration conference where the focus of the declaration is associated to the educational system and was the Intergovernmental Conference on Environmental Education in Tbilisi United Nations Educational, Scientific and Cultural Organization – United Nations Environment Program (UNESCO-UNEP) in 1977 and1978. This declaration becomes wider and the focus is not only for the students, but the sustainability effort must include all the staff at the.

In 1990, The Talloires Declaration was pledge which specified that the institution of higher education head is required to be responsible for the leadership development

and support to mobilized internal and external resource so that the institution can support the urgent challenge of sustainability. The Halifax Declaration in Canada, 1991, was the declaration that shows the impact of direct result the Conference on University Action of Sustainable Development. In this declaration the action of the universities to play the role to improve the countries environmental and development issue. The leadership in universities could play the role to take action towards the challenge in the environmental issue and contribute to the community in terms of the think tank to re-construct the policies and practices. This Halifax Declaration has offered the new dimension of action plan for Canadian universities and the frameworks for action within the universities.

The Kyoto Declaration was the 9th International Association of Universities Round Table in 1990. The Kyoto Declaration main agenda contributes to the framework of sustainability, the Kyoto version is almost nearly tied to the Rio Agenda 21 Summit in Rio de Janeiro. The agenda in Kyoto is claimed to be clearer and more detail on how to achieve sustainable within universities and stressed on the ethical obligation of universities to the environment for sustaining the development principles. All the principals that stated in the declaration forcing the universities to create their action plan to achieve the goal of sustainability.

The agenda 21 – chapter 36 was the result of the United Nation Conference Environment and Development (UNCED) held in Rio de Janeiro, 1992. This conference related to most of the sustainability agenda and all the issue in sustainability in higher education. This declaration chapter 36 includes the initiative of the individual, government and the nation to ensure the sustainable development in the countries and recognizing the countries that developing their own sustainable program according their culture, policies and responsibilities.

This declaration of sustainable higher education was signed by Malaysians representatives with 172 others countries. This declaration was a first step to create a more sustainable campus in Malaysia. This declaration was the basis in creating the sustainable society's development. This declaration had proven that the Malaysian government has the intention to be the sustainable country with sustainable higher education. After this Agenda 21 conference in Rio, there were more conferences held by UNESCO, UNCED, and by other universities. Table 2.3 shows the common principle of the declaration form the first declaration to the most recent.

Table 2.3: *Common Principal of Sustainability in Policies and Declaration.* (Source: Wright, 2002)

Policy / Declaration	Moral Obligation	Sustainable Physical Operation	Encourage sustainable research	Public outreach	Inter-University cooperation	Partnership with government, NGOS & industry	Develop inter-disciplinary curriculum	Ecological literacy
Stockholm Declaration	X			X				X
Tbilisi Declaration	X		X	X		X		X
The Tallories Declaration	X	X	X	X	X	X	X	X
The Halifax Declaration	X			X	X	X		X
The Kyoto Declaration	X	X	X	X	X	X		X
Swansea Declaration	X	X	X	X	X			X
CRE Copernicus Charter	X		X	X		X	X	X
Thessaloniki Declaration	X			X		X	X	X
Dalhousie Draft Environmental Policy	X	X		X		X	X	X
George Washington University	X	X	X	X		X	X	X
Macalester College Implementation Plan	X	X	X	X	X	X	X	X
McGill Draft Environmental Policy	X	X	X					X
Queens University	X	X	X					
Tufts University	X	X		X	X	X		X
University of Buffalo Environmental Policies	X	X	X	X			X	X
University of British Columbia Policy	X	X		X	X	X	X	X
University of Hertfordshire	X	X	X	X	X		X	
University of Southern Carolina	X	X	X	X				
University of Toronto	X	X		X	X			X
University of Wales Swansea	X	X	X		X		X	
University of Waterloo Policy	X	X	X	X				

2.4 Sustainable in Higher Education Institution (HEI)

Higher Education Institution (HEI) is the one of most important places for developing the human capital to be contributing member of the society. Alshuwaikhat & Abubakar, (2008) mentions that the campus is named as a small city to the student that serving their life activities on campus as mentioned before. Therefore, the universities are in the integral position to promote sustainability not only within the campus area, but also to the area surrounding the campus. The idea about sustainable campus has become a global concern and has been mentioned in the Stockholm Declaration at the United Nation conference 1972. In that declaration, a guideline for sustainability in higher education has been declared for the reference in the future. This guideline also recognized the thin line interdependency between the humanity and the environment (Mat et al., 2009).

Many universities or Higher Education Institution (HEI) try to create their education place to be as sustainable for the future. Then, those buildings and environment will be rated in the Green Building Index (GBI) or in LEED, the rating system is purposed to measure how far the building gets green building features in the systems. From the Green Building Council in United State (USGBC) survey, it shows about the sustainable building design will become more popular and will be more commonly practiced in the future when it will be the human benefits are identified, primarily the productivity gains believed to be associated with the provision of high quality interior environments (Osman, 2013).

Some of the universities already have their master plan environmental plan, environmental guidelines or environmental statement for the improving the sustainability in campus area (Velazquez, et. al. 2006). These initiatives are based on

the university environmental goals and targets and university management's concept of sustainability because the concept presents diverging interpretations according to the players that are implied. Table 2.4 below shows the universities that already focusing on the sustainability.

Table 2.4: *The Focus of Number of Institutions – Detailed Sustainability Policies.* (Source: Wright, 2002).

Policy focus on greening physical operation	**Policy focus on sustainability education and greening physical operation**
Queens University	California State University
University of Buffalo	Carnegie Mellon University
University of Colorado	Dalhousie University
University of Toronto	Durham University
	Oxford Brooks University
	George Washington University
	Lincoln University
	Lund University
	Massey University
	Open Polytechnic New Zealand
	Tufts University
	Universidad National Autonoma do Mexico
	Université Laval
	University of Edinburgh
	University of Hertfordshire
	University of Manchester
	University of South California
	University of Sunderland
	University of Sussex
	University of Utecht
	University of Wales Swansea
	University of Waterloo

2.4.1 Sustainable Campus Definition.

A sustainable university is defined by Velazquez et al., 2006 as ''A higher educational institution, as a whole or as a part, that addresses, involves and promotes, on a regional or a global level, the minimization of negative environmental, economic, societal, and health effects generated in the use of their resources in order to fulfil its functions of teaching, research, outreach and partnership, and stewardship in ways to help society make the transition to sustainable lifestyles''. Cole, (2003) also defines a sustainable campus community as ''the one that acts upon its local and global responsibilities to protect and enhance the health and well-being of humans and ecosystems. It actively engages the knowledge of the university community to address the ecological and social challenges that we face now and in the future''.

Universities have several activities and complex operations with potentially significant environmental impacts that, until recently, have been largely overlooked in terms of social and environmental responsibility. Many university-related activities and operations require monitoring for significant environmental impacts. These include workshops and laboratory use, buildings and grounds maintenance as well as energy and materials use. Sustainability assurance means that the full costs of development proposals are identified, mitigated, compensated or offset. We are of the opinion that a sustainable university campus should be a healthy campus environment, with a prosperous economy through energy and resource conservation, waste reduction and an efficient environmental management, and promotes equity and social justice in its affairs and export these values at community, national and global levels.

2.4.2 University and HEI with Sustainable Approach.

Sustainability has become a global thinking, many industries starts to pull the string into the sustainability, product, concept, and also tried to tighten up the ideas to lead the sustainable market. Nevertheless, the universities and Higher Education Institution (HEI) have their own initiative to generate more ideas to create the sustainable place for student and staff in the campus area. Although, there are many papers about the sustainable and sustainability has been written by many scholars, but for the Malaysian Higher Education Institution the practice still in the beginning, the practice and implementations are very limited into certain aspect.

There are several universities and HEI in Malaysia that tries to impose the sustainable design and environment of the building and campus area. From the literature some of the universities and HEI in Malaysia have started to implement the sustainable concept in campus (Saadatian, 2012). Some of the Malaysian universities and campuses have already started their Sustainable Higher Education (SHE) program since 1990. Universiti Malaya (UM) was among the first university that implementing the sustainable program for the campus as the establishment of the educational approach.

The Universiti Kebangsaan Malaysia (UKM) was the first campus that had started the sustainable campus programme and it was launched in 2007 as an integration of the university development programme. This programme is based on the United Nations Decade of Education for Sustainable Development (DESD) 2005-2014. Which is the declaration signed by 413 universities in January 2010 enquire the entire universities to implement the sustainability concept in every aspect within the campus area (Darus et al., 2009). Therefore, to ensure the progress of implementation, UKM has

established an Institute of Environment and Development (LESTARI) in 1994. This LESTARI has highlighted many aspects of sustainability in their charter that commencing the environmental, social ecosystems, sustainable design and community.

In other hand, Universiti Sains Malaysia (USM) striving for the sustainable campus program was started in the year 2000 with the establishment of the Sejahtera Campus (Kampus Sejahtera). Whereby in the program, USM start to optimising the harmonious balance through the spiritual, social, physical, intellectual, emotional, and environmental dimensions (Nejati et al., 2011; Rahim et al., 2012). Later in 2001 the green concept has been introduced into the campus, and then USM declared as the University in the Garden as the synergistic of coexistence of human and nature in the pursuit of knowledge (Nejati, 2011). All of these HEI become a pioneer for Malaysian sustainable campus and become reference to the other campus to start their own sustainable development program.

2.5 The Approach towards Sustainability through Team Integration

Previous studies identified that traditional fragmented approach (over the wall syndrome) is one of the primary roadblocks to attain sustainable development or design practice in a campus building project. The traditional method building construction and development was critiqued for its disjointed approach to project delivery and its failure to organize effective teams. (Latham, 1994; Kent, 2010) emphasized that the traditional building approach involves players that are disjointed from each other and work in segregation part that resulting in inefficiencies.

The fragmentation in between the team members that involved in the construction will lead to the internal conflict that creating negative atmosphere reducing the quality of the design procedure and design outcome (Dulaimi, 2002; Sonnenwald, 1996; and Flanagan & Norman, 1993). As a result of this disintegration, the traditional construction process have a tendency to incur extra costs from errors rework resulting the quality issues and wastefulness of project delivery times and financial, poor performance and other problems that related to maintenance and operation issue (Akintoye et al., 2000; Egan, 1998; Evbuomwan & Anumba, 1998; Love & Gunasekaran, 1998; Egan, 2002; Mohamed, 1999).

For example, the failure to involve construction knowledge and the experienced contractor, manufacturers, user or suppliers companies early in the design stage of the construction process is probable to have a substantial effect on the overall project performance (Song et al., 2009; Khalfan & McDermott, 2009; Trigunarsyah, 2006; Dainty et al., 2001; Russell, 1994).

Many industries-led reports (Bourn, 2001; Egan, 1998; Egan, 2002; Latham, 1994; Strategic Forum for Construction, 2003) have all called on the industry to switch from its traditional modus operandi and implement an enhanced method through the amplified their integration. The UKCG (2009) and Accelerating Change (2002) highlighted the issues in the construction industry to produce a fully collaborated service that have a capable of delivering predictable results to clients through operations and team integration.

Even though many related studies (e.g. Song et al., 2006; Baiden et al., 2006; Buzell & Ortmeyer, 1995) concentrated on this area that attempt to improve construction design team integration, they do not provide any specific guidelines on how to

achieve successful integrated design team delivery. Many frameworks/ approaches that have been developed to aid project team integration through relationship contracting and integrated procurement e.g. Design and Build, Early Contractor Involvement, Partnering (Bowron, 2002; Edwards, 2007; Matthews, 1996; Chan et al., 2003; Black et al., 2000); Concurrent Engineering (Kamara et al., 2000; Evbuomwan & Anumba, 1998; Broughton, 1990); Lean Thinking (Huovila, et al., 1997; Matthews & Howell, 2005); and Supply Chain Management (Khalfan & McDermott, 2009; Love et al., 2003; Vrijhoef & Koskela, 1999).

Nevertheless, the implementation of these initiatives to the sustainable building and design is still restricted (Ismail et al., 2015). This is because of the confusion and partial agreement that exists between current construction industry stakeholders either in terms of unclear working processes or lack of framework, model or guidelines that can be practically used. For example, confusion or misunderstanding arises because most of the integrated framework/ approaches adopted different ways. Therefore, it creates difficulties among practitioners when determining which one of the framework/ approaches is the most desirable for the usage in their task. Furthermore, some of the framework/ approaches have not catered specifically on how project teams can integrate and shape together to become a single entity.

2.6 Main Problem in Malaysian Construction Industry

There are problem of the construction industry was inherited from the traditional construction industry; whereby since 1992, the Malaysian construction industry has been dominated by traditional procurement and it was sufficient to the demand at that time (Masterman, 1992) cited in (Kong & Gray, 2006). It is commonly known that the

traditional method, procurement or delivery mostly has the same problems or issue and many researchers have come out with arguments about the dilemma. Hillebrandt, (2000) mentioned the traditional construction industry, by nature, has many special problems and requirements, as cited in Ofori, (2000). Proverbs, (2000) mention that some severe problems are overwhelmed in the construction industry with including shortage of skilled workers; it's truncated of profitability and a deficiency of investment in research development and improvement.

The issue of low productivity level during construction and some of others construction project failure has caused many alarms in the industry. It is not uncommon where the contractors and industry players' attempts to maximize the project value and minimize the cost in the construction industry (Matthews & Howell, 2005). Many scholars frequently criticize the traditional construction delivery approach to be unsafe, inefficient, fragmented, ineffective, fraught with errors, disjointed, litigious, disloyalty and unproductive as well as disconnected from each stage (Lowe, 1993; Latham, 1994; Evbuomwan & Anumba, 1998; Proverbs et al., 2000; Perlberg, 2009; Nifa & Ahmed, 2009; Smith et al., 2011; Nawi et, al, 2012; Kraatz et al., 2014). Additionally, the traditional construction approach generally leads cost increase, takes longer period to complete and has overall bad performance. This issue is generated by the lack of management and communication between the participant, stakeholders and constructor. There are a number of reports have been issued targeting radical improvement of the efficiency and the quality of the construction industry. Therefore, to strengthen the impact of the construction industry transformation, a new generation of industry players is making steps to be more approachable toward the client requirements (e.g. Banwell, 1964; Latham, 1994; and Egan, 1998).

(Sakal, 2005; Matthew & Howell, 2005) observed the implementation of lean construction on a project to minimize cost and waste and also maximizing the value of the project are difficult to reach when the contractual structure inhibits coordination, stifles cooperation, lack of innovations and motivation. Furthermore, the reward systems in current construction industry does not applied to single contractor in the project for their participation reserving good ideas, and optimizing their operations at the expense of others. This is specifically in the following places; good thoughts are taken back, contracting limits cooperation and innovation, inability to coordinate, and the pressure for local optimization.

2.7 Contemporary Issues in the Construction Industry

Overall, the construction industry globally faced many issues, problem and challenge in their construction projects (Ofori, 2000; Hillebrandt, 2000; Proverbs et al., 2000; Van Wyk, 2004; Koshnava, 2008; Windapo, 2013; Zakaria 2013). Even though there are plenty of researchers have noted the issues and challenges in the construction industry, but this negativity still has plagued within the industry. The construction industry are known as one of the most dynamic and complex industrial sectors. This industry relies on manual intensive labour and heavily on skill based that supported from the interconnected management coherent with the design team. Right now all of parties in the construction industry are highly fragmented in between them in term of the project delivery (Nawi et al., 2010; Perlberg, 2009). Proverbs, (2000) highlighted the construction industry problems can be recognized in five main criteria such as an unfair tendering issue, methods of procurement problems, planning of design project problems, monetary problems, human resource problems, productivity problems,

material problems, and the technological problems, all of these problems was occurring the construction industry inherited from generation to another generation.

Several method has been used for the project delivery depend on type, size and cost of the project. The delivery method of the project based on the variant comprised to the residential, commercial and industrial construction projects. Apart from that, Nifa & Ahmed (2010) also mentions there are currently many issues and problems occur in contemporary construction method. This issues are includes the behind schedule buildings constructions and constructions in excess of budget and as well as adverse relationships among the participant (main stakeholder in the construction project).

As has been mention, there are three common traditional methods used in the construction industry globally, this method are known as Design bid and build (DBB), Construction Manager at-Risk (CMR) and Design and Build (D&B) (Kent & Bercerik-Gerber, 2010; Nawi et al., 2014). Every single traditional construction method has their specific unique system which is has advantages to the certain people in the construction industry. In addition, those projects while taking into consideration as evaluated on a project-by-project basis as followed as the project requirement at cost and schedule. Figure 2.2 below shows the common traditional method hierarchy.

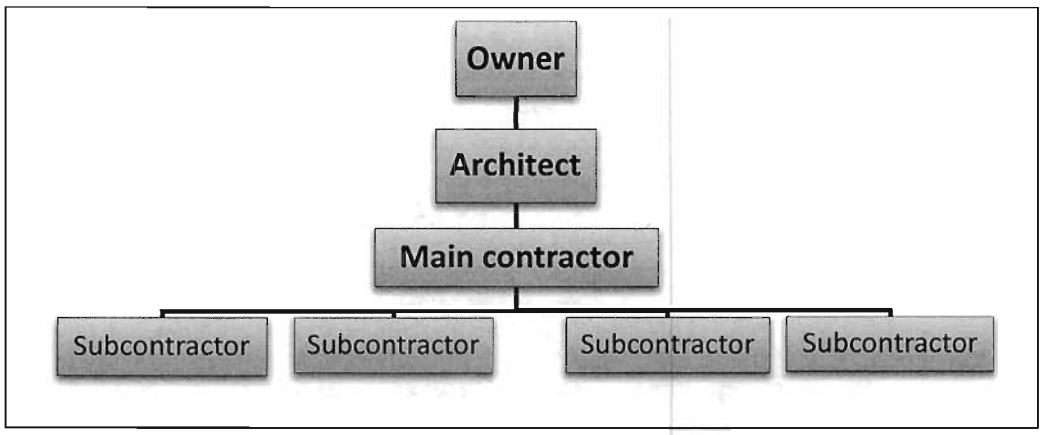


Figure 2.2: *Traditional Construction Diagram*

Accordingly, realising the potential of sustainable buildings design for Higher Education Institution are needs to have some sort of necessary research to gain the improvement of the team collaboration. Therefore, many researchers currently studies about the teams' collaboration in the construction industry to enhance the level of integration between each team in order to maximize the potential of the system. As has been highlighted earlier, the sustainable building design in the university or campus is highly potentials to provide the direct cost saving and the economic benefits to the owner and society. As a matter of fact, the sustainable building design can create more productivity to the occupants as the better health and comfort increased, this features promoting the well-being then directly can reduce many staff problems such as absenteeism and discipline also indirectly improve organization productivity.

At present the delivery method have the evolution to and change to many hybrid delivery methods, this evolution and change has been made to reduce and eliminate the problem that occur within the construction project. Consequently, there are the necessities of involving into the integrated, collaborated team approach to get the decimal point that can ensure the development of integration among the stakeholders during the designing stage to be more effective. This integration should improve the chances to increase the cost saving during the construction project and improve the potential to implement the sustainable design for Higher Education Institution (HEI) buildings in northern region (Brown et al., 2010; Cassidy, 2003; Heerwagen, 2000). In addition, the features of sustainable building construction can provide many benefits that to the owner and the occupants of the buildings. The benefits of the sustainable construction as described in figure 2.3;

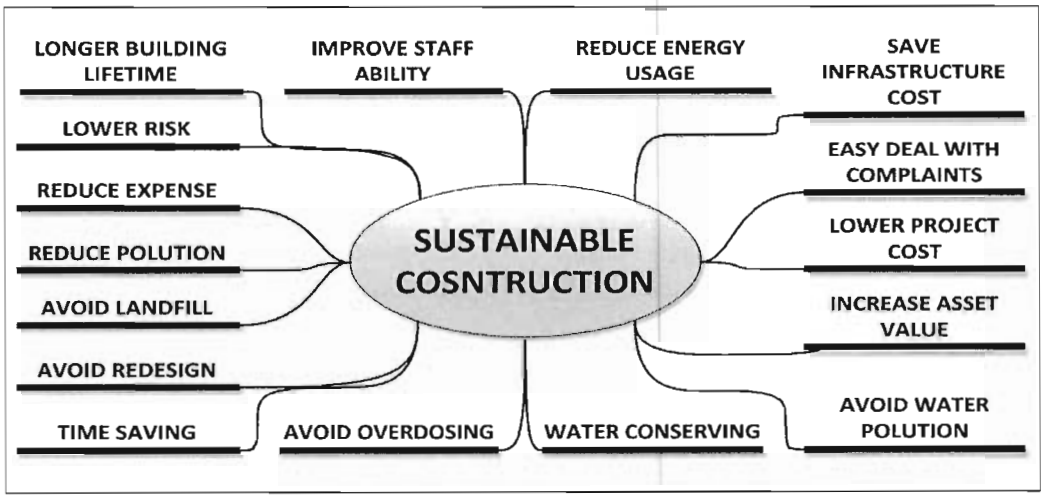


Figure 2.3: *Sustainable Construction Features* (Yates, 2013; Cassidy, 2003 & Ofori, 2000).

Furthermore, in Malaysia, most of the construction project delivery methods are still using the traditional project delivery. Moreover, previous studies has identified that traditional fragmented approach (over the wall syndrome) is one of the main barriers to achieve sustainable development or design practice (Nawi, et al., 2012). As mentioned before, Latham (1994) highlighted about the same problem with traditional method which is the construction process are disjointed among the stakeholder in the projects. Moreover, all workers at the site project also isolated from the other team sub-contractors will result the inefficiencies. The fragmented structure in the construction industry also contributes towards the efficiency problem (Cox & Townsend, 1997).

Technically, there are several approaches of traditional construction method. However, these three are the most commonly used methods in the construction industry. Among of these design methods, Design Bid Build (DBB) is the most popular system of construction compare to others. Next is Design and Build, followed by Construction Management at Risk. These traditional approaches consist of with

lots of barriers, injustice, inefficiencies, ineffectiveness and lot of waste that contribute to waste land dump (Proverbs et al., 2000; Gotthelf, 2011; Kraatz et al., 2014).

2.8 Project Delivery Method

In the construction industry mainly the contract that associated to the government sector, there are many styles that can be chosen by the contractors to deliver the project to the owner (government) based on the agreement in between the main contractor and the owner. This method depends on the selected type of procurement to be use, type of construction and budget given to the main contractors. The description of this method will be explained in the next section. Correspondingly, based on (Pakala, 2002) in his book listed nine types of construction delivery methods that can be used for delivering the government project. In this diagram shows the type of construction method that currently used in the government sector construction projects as in figure 2.4 below;

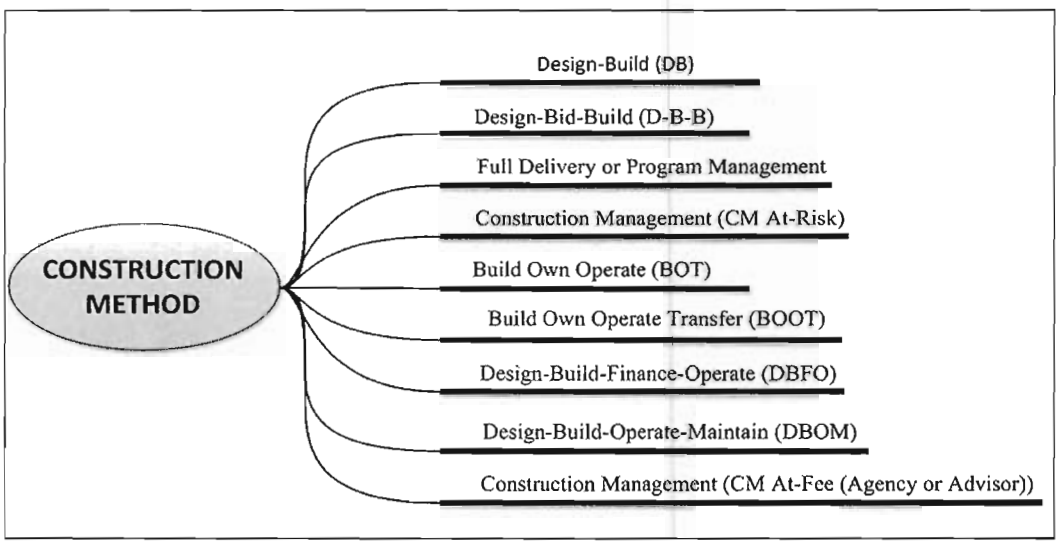


Figure 2.4: *Construction Method Applied In Government Construction*

From figure 2.4 the explanation will be elaborate in sub-chapter for every construction method that applied in Malaysian construction industry.

2.8.1 Design – Build (DB)

Design – Build (DB) method are known as the second most popular method among the traditional triad delivery method. The popularity of this method has gradually ascended, as many are certain of that compensates for quite a few of the inadequacy of the delivery method (Mahdi & Alreshaid, 2005). The benefits goes to the building owner where cooperating with single entity and using only one agreement that to performing the designing and constructing service from project initiation to project handover. Figure 2.5 shows the relationship of key players in DB construction method;

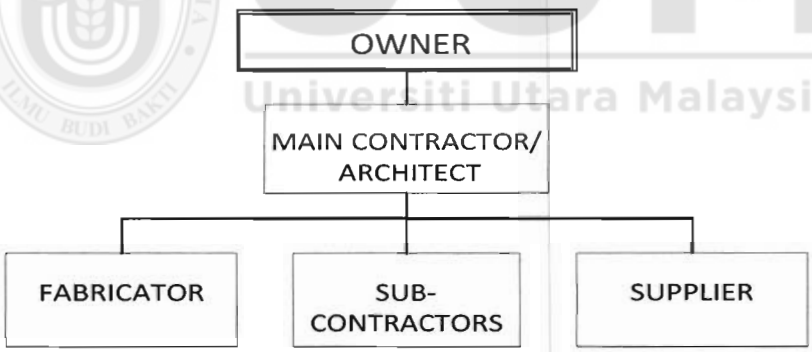


Figure 2.5: *The Relationship of Key Players in Design-Build (DB) Illustration.*

By the way, this system is almost similar to Construction Management at Risk (CMR), the designing process and constructions progressing are subsequent to each other as they are in one entity that performing booth services. Whereby, the Design Built delivery method possibly will be carried out by a single firm or joint venture

(Chan, & Ann 2005). Whereas the other delivery methods argumentative in between the architect and contractor relationship (typically due to hierarchical line of communications and fragmentation of the contracts). Therefore, single source of responsibility will house both parties into Design – Build.

Design – Build (DB) common disadvantage is that method of procurement does not fit within some number of other state laws. This argument relating to the public treasuries as numerous of state laws in United State are required the main contractors to tender the contract through an open bidding process before the selection can be attained. Clearly, in current DB method the project tender awarding process selected the lowest bidder to as a mark to the contractor to get the project (Fisk & Reynolds, 2011). Although DB allowed when the selection process of main contractor and designer to be choose based on their range of qualification. Yet, many United States countries are not able to implement the system as it not adhere their laws.

2.8.2 Design – Bid – Build (DBB).

Over the century, many government sectors in most part of the globe using Design Bid Build method for the construction (Kieran, & Timberlake, 2003). By using this method it would conclude the three main stakeholders in the construction as there are the owner, the designer and the contractor (builder). For this DBB method, the flows of the project are not flexible as the construction does not occur before the designing and planning process. Therefore, the designing and planning process are perfectly allocated with the executor. Furthermore, the architect and within the same project using DBB method, the main contractor have the authority to hire their sub-contractors and each of the sub-contractors are separated and isolated within their own

job scope. Those sub-contractors have no connection to the owners as the direct one way communication in between owner to main contractor and the architect. Figure 2.6 shows the connection in between the owner, architect, main contractor and sub-contractors/ fabricators/ suppliers in DBB method;

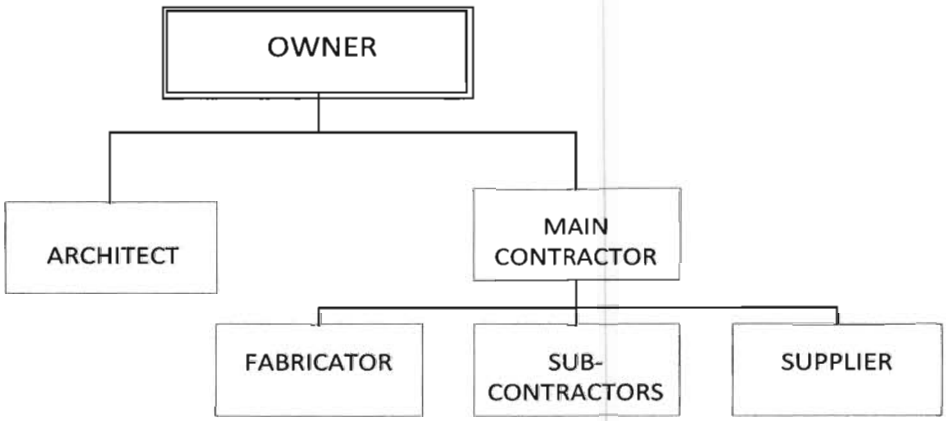


Figure 2.6: *The Connections between the Key Players in DBB.*

To be more precise, the initial stages of the construction owner assigns architect to proposed the building plan with the desired specification and design. In the while, owner will open the tender to and request the main contractor to bid the tender. Finally then, the most appropriate tender will get the contract to do the construction, most of the time the contract goes to the lowest bidder. The cost of labour, material, overhead, and profit should be is included with the awarded price (Kieran, & Timberlake, 2003).

DBB was the most common technique being used in most of the public work project because of these benefits, which is DBB construction methods, has no any restriction in specific number of companies that bidding for the project. It also allows any small, new or unknown construction company to participate on tendering the projects as equal opportunity align with the top corporations. DBB criticizes for creating an argumentative of the association in the main contractor and the architect. Moreover,

the main contractor are separated with the design and architect team, then the main contractor do not contribute any input or ideas on the designs during the initial phase of construction process and it is taking more times for designing and constructing the projects. Because of the work structure in DBB, the performances of the key-participants are not efficient and will cause the delay issue and this should increase more cost on the project. (Fisk & Reynolds, 2011) says DBB can habitually consequence into the higher costs in the construction due to the nature of this method which is fast-paced during tendering and construction.

As a single entity will speed up the argument to resolve and makes much more obligatory. Furthermore, the owner will have direct line of communication to the architect and the contractor both of them not dragged into disagreement perseverance. The other advantage of this system is when the architects and contractors are working together from the initial establishment of the construction project. The good relationship among them will help enhancing constructability and less variation orders during the project (Kieran, & Timberlake, 2003).

2.8.3 Construction Management at Risk (CMR)

Initially, the General Service Administration developed a method called Construction Management at Risk (CM at Risk) to be used in numerous of construction projects mostly funded by the federal government (Sanvido, & Konchar, 1999). The CMR project involved the three main stakeholders in the construction process; the involvement of the owner, designer team and the main contractors' team. The structure of the CMR project whereby the owner directly communicates to both teams and no direct communication in between design team and main contractor. The

designer team consisting the architect and engineer is in charge of designing the project and it is separated from the construction management team as they are appointed to function as a main contractor. The plus factor in CMR construction method is the appearances of the construction manager (CM) those taking charge the overall intercommunication and aligning the project in between main contractors, sub-contractors, fabricators and suppliers. Figure 2.7 will explain the relationship between owner, engineer/architect, construction manager/ general contractor, subcontractor, fabricators and suppliers in CMR construction method.

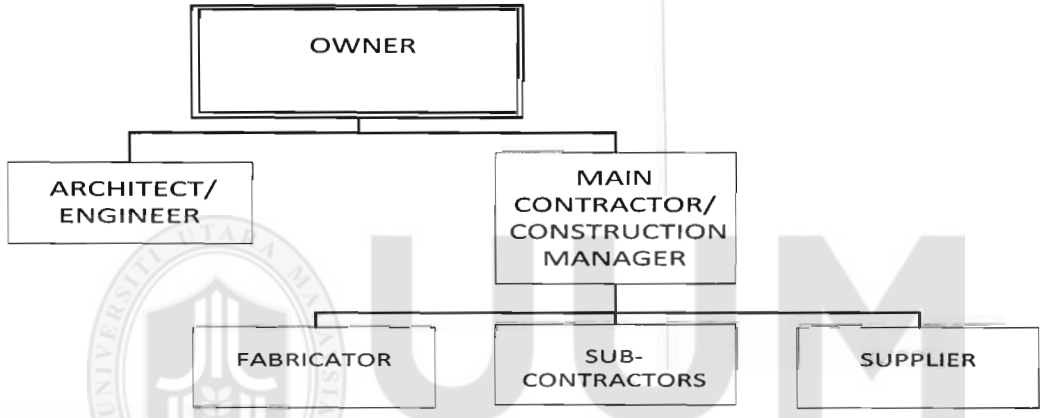


Figure 2.7: *The Relationship of Key Players in Construction Management at Risk Illustration.*

During the design process, the construction manager (CM) will perform as an advisor then switch their roles after once the project tendered and completely awarded to the team, CM have a new role as a manager the overall of the construction process. CM will act as a manager in the construction and will hire subcontractors, fabricators and choose the suppliers. The best part in this CMR system is that the construction project can be started without having a complete design, the construction can be started during the early designing stages and both of the design progress and construction progress are moved in parallel to synchronize to each other at times (Mahdi & Alreshaid, 2005). Shortcoming of CMR is the role changing for some CM in CMR

construction method acting an advisory role throughout the design stage, but then converted to the standard construction manager, and this situation leading the stakeholders into the pressure over the construction budget, construction schedule and overall project quality. In addition, even though CMR construction method is slightly quicker that DBB construction method, but it is still slower than the other contemporary project delivery methods.

2.8.4 Full Delivery Program or Program Management

Program Management is the practice of professional Construction Management applied to a capital improvement program of one or more projects from inception to completion. Comprehensive Construction Management services are used to integrate the different facets of the construction process—planning, design, procurement, construction and commissioning—for the purpose of providing standardized technical and management expertise on each project. This program management is considered as a construction entity that provides a comprehensive list of services to an Owner/ Client from the planning stage throughout the entire process. This can include maintenance and operations, also. This process requires a broad focus of expertise and knowledge, and certainly in today's market, requires partnering with many skilled service providers. This may be considered as the best alternative when in-house expertise is lacking, also staffing reductions are needed, and outsourcing issues are current.

Program Management is typically used in agency form. However, unusual owner or program circumstances occasionally suggest the use of program management at risk, wherein the PM takes on construction responsibility for some or the entire program.

The project or program team is critical to successful delivery, and should enhance and compliment the strengths of the owner to provide a comprehensive set of resources and skills. The core players on a design and construction team are the owner, the designer, the builder (or contractor), and the manager (CM or PM). The designer, the builder, and often the manager, will typically have numerous sub-consultants and/or subcontractors. The owner, using either a Construction Management or program management approach, may choose to manage the team with in-house personnel, or contract out to a qualified consultant, or use a combination of both. The relationships of the various players among one another will be determined by the management plan, the delivery method chosen, and the contracting format.

2.8.5 Build Own Operate and Build Own Operate Transfer

Build, own, operate and transfer contract is a type of a privately financed contract where by the contractor finances the project, designs it, undertakes the construction, owns and operates it over the concession period and on its expiry transfers the beneficial ownership of the project back to the employer (Harbans, 2005). It finds extensive application in infrastructure projects and in public–private partnership. In the framework of third party, for example the public administration, delegates to a private sector entity to design and build infrastructure and to operate and maintain these facilities for a certain period (Nifa & Ahmad, 2014).

However, the asset ownership remains with the awarding authority. At the end of the concession period, all the assets are transferred to the awarding authority, including any assets purchased by the private operator. These are very long-term contracts (twenty-five to thirty years) wherein the private operator takes the risk for the

condition of the assets as well as the investment (Consession, 2015). Concessions include taking over existing assets, or building and operating new assets. The operator typically obtains its revenues directly from the consumer. The operator is a special purpose vehicle to ensure that the project assets are ring-fenced and risks associated with the project are allocated appropriately (Build-Operate-Transfer, 2008). Figure 2.8 below depicts the contractual framework for a concession/BOT project.

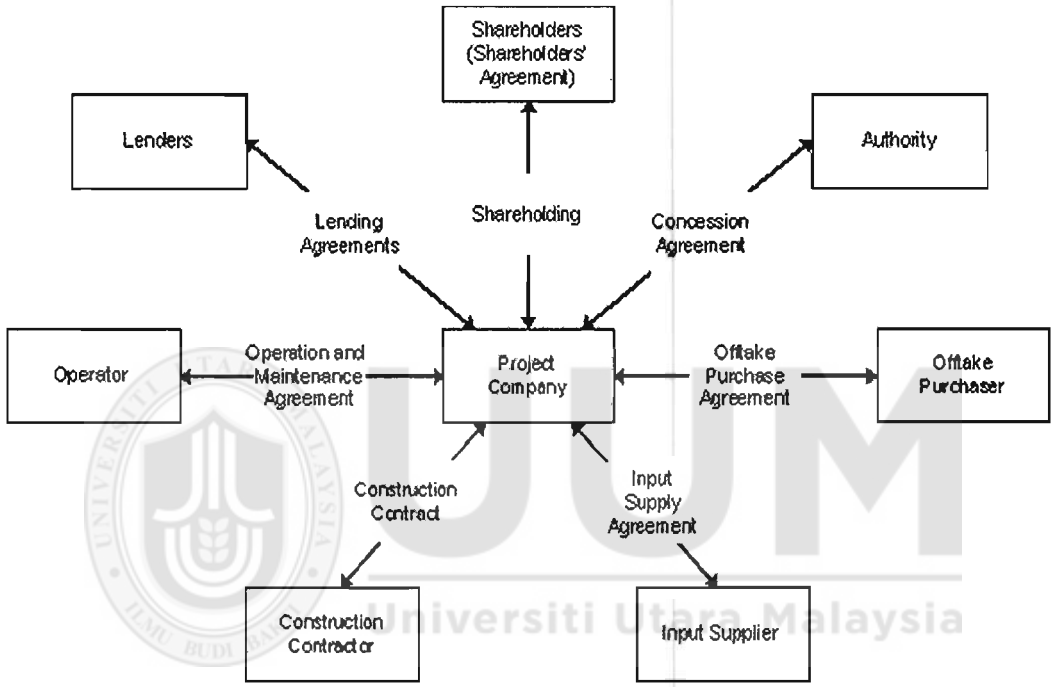


Figure 2.8: *Contractual Framework for a BOT Project/Concession* (Source: Public-Private Partnership in Infrastructure Resource Centre, World Bank)

In a Build-Operate-Transfer (BOT) project, the awarding authority grants the right to develop and operate a discrete Greenfield project to a private operator for a certain period (called Concession Period). A BOT project differs from a concession in that it involves a Greenfield project and the revenues are obtained from a single off take purchaser such as the government entity or a utility. As the project is Greenfield, there are no cash flows from the outset. In general, a project is financially viable for the

private entity if the revenues generated by the project cover its cost and provide sufficient return on investment. On the other hand, the viability of the project for the host government depends on its efficiency in comparison with the economics of financing the project with public funds. Therefore, the private entity bears a substantial part of the risk. These are some types of the most common risks involved:

- Political risk: especially in the developing countries because of the possibility of dramatic overnight political change.
- Technical risk: construction difficulties, for example unforeseen soil conditions, breakdown of equipment
- Financing risk: foreign exchange rate risk and interest rate fluctuation, market risk (change in the price of raw materials), income risk (over-optimistic cash-flow forecasts), cost overrun risk.

Even if the host government could borrow money on better conditions than a private company could, other factors could offset this particular advantage. For example, the expertise and efficiency that the private entity is expected to bring as well as the risk transfer (Walker & Smith, 1995; Mishra, 2006; Wilde Sapte LLP Denton, 2006).

2.9 Integrated Project Delivery – The Perspective

Integrated Project Delivery (IPD) (AIACC, 2006) as a newly established delivery method that has been mentioned as the cure for many challenges currently faced by the construction industry as whole (Jayasena & Senevirathna, 2012; El Asmar et al., 2013; Nifa et al., 2013). Recently, many researchers in construction start to explore some of the opportunities in the construction industry globally to improve the idea of integration, collaboration, partnership and cooperation in the construction industry.

The researchers are concerned to utilize the Building Information Modelling (BIM) through the collaboration and integration in the project where all of team members involve in initial stage of a construction project (Cross, 2008; Gotthelf, 2011). Figure 2.9 below is the illustration of the integrations of IPD in between the entire stakeholder in the project;

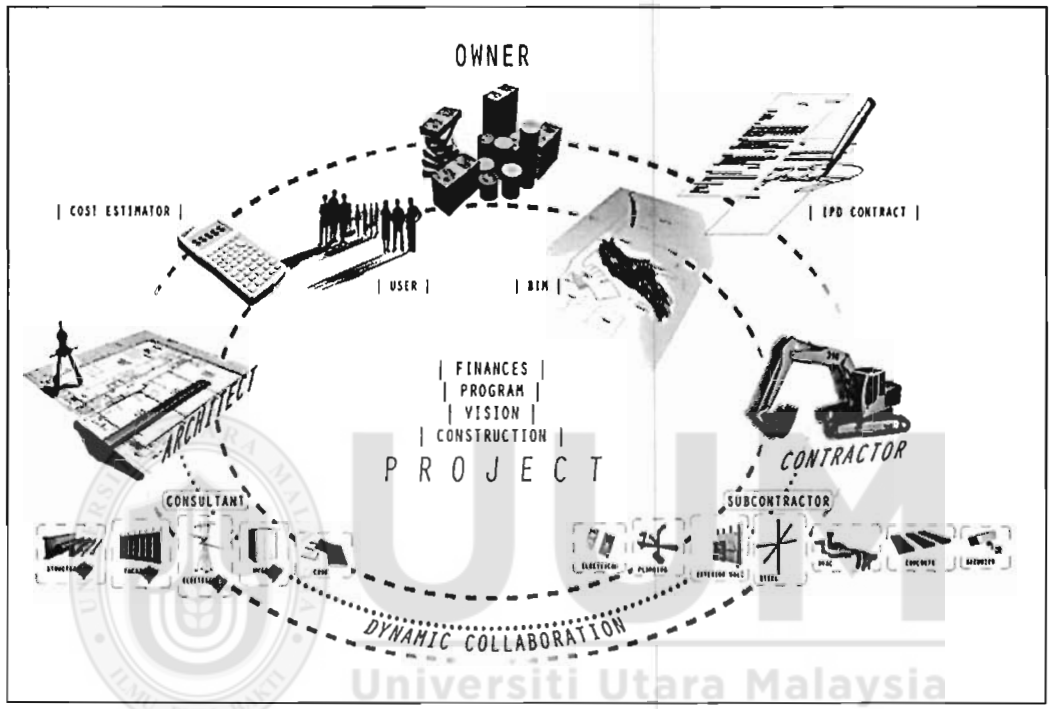


Figure 2.9: *Integrated Project Delivery (IPD) the Integration and Collaboration* (Source: http://www.archdaily.com/153953/integrated-project-delivery-methodology)

Integrated Project Delivery (IPD) is a system that is archiving a good reputation in the United States because of the success rate gained from the feedback by contractors who applied the IPD method on their projects. It has become one of the hot topics discussed among the builders, designer and the constructors. Most of the issues discussed are about IPD efficiencies, methods and the best way implement the IPD. Therefore, there has to be a standard contract to ensure that the project participants

will understand all the functions of IPD and applying the IPD principles in the construction project.

The new generation of the contractors are keener on the new method to integrate the process of the construction to become more efficient and effective. IPD is seen as the solution of the problem that is integral in the construction industry, which is brought upon by many years of traditional procurement (Raisbeck et al., 2010; Singleton & Hamzeh, 2011; Kraatz et al., 2014, Jones, 2014; Nifa et al., 2014;). Therefore, the IPD has been pledged as a new philosophy of construction method of construction that can cure and solve the many issues and problem that is delinquent in the traditional delivery approach such as CMR, DB, and DBB whereas the owner and the construction teams are not sign the multi-party contract during the initializing phase of the project (Jayasena & Senevirathna, 2012).

2.9.1 Contract agreement in IPD

The contract or agreement was developed as the participant can be tied into the same objective, information and goals. There are a few of agreement in table 2.5 below that listed by (Smith et al., 2011) from some other country;

Table 2.5: *Integrated Project Agreement in Other Country.*

No	Agreements	Country	Year
1	Integrated Form of Agreement for Lean Project Delivery	USA	2005
2	AIAC191-2009 Standard Form Multi-Party Agreement For IPD	USA	2009
3	A295 General Conditions for Integrated Project Delivery	USA	2008
4	ConsensusDOCS300	USA	2007
5	PPC2000 & PPC2000 International	UK	2000
6	Alliancing Agreements (based on UK contract agreements 1980)	Australia & Finland	2005

This relational contract will create a bonding combination of the people in a project, enable the transparency in between the participant increase and the responsibility of all participants can improve as the liability of projects are shared (Smith et al., 2011). The IPD contract defines the tools that project parties need to use. "IPD contract usually defines the BIM software tools the various team participants will use and the information sharing server solutions the project will support for the benefit of the project as a whole" (Khoshnava et al., 2008; Eastman et al., 2011; & Zakaria et al., 2013). Although implementing IPD is possible without Building Information Modelling (BIM: discussed hereinafter), IPD is required for collaboration of the participant that to achieve the essential of efficiency in the construction project (AIA, 2007; Cohen, 2010). Figure 2.10 illustrate the relationship in between IPD, BIM and Lean in cosntruction;

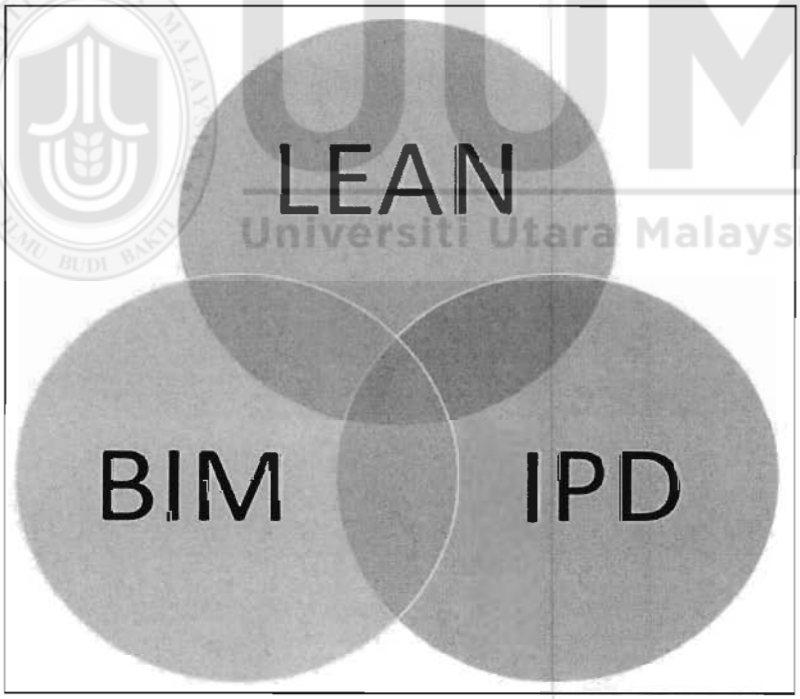


Figure 2.10: *IPD BIM and LEAN relationship.*
(Source: https://www.pinterest.com/pin/151222499965879794/)

This IPD delivery method can be preceded when the owner has selected the prime designer, main contractor and the other key members as a stakeholder for the

construction project to sign a multi-party contract between them to create the project team for initiating the construction projects (AIA, 2007; Sington & Hamzeh, 2011; Jones, 2014). Table 2.6 describes how IPD differs from the traditional procurement:

Table 2.6: *Traditional vs. Integrated – a Comparison of Character.* (AIA National, & AIA California Council, 2007).

Traditional Project Delivery	Characteristic	Integrated Project Delivery
Fragmented, assembled on "just-as needed" or "minimum-necessary" basis, strongly hierarchical, controlled,	Teams	An integrated team entity composed key project stakeholders, assembled early in the process, open, collaborative
Linear, distinct, segregated ; knowledge and expertise	Process	Concurrent and multi-stage; early contributions of knowledge and expertise; information openly shared; stakeholder trust and valued
Individually managed, transferred to the greatest extent possible	Risk	Collectively managed, appropriately shared
Individually pursued; minimum effort for maximum yield; (usually) first-cost based	Compensation/ Reward	Team success tied to project success; value based
Paper-based, 2-dimensional; analog	Communication/ Technology	Digitally based, virtual; Building Information Modelling (3, 4 and 5 dimensional)
Encourage unilateral effort; allocate and remove risk; no sharing	Agreements	Encourage, foster, promote and support multi-lateral open sharing and collaboration; risk sharing.

Consequently, research into collaborative, integrated teamwork approach is very important to ensure the level of integration can be improved in order to raise the essential level of integration among stakeholders during the initial phase of the

construction. It can give the best benefits to the owner and the other occupants in the building if the sustainable design has been implemented for HEI buildings are to be realized. As highlighted earlier, the sustainable building and construction can provide indirect economic impact as it can give many good advantage to the owner and contractors during the construction project or after the building handover to the owner. For example, most of the sustainable building and construction features can promote many benefits such as good physical condition, more comfortable workplace, well-being body and mind, safeties and increasing the productivity to the contractors and also the building occupants.

As a current best method of project delivery, IPD is well-known by a contractual agreement between a slightest numbers of owners. In addition, the contractors and the designers will align the business interests of all parties (AIA, 2007; Cohen, 2010; Jones, 2014). The focus in IPD is the concluding of significance that shaped for the owner and the building teams. In other words, the main stakeholders and all of participants are not only focusing in their own job scope without involving with other teams in the construction project but bearing in mind with others members in the construction to collaborate as a single team in the whole projects. Therefore, the integration through IPD method influence the others team members to participate with the other team members during the initiating of the project as a collaboration with same objective to maximizing the project value for the client.

This collaborative approach integrate the decision making of the team during the project planning phase where the most significance ideas can be tabled (AIA, 2007; Nawi 2013). IPD motivates collaboration of the commencement of the project throughout the building process, tying all parties of the stakeholders toward the

project success, and substantiates the following contractual and behavioural rules, as presented in Table 2.7 below.

Table 2.7: *Contractual and Behavioural Principles of IPD* (Source: Cohen, 2010)

Principles of Behaviour	Description
Contractual	❖ Key participants bound together as equals ❖ Shared financial risk and reward based on project outcome ❖ Liability waivers between key participants ❖ Fiscal transparency between key participants ❖ Early involvement of key participants ❖ Jointly developed project target criteria ❖ Collaborative decision making
Behavioural	❖ Mutual respect and trust ❖ Willingness to collaborate ❖ Open communication

The adjacent of team collaboration shall abolish a large trade of waste in the blueprint of the construction projects. This integrated project delivery allows unlimited information sharing between the development and construction team. Therefore, this collaborative team of integrated team will eradicate a boundless obstruction to indicate the productivity increased in building construction projects.

2.10 IPD Team Effectiveness

It is common in a construction project where various parties with different objectives, requirements and principles to come together as a particular cohesive and equally supported unit. As mentioned by Baiden et al., (2011), this condition as known as the 'Project Team Integration'. Project team integration is usually backed by the collaborative configuration of developments and principles within the scope of the projects (Baiden et al., 2006; Ibrahim et al., 2013). In the construction industry,

integration frequently denotes to collaborative operational routines, methods and behaviours that promoting an atmosphere where all of the knowledge can be liberally exchanged in between the different members who are working towards a mutual goal. (Ibrahim et al., 2013), listed the indicators of the team integration as shown in table 2.8 below;

Table 2.8: *Six Key Practices Indicate of Team Integration* (Source: Ibrahim 2013)

Key practice indicator	Details
Focusing on goal and objective	• Focusing on single goal as the objective to tie the participant to achieve. • The ability to focus and work together in a project can maximize the work organization and the project value.
Seamless operation with organizational defined boundaries	• The entire participant must have to agree to be part of the organization as a professional participant to break the boundaries in between members. • This collaboration is requires the participants to be able to adapt the new culture of the team. • The collaborative interaction in multi-party coalitions is the key to integrating the project team and understanding the complexity of the construction project.
Trust and respect	• It is vital for construction companies to develop trust and understanding with their working partners as it can necessitate some cultural changes. • Mutual understanding and respect for entire project team must be combined in order to achieve the successful completion of the project.
Communication	• The importance of communication, to ensure communication barrier can be resisted by establishing the communication network through the technologies. • Key person to control the communication flow that can clarify the other participant to gain sufficient information.
Sharing information	• All of the information should be open access to every participant of the project. • Regular meeting to share information, discussion and issues raised to generate ideas in order to achieved the objective on the project.
Integrated ICT system	• Assistive of ICT system by the participant should enhance the delivery process and to drive the project to achieve. • The utilization of internet networking emerged as to integrate project team by flexible distributing the information.

The current competitive market in the construction industry requires the synergy of many the accomplices to create the stronger structure to break the barrier of fundamental of traditional construction methods. Baiden et al. (2010) proposed this

team integration project delivery is defined as an outline of "working practices, methods and behaviours that create a culture of efficient and effective collaboration by individuals and organisations". In general, team effectiveness for integrated project delivery is determined by the team's understanding of the following aspects; team work and team synergies. Within an integrated team in a project delivery; most of skills and cognition are shared between the participants. Therefore, the traditional system over the walls syndrome are separating the initial process to designing the project from construction activities are marginalized the escalation toward delivering a construction project (Baiden et al., 2006; Ibrahim et al., 2013). Consequently, the character of a new team formed to accomplish by the fully integrated team, but the disappointments and achievements are collectively shared among the members.

2.10.1 The Concept of Teamwork

The description of teamwork mentioned previously, as highlighted by many scholars such as (Dickinson & McIntyre, 1997; Scarnati, 2001; Conti & Kleiner, 1997) the most important in the team collaboration is the need of all the team members to express their determination towards the organized and concentrated of their mutual objective. Indeed, many practitioners, construction stakeholders, and the participants of the projects habitually take the teamwork concept for a granted, as (Hayes, 2002; Scarnati, 2001) highlighted the core of the impressions of the construction personnel that are assuming it as a team foundation. By then, the perception of the ideas has borne to strengthen in particular discipline such as sustainable, constructions, design and manufacturing. Furthermore, most of the actions are performed by the members with various skills from corner to corner of the organizations who must share their

knowledge and information for optimizing the results. (Baker et al., 2006; Steward & Barrick, 2000).

2.10.2 Team Synergy

Within the construction project during the project execution, there are a biggest challenge's to collaborate all of the project team members to contribute and response to the team in others department. Likewise, the example by scholars (Ankara et al., 2009; Al-Rawi, 2008) highlight that when one of the members in the project tries to contribute any good ideas such as proposing the an enhancing method to conduct a program to improve the activities for the team, even though there are non-hidden self-agenda for the individual members but for the whole team improvement.

However, the teamwork concept are relied on group of teams which all of the team members are on the existence of synergies to cooperate within and every single members will individually contribute to the team to ensure the successful of the foundation when the initial of the project are laid (Katzenbach & Smith, 1993; Al-Rawi, 2008). Furthermore, all of the team members are required to adjust and become more flexible in terms of contribution, cooperation, integration and the amount of equalization in the team are derived the equal adjustment onto mere functioning of the collaborative atmosphere to achieve the objectives collaboratively rather than compete to each other (Tarricone & Luca, 2002). In other hand, (Macaulay & Cook, 1995) validated careful with the management and application can result into effective teamwork and this will produce and preserve the team's commitment, emphasis and strength.

2.10.3 Project Delivery through Team Integration

Team integration in the construction process will should be aspiring to all the team members as directs to the project delivery process ensuring the efficiency working progress and underpinned the effectiveness of financial cost control by waste reducing and elimination. In hence, through the integration team, creating competitiveness and profitability which is the organization facilitating the client needs and requirements, at the same time delivering the project cost within the most economic value. Other than that, the benefit of the team integration to the group of small firm to have the collaboration with other firms and will leads to creating more collaborative, partnership and integration within them to enhance the capability of each other members to create more competitive group as a significant entity for better monetary value for profits on the capital invested in construction surroundings of a competitive market (Alshawi & Faraj, 2002; Crane, 2002; Lennard et al., 2002). Moreover, pronouncing of the integrated project team approach is more competitive for working project in the market as the evidence from the project demonstration set by the industry (Vyse, 2001; Strategic Forum for Construction, 2003).

For the procedure to delivering a project, all of the team members in the construction project shall comprise the key person who is involved in the project to provide the answers to satisfy the all aspect of the requirement requested by the client or owner of the project. Because of this, integrated team project delivery requires all of the participants are going to be binding their potential to the processes allied to ensure the project can be delivered efficiently (Egan, 2002). Therefore, the collaboration of project team members requires some kind of soul such as collaborated teamwork that could eliminate the traditional construction procurement such antagonistic approaches as a hurdle. Furthermore, this demand will imply that all team members may stand to

cross the traditional boundaries to share their thoughts and conversing with conflict in the workplace. To achieve the main objective of the construction project by optimizing the goal achievement, therefore a competent and knowledgeable leader with the capability and power to push the whole of the members, stakeholders, owners and others participants in the construction projects also in the organization will be necessary (Chen & Lin, 2002).

2.11 The Definition of Integrated Project Delivery

Since IPD was introduced by the AIA California Council in 2007 but until now the research still going on to improve them, also to replace the traditional and conventional practices in construction. The benefit of IPD development assembled by many literature and case study in the current situation of the construction projects, along the way to creating an underlying basis of foundation for the IPD then the guidelines and operating method for IPD framework that valid through recent age. AIA California Council, (2014) define IPD as "a project delivery method that integrates people, systems business, structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimised efficiency through all phases of design, fabrication and construction". AIA Minnesota, (2012) define IPD as "the tactic of strategies employed, ether commercial, social, environment or technological".

Many scholars has their view point of ways to define IPD through their perspective, While IPD has up now, Baiden et al., (2010) has defined IPD as "a method where the diverse disciplines in the construction project with has different goals, needs and cultures merge into a single cohesive and mutually supporting unit with the

collaborative alignment of process and culture". From practitioner's perspective (Anderson, 2010) define the Integrated Project Delivery (IPD) is to be "a comprehensive construction business model that includes the designing stage, project execution, and project delivery of buildings. This project brought by the collaborative, productive and integrated teams that combining all of the key project participants into a single objective".

The initial of early process or team member to form, the team members will contribute their expertise into the team, basically the members will be guided by transparent principals of trust to gain effectiveness of the collaboration process. Therefore, through this principal the team members will draw a connection in between them to open into the information sharing, team success tied to project success, shared risk and reward, value-based decision making. This effective collaboration will utilize of their full technological capabilities and support outcome with the opportunity to integrate the designing process, building construction and whole working operation to be as efficiently as possible.

In a doctoral study, El Asmar et al., (2013) had *defined IPD* "as an emerging construction project delivery system that collaboratively involves key participants very early in the project timeline, often before the design is started". The most current definition of Integrated Project Delivery (IPD) is provided by AIA (2014), where it is defined as "a collaborative project delivery approach that utilizes the talents and insights of all project participants through all phases of design and construction".

The definition of IPD can be seen to vary depending on the different perspectives of the authors. However, there are similarities, in all definitions is mentioned 'early involvement of participants' and 'collaborative' in describing what entails IPD. This

indicates that these two aspects carry the core meanings of which are reflected in the implementation of IPD. Accordingly, in the context of this research, IPD is defined as a method which requires early involvement of key participants to engage, collaborate, and mutually dependent relationship throughout the entire phase of project delivery from design to completion. The subsequent sections, is going to described tenets of IPD in the construction industry, based on an extensive literature study.

2.12 IPD Primary Area

The Integrated Project Delivery (IPD) Guide by (AIA, 2007) has discussed several case studies to provide a clear description of how IPD had been applied and could be applied in the construction industry. Although the case studies presented in IPD Guide (AIA, 2012) are not extensive, but they were indicative of the five primary areas which affect IPD. Highlights of the findings had summarized initial trends in IPD. Five primary areas of interest are as shown in the following Figure 2.11;

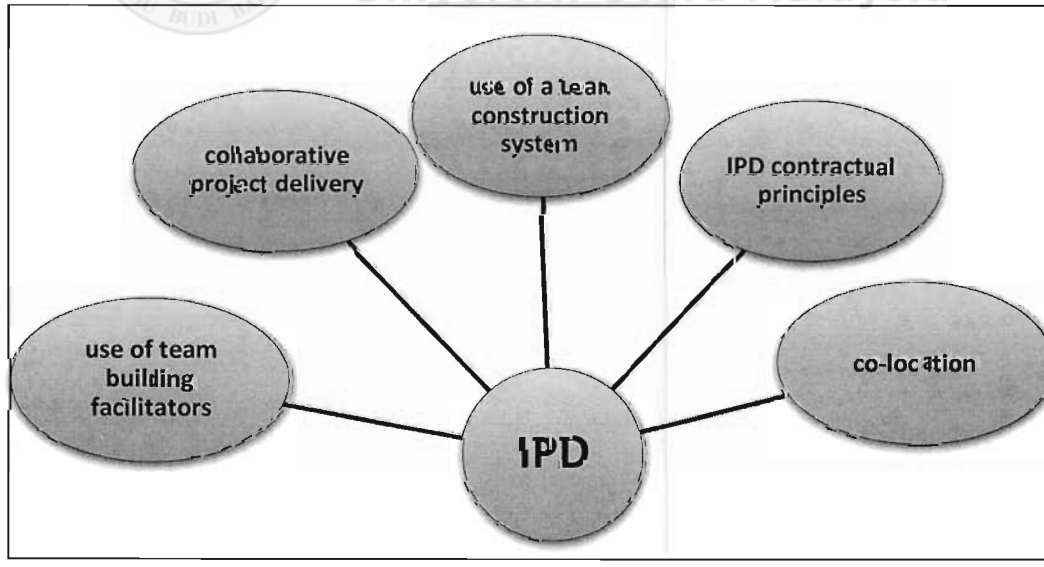


Figure 2.11: *Five IPD Primary Areas* (Source: AIA, 2007)

In order to understand the primary area as specific, the details can be described as the following information below;

- **IPD contractual principles (multi-party agreement):**

  IPD has been acknowledged benefits towards. For example, fiscal risk and reward incentives sharing, use of legal responsibility contracts, and financial transparency. The contractual concept of IPD has increased the teams' perception of trust and respect for project team members.

- **Use of a Lean construction system:**

  Lean construction system has a positively increase the level of sharing project information and sharing thoughts and opinions among team members, and on task efficiency in several of vital area.

- **Co-location:**

  Co-location has recognised increase participants' ability to communicate with team members from other contracting parties, the efficiency of the work process, and their direct interaction with team members who work for the other parties.

- **Role of team building facilitators:**

  The utilisation of facilitators revealed mixed results. Team building facilitators has produce a positive impression on their perception of sharing of project info with all team members equally, their understanding of team members' roles, and effective communication between team members. Nevertheless, they did not perceive a positive outcome of a facilitator on how the participants share their ideas and feelings with their 'team members' respect of participants' contributions by listening and giving reasonable consideration to their minds.

- **Collaborative project delivery:**

  Due to the integration concept has led to the existence of high collaboration among the project stakeholders i.e. owner, designers, contractors, suppliers, subcontractors and engineers in towards mutual objective in construction task. As a result, high understanding exists among project members and automatically will minimize problems in the construction project.

2.13 Pre – Requisites to Implement IPD

IPD comparatively is a new notion of the global construction industries, the maturity should take more time to gain. Therefore, in present the knowledge may comprehensively not be that sufficient to respond to the question "what are the pre-requisites to implement IPD?" comprehensibly. Consequently, there were some studies that have been acknowledged by numerous of the researcher in many different portions of the world which would help. Nevertheless, the finest method would be to rationally shape up the answer by producing the verdicts of those researches and the physical features of IPD.

There are many factors that effecting the process of implementation of IPD in the construction project, the barrier might come from the restrictions in the legislative procedures, the limitations of government policy or the community cultural barriers itself. O'Connor (2009) and Cooper, (2009) found the contemporary of a good knowledge's are based on the fundamentals of the studies. They highlighted the aspect that the most important is the mutual trust among the team members, so that will be something that cannot be created by any agreement of contract. However, for this every each of the team members should be independently share the trust that

needs to be existed in their team. Furthermore, those researchers also recognize there are many other substances showed that they are directly influenced by parties' contracts as the key concepts that must be sustained when proceeding with the IPD method.

2.14 Synthesis of Fundamentals to Implement IPD

Thirty seven numbers of fundamentals to implement IPD were synthesized by reviewing the current knowledge and constructing arguments on it. For clarity and consistency, these fundamentals were categorized into four categories (Jayasena & Senevirathna, 2012). Such as 'IPD characteristics', 'IPD agreements', 'cultural requirement' and 'technology requirements' as listed below:

2.14.1 Fundamentals by IPD characteristics

- Mutual trust among the parties
- Open communication between parties
- Mutual understanding with respect to each other's objectives
- Frequent formal and informal meetings for continual improvement
- Language directing the parties to collaborate upon developing project goals.
- Lean logistics
- System thinking & lean thinking
- Early involvement of key team members
- Clarity of client's understanding of the purpose end result
- Early consideration of logistics and other buildability issues
- Whole life value assessments that include organizational outcomes
- Project bank accounts
- Intensified Planning

2.14.2 Fundamentals from IPD agreement

- Awareness of risks and rewards
- Effective co-ordination
- Collective responsibility instead of personal responsibility
- Alignment of objectives
- Agreed, clear and quick process for dispute resolution
- Pioneering role of the owner/client
- Legal implications
- Risk allocation must be consistent with public low requirements
- Project specific insurance may be required in order to achieve IPD risk shearing objective
- Risk management team, include potential insurers should be engaged early in the process
- Tolerance for risks retained must be evaluated for all stakeholders
- Risk assessment, safety plan, project labours agreement, ADR for workers compensation should be part of the early collaboration
- Good relational contract
- Clarity of management decisions
- Performance evaluations and pay-outs

2.14.3 Cultural requirements

- Positive attitude of the project participants
- Readiness to compromise on uncertain issues
- Professional ethics
- Agreed mechanism for performance appraisal
- Cost of implementing IPD
- Willing to collaboration and flexibility
- Compatible organizational cultures

2.14.4 Technological requirements

- Appropriate Technology
- Building Information Modelling (BIM), a single digital model to which all contribute

2.15 The Advantages of IPD Implementation

As previously highlighted, traditional contracts are transnational in nature. Contrastingly, the construction industry is affected through relationships that include a network of transactions. This is the main reason why IPD should functions through the relational contract which is that will recognize what is the reality needs to occur the project delivery to be more effective (Smith et al., 2011). Besides that, prompt involvement of regulatory agencies, specialist contractors and manufacturers provide the opportunity of shortening the documentation and construction phases (Smith et al., 2011).

Based on the case study conducted by Khemlani, (2009) who claimed that time for structural design was reduced from an expected 15 months to 8 months, and planning using information from other disciplines that is not usually available which led to better design quality. The same author further highlighted that despite all the time spent planning the design process and meeting to do 3D coordination (all of which were billable hours), the cost for design was at or below what was anticipated. Thus, up to the design stage, the process was completed faster, with no quantifiable increase in cost, and better quality work. Beyond these benefits, IPD also provides other positive values to the project such as strengthening the project team's understanding of client's needs and streamlines the communication among the project team (IPD,

2007). This approach also allows constructors to contribute their expertise in construction techniques early in the design process which will, indirectly, help the designers to produce an accurate budget of estimation and reduce design-related issues during the construction phase such as, constructability, reworks, wastages etc. (AIA, 2009; Perlberg, 2009; IPD, 2007; Matthews & Howell, 2005). Furthermore, the use of IPD and BIM is advancing the construction industry overall by making it easier to not only predict, but also, to achieve high-quality outcomes (IPD, 2007). Consequently, as IPD is established to resolve current negative issues in the building industry, there are notable benefits mentioned other studies table 2.9 as mention by AIA (2012);

Table 2.9: *The Advantages of Implementing IPD*

Benefits	Description
Market advantage	IPD may give the firms valuable experience upon which to market themselves as industry leadership. Improving the delivery may also be a market advantage if measurable results can be attained.
Cost predictability	All projects would like to fit budget, however, for some the predictability of monetary value is a notably driving factor.
Schedule predictability	Schedule predictability: Similar to cost, all projects shares the goal of conforming to their projected schedule, but for some projects this is a major component.
Risk management	Reducing or managing risk can be tied to cost or schedule, but also may include transaction risk inherent to design type, site or other conditions. If risk management is a critical factor, the increased communication in IPD may be of particular advantage.
Technical complexity	A high degree of complexity will usually demand integration of expertise and require a level of coordination that is achievable in an IPD environment.

Kent and Becerik-Gerber (2010) describe in their study to understand the experience and attitudes of the industry towards IPD has identified that the common observed benefits were; fewer change orders (variation order in the Malaysian construction industry context), cost savings, and shorter schedule. There is also a decrease in request for information during the construction phase. This indicates that the aim of IPD is successful in keeping all participants informed in a timely manner as to minimize the issue of waste due to misinformation among participants. Table 2.10 summarizes the benefit mentioned within some of the current literature;

Table 2.10: *Summary of IPD Benefits as Cited in Current Literature*

Source	Benefits mentioned
Smith (2010)	Shorter documentation and construction phases
Kent & Becerik-Gerber (2010)	Fewer change orders, cost savings, shorter schedule
AIA (2012)	Market advantage, cost predictability, schedule predictability, risk management, technical complexity
Sive (2009)	Market demands, industry desires, technology drivers, sustainability pressure, collaborative style.
Ghassemi & Becerik-Gerber (2011)	Collaboration among participants, open communication, fosters environment of mutual trust and respect.
Smith, Mossman & Emmitt (2011)	Collective sharing of risks and cost savings, relational agreement – projects as collective enterprises, optimization, and ease of funds movement across traditional commercial boundaries.
Singleton & Hamzeh (2011)	Integrated team, integrated governance, high performing teams, lean construction techniques, collective risk sharing, pain sharing & gain sharing, profit pooling, and contingency sharing.

Sive (2009) highlighted several benefits of IPD which may increase the adoption of this method in the construction industry. These benefits include; market demands, industry desires, technology drivers, the sustainability pressure and collaborative style. The benefits described by Sive (2009) are similar to other benefits found in

literature, however, it must be mentioned that Sive (2009) had linked how sustainable campus development could be benefited through the implementation of IPD. This confirms the direction of this research, which is to apply IPD in achieving sustainable design for campus development. It can be seen, that there is a consensus among current literature in reporting the benefits of IPD Table 2.11 next page is IPD key literature review;

Table 2.11: *IPD Key Literature Review*

	Topic, Theme or idea furthered							
Author(s)	Benefits IPD	Comparing Method	BIM synergies and integration	IPD behaviour	Contract development best practices	Barriers to IPD Implementation	Implementation without 3-party agreement	Critical success factors/outcome
AIA (2007)	X	X	X	X	X			
Chan et al. (2003)								X
Chen and Chen (2010)								X
El-adaway (2010)	X							
Ghassemi and Becerik-Gerber (2011)	X	X	X	X	X	X		
Kent and Becerik-Berber (2010)	X		X	X				
Lancaster and Tobin (2010)	X		X					
NASFA (2010)	X	X	X	X	X			
Singleton and Hamzeh (2011)	X						X	
Smith, Mossman and Emmitt (2011)	X		X		X	X		
Wong and Cheung				X				

The most common benefits of IPD are shorter project duration, cost efficiency, mutual trust and respect, as well as collective risk and reward sharing. There is no doubt that IPD construction method has many benefits to the owner, stakeholders, contractors and other shareholders. Upon this project, IPD are covering in every aspect in the construction from the project planning, the project construction and building maintenance. Many researchers have found the literature about IPD is extremely in positive concerning the future of IPD and the potentials of business expansion in the construction industry.

2.16 IPD Components and Tools

The advent of new communication and information technologies (ICT) brought upon the demands by clients and organizations. This communications platforms are used in the construction projects is to provide better service and effective implementation and utilization of the resources in the construction projects. The benefit will show the positive impact to the improvement of client, organizations and individual in a construction project, and its move by key players to assure an effective timely communication of relevant information. This communication can be the right tools to the more sustainable campus development in Northern Region Higher Education Institution development which is the all of the resources can be more integrate without communication barriers in between the stakeholders.

Part of this innovative development had somehow propelled the construction industry to move towards leaner methods, which minimizes waste, optimizes resources and cost efficient, which inevitably results in mutual trust and respect among participants in the construction industry. This is how IPD has evolved from its less formal

predecessor, partnering. According to the literature (Sive, 2009; Cohen, 2010), IPD is characterized by the following components such as a multi-party contract, early participation of key members, risk and reward sharing among key members, such as the decision making and control as collective resolution, liability waivers between the key members, jointly developed and validated project goals.

For the maintenance of the Integrated Project Delivery (IPD) process and the IPD components, there are tools designed to monitor and ensure the IPD spirit is consistent throughout the construction project (Sive, 2009; Kent & Gerber, 2010; Kim & Dossick, 2011; Smith et al., 2011; Singleton &Hamzeh, 2011). These tools are as shown in Table 2.12:

Table 2.12: *Tools for IPD Maintenance*

IPD Tools and Techniques	Description
Integrated form of agreement	A single unifying agreement which includes all parties (owner, designers, constructor and trade partners) requiring them to share risks and rewards. All parties will be inclined to put the project's interests first, as their profit depends on the overall success of the project.
Planning process	Robust planning is conducted to define how the design and construction processes will be performed. Workflow is mapped out with the involvement of all relevant participants, instead of directed by the owner.
Charrettes	Design processes are conducted as group work. Options are created, analysed, and decided in group working sessions.
Building Information Modelling (BIM)	Not just for technical process, but also assist in coordinating all project participants, improves visualization and fosters interdisciplinary collaboration.
Target Design Value (TDV)	Design is conducted to fulfil owner's need and expectation under an allowable budget. Rigorous verification of owner's need is carried out during the design process.
Pull Scheduling	Design documentation is produced for a particular component needed by the next member of the team. Schedules begin with milestones and long-lead items. Detail is established by all those responsible for identifying specific needs and exploring the most efficient sequence.
Set-Based Design	The parallel development of multiple design solutions for a given element, until it is absolutely necessary for one solution to be chosen. Benefits in ensuring the best decision, not the most expedient.

The perspective adopted for this research is that of "people and process". By this, the researcher refers to the perceptions and experience of the individuals that participate in any project and the processes essential for the timely accomplishment of a given construction project. Considering the aforementioned tools and techniques, it is helpful for construction practitioners as it provides a focus for those seeking to promote and/or progress the uptake of the IPD systems within organisations.

2.17 Integrated Project in Other Countries

Integrated Project Delivery (IPD) is one of the most recent project collaboration systems that is cited by the Lean Construction Institute (2004) and published in Lean Construction Journal in 2005. The American Institute of Architects, (AIA) in 2006 was expanding this idea and line up the guideline. Cohen, (2010) claimed that systems are proven in the cost saving. Most of IPD projects are proven were efficient, effective and time saving. Figure 2.6 below indicates the adoption of IPD in the US construction industry (AIA, 2012). There are evidence to indicate active adoption of IPD in the US and in the UK, based on the established IPD agreements and contracts in both countries (Ghassemi & Becerik-Gerber, 2011; Smith et al., 2011). The joining agreements developed in the UK have now been applied in Australia and Finland, indicating the increasing awareness of IPD and its benefits at an international level (Smith et al., 2011).

In Ireland, as the reaction of the new government construction policy that reducing 20% of the construction budget for public contract, therefore Ireland government has

introduced of a mandatory obligation for BIM and IPD would increase the probabilities of achieving that goal (McCauley, et al., 2013) cited in McDonnell, (2015). The case study by Scott, et al., (2013) shows the implementation of IPD in the construction project give the positive impact to the entire project from start to end.

Integrated project delivery is one of the most recent project collaboration systems that is cited by the Lean Construction Institute (2004) and published in Lean Construction Journal in2005. The American Institute of Architects, (AIA) in 2006 was expanding this idea and line up the guideline. Figure 2.12 below indicates the adoption of IPD in the US construction industry (AIA, 2012).

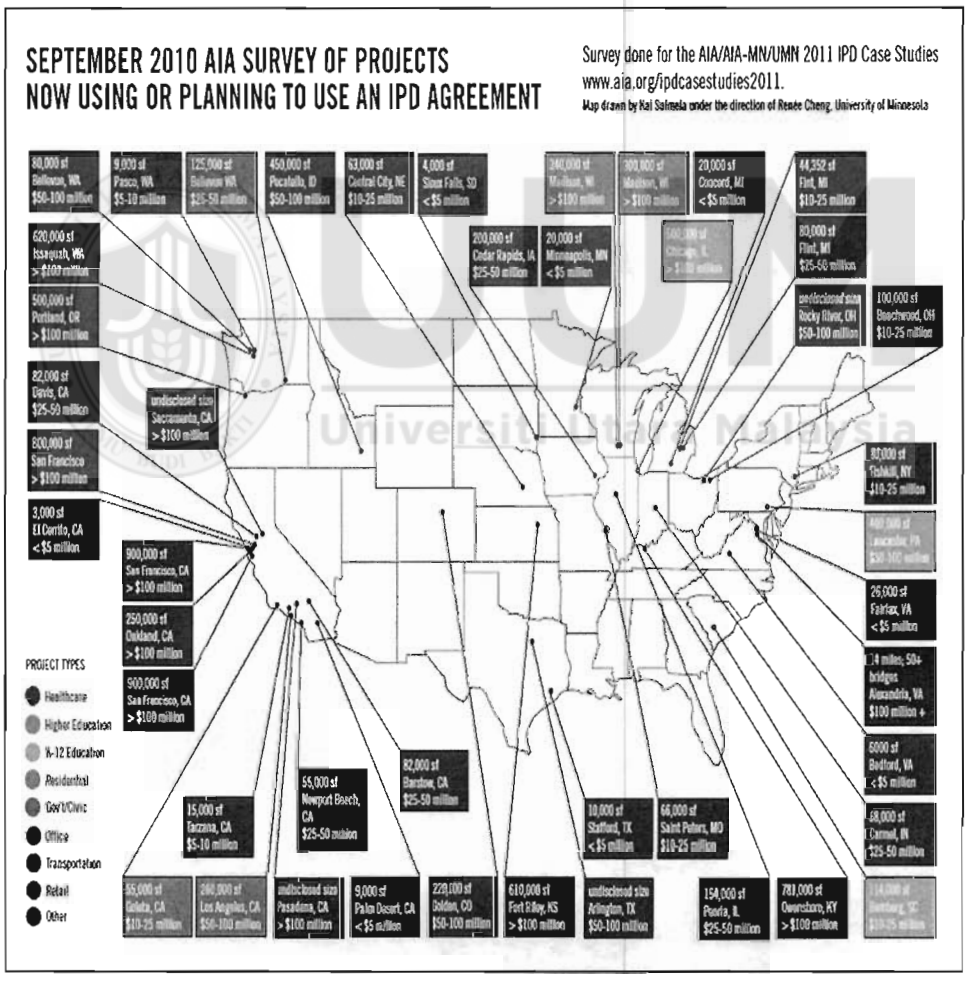


Figure 2.12: *The map or IPD project in all over country in the US (Source AIA California IPD Case Study 2012)*

In other way, the scenario of the construction in Japan has no difference to the other countries, Yamazaki et al., (2014) shows the urge or the integration in the construction project as now days the large-scale building projects have the complexity of the design and structure aspect. This large scale and complicated project required the intense project planning as the called as Computer Integrated Construction.

Consequently, in 2010, the Australian government had actively adopted Alliance contracting as a procurement method. This action is based on the Wandoo Alliancing huge success on the project of The National Museum of Australia which opened in 2001 (Raisbeck, Millie & Maher, 2010). Based in Raisbeck et al., (2010) IPD and Alliancing model are similar to each other from the beginning of the projects until the project handover to the client.

2.18 IPD Awareness in Malaysia

The Malaysian construction industry is where most of the contractor and the key players in the industry are so used to with traditional method of procurement (Nawi, 2012; Nifa, 2013). There has been some evolution with regards to procurement, where design and build (DB) contracts have become one of the most common methods of project delivery in the Malaysian construction industry, alongside the traditional method of procurement (Narayanan et al., 2011; Nifa, 2013). From observation, Malaysian construction industries have already achieved the maturity in process and technique in building and constructing the project. This is the perfect timing to make a new move to the most transparent way to do the constructing the building for the future benefit of economy, social and environment.

However, most of the government sectors in Malaysia are still using DB procurement in their projects (Nawi et al., 2014). According to Nifa et al (2014), the awareness of IPD in Malaysia is still limited, most of the construction practitioners are not aware about IPD. Some of the participants in the aforementioned study claimed that they apply some part of the IPD concept such as collaborating with other sub-contractors to complete part of the project. However the collaboration among the contractors is so still relatively minimal.

2.19 The Comparison IPD and the Others Delivery Method

The table 2.13 shows the comparison of the delivery characteristic, advantage and disadvantage in-between CMR, DBB, DB and IPD delivery systems. Based on this comparison the IPD delivery system positively shown the most benefit for the construction, and all of the parties in the project. From the table shows that the usages of IPD factors for project delivery have the least disadvantage compared to the others delivery method used in a construction project in northern region higher education institutions.

Table 2.13 *Comparison of the Delivery Characteristic, Advantage and Disadvantage In-Between CMR, DBB, DB and IPD Delivery*

	CMR	DBB	DB	IPD
Characteristic	• Owner contracts directly with Architect firm • Owner contracts directly with each sub-contractor • Similar to CM at risk, but no guaranteed price • CM & Architect can be selected based upon qualifications & expertise	• Architect hired first by the owner • Owner/Architect develop program & complete documents • Architect fully responsible for estimates, constructability - design • After project documents complete designed, then put out for bid • Traditionally the low bidder is selected to complete project • Communication is directed through Architect to the Owner	• Owner hires a GC or DB team • The DB team is fully responsible to the owner for project delivery • Typically at some point (as early as possible) in the process a GMP is established • Communication for the project flows through the GC or D/B team to the owner	• Owner selects CM and A/E based upon qualifications prior to design being started • Owner/Architect/Construction Manager sign a joint contract • Entire team establish the project goals and objectives • Characteristics similar to those of CM at risk
Advantages	• CM & Architect selection based upon qualifications • Owner can be involved in selection of CM team members • Early CM involvement to control budget & schedule • Owner be involved in sub-con selection • All work except CM & AE is should bid • GMP is established early • Projects can be delivered at accelerated/fast-tracked schedule • Opportunity for cost sharing • Ensures high quality at lowest cost	• Familiar delivery method • Defined responsibilities /roles for team • Allows more firms to bid • Initially presents the lowest potential cost for the project	• Owner has a single contract for design & construction • GMP is established early & owner risk is controlled • Except for Owner changes, no change orders • Project schedule can be fast-tracked if necessary • Owner involvement in the process is limited • Construction budget control • Owner is not issue resolution agent • Opportunity for cost sharing	• CM and Architect selection based upon qualifications • High efficiency delivery method • "Fast-track" process • Ultimate "team" project approach • Early involvement of not only CM & A/E but sub-con for major trades • Owner risk is limited by team approach to risk/ reward incentives • Success of team members is measured against success of project • Opportunity for cost sharing • Increased ability to deliver project within budget and schedule
Disadvantages	• Design team may not take input from CM during design • Perception that price competition is limited	• No "fast-tracking" process available • Budgets may or may not be met. architects are not always current on pricing market(s) • Low bidder may not understand project goals, objectives & criteria • Owner has no control or input on subcontractors • Process puts Owner as issue resolution agent if architectural documents & construction conflict • High potential for change orders and conflict • Owner control over GC's staff is limited • No cost savings sharing • Relationships can be adversarial	• Owner has limited involvement • Difficult to establish criteria for selection of DB team • Design is complete at GMP • Process may not bring best designer & best builder together for owner • Quality control is responsibility of DB team, no checks & balances	• Newer delivery method • Requires very involved owner • Some contractual issues to be addressed

2.20 Chapter Summary

This chapter has discussed the tenets of Integrated Project Delivery (IPD) and sustainability in design of campus development. The awareness of these concepts was also discussed as well as the adoption of these concepts by the construction practitioners in Malaysia and beyond. A closer look at the literature has shown that there is a significant gap in linking the effectiveness of the IPD system and how this effectiveness can be benefited in applying sustainable development. The next chapter will elaborate on the research design and methods to be adopted to achieve the objectives of this research.

CHAPTER THREE

RESEARCH DESIGN AND METHODS

3.1 Introduction

In this chapter will describe the research process that carried out for this research. In the previous Chapter 2 was mentioned about the conceptual of this research, the concept will be expended for future exploration based on the literature review. Although it was noted that sustainable design and development will benefit from the implementation of integrated project delivery (IPD), it was highlighted in Chapter 2 that of these methodologies have not been merged to achieve sustainable design for physical campus development in previous literatures. Consequently, to strike the objective of this research to propose a guideline towards a sustainable campus through integrated practice for construction project delivery; an in-depth investigation is required to ensure the level of engagement of the maintenance department in the northern region HEI in IPD practices as well as the awareness of the maintenance departments in sustainable campus development.

Since the exploratory research strategy will be based in this research, therefore, this chapter will debate and to deliberate some sort of others research methods to be implemented. Whichever method selected that shall fulfil the research objectives satisfied, this research will also attempting to enhance the theory building for addition. Through the end, in this chapter will make a conclusion with the foundation trough the main objective with the approach and techniques selected of this research.

3.2 Research Approach

Saunders et al., (2008) expressed in their researchers where is has come to the extent that cleared about philosophy increased some of critical issues identifying with the research design. Generally, there are many research methods to be selected for the research, figuring the most suited approach to answer the research question shall be determined by researchers. Moreover, broadly discussion has been going through about philosophy of the research in the previous section, yet these discussion has provide the suitable research approach as a basis to be employed as a part of the study of this research. Consequently, in the research, approaches are including the theory ascendants of theory generation and theory testing methods, Kagioglou et al., (2000). In addition, the theory generation is discussed as it is convenient to understand two diverse methods for undertaking the reasoning by the research to be specific; inductive and deductive approaches (Sutrisna, 2009).

For the further information, the theory and hypothesis will initiated by the research projects, then, the theory generation of deductive generations will take into places.

As known from the research area, the hypotheses are deducted which is then will be subjected to the empirical testing. Furthermore, (Hyde, 2000; Grix, 2010) mentions the deductive research method will be through of all the phases such as theory development, hypothesis development, data collection, compilation of findings, confirmation or rejection of the hypothesis and the revision of the theory. In short, the deductive theory generation is fundamentally recognized as the theory test. Bryman & Bell, (2007) commented that there are many scholars linked this deductive approach with quantitative testing methods.

In the other side, the inductive theory generation understanding the theory as the outcome of the research which is the specifically situated as theory building. Furthermore, the concept of theory generations are established based on the conclusions of the research outcome and it takes into the deliberation of the exceptional features of the framework in research, (Landman, 2000; Saunders et al., 2003). Moreover, the inductive research method is limited to a small sample of subjects to gain more appropriate observation, within the context of the research inductive which is the events are taking the place. There are many researchers proactively using this approach that using the qualitative data and a selection as a technique to gain the information and data in order to gain the marginal explanations of the condition (Bryman & Bell, 2007). The process of inductive theory generation can be seen in the following Figure 3.1.

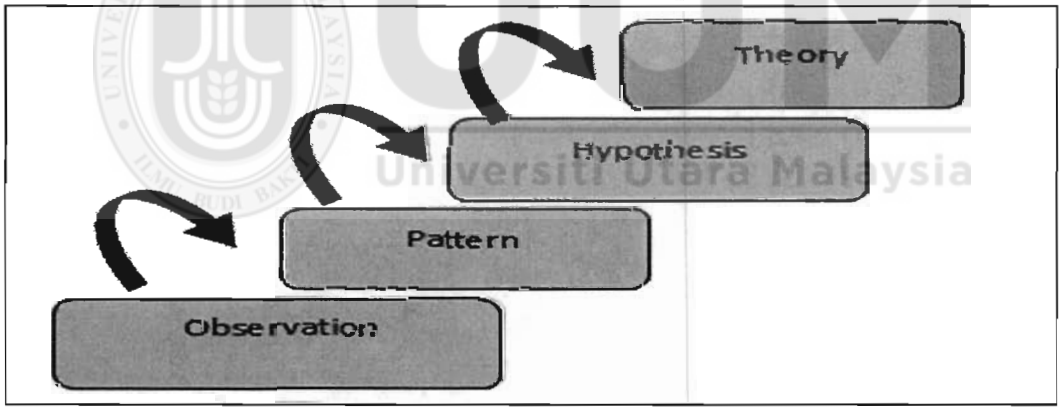


Figure 3.1: *Process Flow of the Inductive Theory Generation*

Research approach are discussed based on the research characteristic of the and it is taking into the consideration, where the theory buildings are required from the Malaysian construction industry practitioners of their opinions and views; within this research and the strategies are well suited research for inductive reasoning. In

addition, the quantitative and qualitative methods indicate the opposite, according to approach adopted with epistemological and ontological considerations. Table 3.1 shows the difference between the approaches;

Table 3.1: *The Fundamental of Quantitative and Qualitative Methods* (Bryman & Bell, 2007)

	Quantitative	Qualitative
Research Approach	Deductive; testing of theory	Inductive, generation of theory
Epistemological assumption	Natural science model, in particular positivism	Interpretivism
Ontological assumption	Objectivism	Constructivism

None the less, (Mason, 2002) has mentioned the inductive reasoning in research normally replicates the use of qualitative methods. Furthermore, due to the inadequate quantity of IPD projects that have been accomplished or are currently underway (Ghassemi & Becerik-Gerber, 2011) and the minimal involvement of practitioners in IPD in the Malaysian construction industry (Nawi et al., 2014), only a qualitative investigation is feasible for an exploratory research on IPD in sustainable campus development. The next section will describe the varieties of approaches in data collection and the most suitable methodology to be used in this research.

3.3 Research Strategy

Within the specific area of the research, when the decision has been made in choosing the philosophies and approach, and in the next stages of the research will be exploring the few differences of strategies accessible in order to progress with the research. In

adequate to make certain of the equality point within the basis foundation of the research, at the end there are research strategy that is selected would be delighted by the researcher's philosophical standpoint and methodology. To ensure the essentially of the research strategy (Yin, 2009; Saunders et al., 2009) or research design (Bryman and Bell, 2007; Sexton, 2003) delivers the researcher a 'roadmap' or a 'plan of action' in directive to interpret the aims of the research into achievable results.

Furthermore, Saunders et al., (2009) has indicated that the research strategies used in the research are critical in ensuring the researchers to be able in responding to research questions and undertaking all of the research objectives. Currently, (Yin, 2009; Author, Saunders et al., 2009) has proposed on the ultimate appropriate research strategy with three comprehensive condition circumstances as listed in table 3.2 below;

Table 3.2: *Research Strategies by Yin, Author and Saunders.*

	Yin (2009)	Author	Saunders et al (2009)
Research strategies	the category of research question	experiments	experiment
	the control of the researcher over behavioural events	survey	survey
	the degree of focus on contemporary as opposed to historical events	archival analysis	case study
		history	action research
		case study	grounded theory
			ethnography
			archival research

Although there are numerous of researchers that characterizing the research design as a research strategies, as Bryman & Bell, (2007) defined the research strategy as a general orientation to conduct the business research. Therefore, the nature of the research strategies can be categorised into two types as quantitative research method and qualitative research method. These research methods naturally stick the researcher into the research style and design to create the framework for the data collection, type of analysis and the direction of the data to be presented. By then, these research strategies that have been selected by researcher will reflect to the decision that made in order to identify the range of dimensions within the research process.

For further understanding about the dimension of the research process, Creswell, (2009) has classified there are 5 dimensions of research design currently available such as the survey, experimental, case study, comparative study and longitudinal research. In other hand, Sexton, (2003) has earlier categorised the research design into five main research strategies such as survey, comprised of experiments, case studies, ethnography research and action research.

The important of the research strategies selection in the research to respond and should correspond in answering the research question that made the research foundation for the whole research process. Every single research strategies are equipped with their own advantages and practicality to answering the certain types of the research question and the research objective. The following Table 3.3 describes the relevance of available research strategies to types of research questions, and other requirements in research.

Table 3.3: *Comparison of Various Research Strategies* (Nawi et al., 2012)

Research Strategies	Advantages	Disadvantages	Form of research question	Requires control of behavioural events?	Focuses on contemporary events?
Experiment	Clear possibility and answer; controlled context, replicable and generable; save time and resources; causal relationship	Requires specific knowledge; artificial; ethical problem due to variable control; quantitative does not really explain	How Why	Yes	Yes
Survey	Widely used; qualitative and quantitative; directive; affordability of large data; high predictability	Risk of misplacing findings; difficult to obtain truthful data; may subject to bias; less detail and depth; may not be applicable to phenomenon studies	Who What Where How How many How much	No	Yes
Case study	In-depth, capture complexities, relationship; multiple data sources and methods; flexible time and space; less artificial	Problem of generalization; focus on natural situation; unpredictable; unacceptable for some course	How Why	No	Yes
Action research	Collaborative; the researchers and context integrity; for practitioner-researchers; professional and personal development; practical	Difficult for new researcher; exclusive; work setting influence; unacceptable for some course	How	Yes	Yes
Grounded theory	Generating theory from a research; flexible structure; detailed set of rules and procedures	Too specific; ignore the previous knowledge to the analysis; many variants of the strategy	How (Focus on process)	No	Yes
Ethnography	Feasible within the constraint of time and researchers; direct observation; no specific data collection methods; rich data; deal with culture, inclusive.	Difficult for new researcher; high skill needed; descriptive to explanative; ethical issues; limited accessibility; problem of generalization.	Why (To understand context and perception)	No	No
Archival research (documentary study)	Independent researcher; researcher has no influence on the quality of documents; can be reviewed repeatedly.	The documents might be produced for specific reason; lead to bias; irretrievability.	Who What Where How many How much	No	Yes/No
History	Applicable deal with 'dead' sources of evidence; can be reviewed repeatedly	The data is limited in term of in-depth descriptions (no specific reason produced)	How Why	No	No

To make the selection of the best methodological research approach, the formulation of research types are decided at the initial stage of the research need to be made and shall revisit. These are the research question;

- What are the current practices of design, construction and maintenance process in the Northern Region HEI campus?
- What are the key factors that are crucial to the effectiveness of an integrated team delivery to achieve sustainable building design?
- How can IPD assist in enabling sustainable design in campus physical developments?

Towards in this research, all of the data information and the data that gain are based on the interaction to the social structure in the maintenance department in Higher Education Institution in Northern Region. The action to gain more accurate data that needed the maintenance department as a client/ user representative or in some cases the project manager in campus construction projects shall be considered.

Consequently, there is no appropriate mechanism that can be used to control the participant behavioural during the information gathering event. This is because to ensure the richness of research value can be contained with full of information that gathered from the interaction to the participants. To bear in mind there is no control of the behavioural in those events are required as the exclusion of the action research methodological approach and experimentation research methodological are excluded from the research strategies ranges. But in respond to the research question types in this research which is 'What' and 'How' as a result that will eliminates of those selections of the action research, the ethnography research, history research and grounded theory research strategies. Within this research also will not respond to the

'What' research question which the gathering of information are saturated from in-depth examination to the involved participants from the professional personal in the construction industry to ensure the methodological approach adopted in this research will archive the required information in this research and constant documents of the information. Then henceforward, the only strategies that considered suitable for the research flow left to be picked just the survey and the case study.

As elaborated, Yin (2009) the case study is a pragmatic task that examines the phenomenon existed in-depth that surround within the context, that specifically when the limitation between the phenomenon and the context are vague. In a case study, the investigator or researcher takes on a sequential specific process which is qualitative in manner, to explore a certain arrangement single case of in multiple cases for certain arrangement within the specified time frame which in should be through the data collection and through the detailed processes. This data collection process usually involves numerous sources of information which may include; interviews, observations (active or passive), audio visual (AV) material, and documents, be it in the traditional printed form or the virtual formats as found on the Internet. According to Creswell, (2007) case study research will usually integrate the data from these various sources through the process the reports of a case are described to the explanations on cases based themes. Furthermore, a case could be in the form of a single area or location, a single organization, a person, a group of people or a single event as implied by Bryman and Bell (2007).

Creswell, (2007) further added that the case study methodology, in the event of the case is an object of interest in its own right and the researcher will try to deliver a comprehensive understanding of the certain arrangement. On the other hand, within a multiple case study, the researcher selects an issue to be investigated and then

identifies whether the research should be conducted from multiple locations or multiple groups within one selected location. Due to context of this research which requires the input from several different campuses, the researcher has an inclination to choose this method; however due to several research questions beginning with "What", the case study method is not selected for this research as the "What" questions are best answered through the survey method (Yin, 2003).

One of the most commonly used methods in qualitative or quantitative data collection in social science and management research are surveys. Many scholars (Sarantakos, 2005; Saunders et al., 2009 and Yin, 2009) has mention that those frequently used to answer the agreements such as the question like who, what, where, how, how much and how many research questions. Revisiting the research questions formulated at the beginning of this research, it can be established that the "What" and "How" questions in this research would be best resolved using a Survey research design.

Apart from identifying the appropriate research design for this study, it is also imperative that a comprehensive review of literatures is required as it will serve as the secondary data in this research and it will be combined with primary data which is derived from the investigations interviews among Maintenance and Development Department top and middle managers in Northern Region Higher Education Institution. The data are obtained from both primary and secondary sources will be synthesized in to achieve the research aim in developing an IPD framework for sustainable design for campus development.

3.4 Research Techniques

The previous section has determined that the survey design is most appropriate to resolve the research questions. As this research is exploratory in nature and therefore requires an in-depth investigation a specific group, this research is considered to take an inductive approach and therefore qualitative techniques are most suitable to capture the valuable insights of the participants. This research primarily undertakes the survey design, which semi-structured interview data are supported by the secondary data derived from the literatures. This section will discuss in detail the research techniques employed in this research; the literature review and semi structured interviews.

3.4.1 Literature Review

Sekaran (2004) mentioned that a literature review entails a record of a complete review of the published and unpublished research from secondary sources of data in the specific area of interest of a current work. Accordingly, a literature review is crucial in ensuring the researcher from repeating or recreating the similar issues that have been resolved by previous investigators, apart from confirming that the researcher has obtained the most updated knowledge within the area of study (Kulatunga, 2008). A literature review is critical in the aspect of formulating a sound argument to justify the significance of a research and how it adds to the present body of knowledge. Therefore, it is imperative that a literature review should not only extend beyond the reproduction of theories and opinions of past scholars, but also deduced previous theories and synthesizes these propositions to support a certain perspective or argument (Bryman and Bell, 2007). Chapter 2 of this research has

discussed the literature review that has been conducted in order to identify existing knowledge and the current gaps in research for IPD, specifically in the context of sustainable campus development and planning. Consequently, the review has incorporated numerous literatures on IPD, sustainable design, their enablers and components, and the current practices in the HEI Maintenance and Development Department in order to gain the insights on the current scenario. The core of the institution development in campus area is handled by the Maintenance and Development Department. Therefore, the most appropriate department to gain the best information about the HEI development is from the expert from this department.

3.4.2 Semi-Structured Interviews

In this research, semi-structured interviews will be implemented as the qualitative data collection method. The participants for the semi-structured interviews are the officers from the top and middle management of maintenance departments in Northern Region HEI.

Initially the researcher targeted a number of 10 interviews to gain the perspectives of the participants in this research. However, due to several constraints, location of study and considering the exploratory nature of this research, the researcher was only able to identify 6 expert participants for the semi-structured interviews. Smith (2003) has proposed a number of 6 to 8 interviews to be sufficient in a qualitative study. Furthermore, in regards to the number of interviews, Guest et. al. (2008) has mentioned that themes can be proposed as early as 6 interviews, reflecting that the number of interviews is satisfactory for this research. As a semi-structured interview enables the researcher to delve into vague areas of the IPD and sustainable campus

knowledge among the participants, this method is chosen as the main method of inquiry in this research. These interviews will be conducted to gain data respond, knowledge and experience from the northern region HEI that there are from Universiti Utara Malaysia (UUM), University Sains Malaysia (USM) and University Malaysia Perlis (UniMaP). The focus group targeted for interview are consisted the head of technical department that have the responsibility for the development of the campus. In UUM campus, the department that in charge for the Maintenance and Development Department is *Jabatan Pengurusan dan Pembangunan Universiti Utara Malaysian* (JPPUUM). For the interview, four main units will be selected to gain the respond from Maintenance and Development Department UUM are;

1. *Unit Awam* (Civil Unit),
2. *Unit Elektrikal* (Electrical Unit),
3. *Unit Servayer* (Surveyor Unit)
4. *Unit Arkitek* (Architecture Unit).

For University Sains Malaysia there are four units will be selected to gain the knowledge and information about the project development in campus USM. The head units form;

1. *Bahagian Pengurusan Projek dan Kontrak* (Department of Project Management and Contract);
2. *Bahagian Pengurusan Perkhidmatan Fasiliti [Awam]* (Department of Civil Facilities Management);
3. *Bahagian Pengurusan Perkhidmatan Fasiliti [Elektrikal]* (Department of Electrical Facilities Management);
4. *Bahagian Pegurusan Pentadbiran dan Fasiliti* (Department of Facilities Management and Administration)

For the UniMaP campus, interview will focus to the technical department to gain knowledge and information about the project and the development in the campus. The interview will target to the head units of the department; *Campus Project Department;*

1. *Unit Awam* (Civil Unit);
2. *Unit Elektrikal* (Electrical Unit);
3. *Unit Ukur Bahan* (Surveyor Unit).

The selections of the head units from the technical area in HEI are to ensure the interview can gain the information about the flow and the overview of the practise that been used in the campus.

Qualitative interviewing can be categorized into 2 distinct types; unstructured and semi-structured interviews (Bryman and Bell, 2007). In unstructured interviews, the interviewer will pose a single question and the interviewee is free to respond to minor intervention from the interviewer. The interviewer will only comment or ask follow-up questions if there are topics of related aspect that he or she feels feasible to be followed up. Due to the nature of the unstructured interview, Saunders et al (2009) had termed the interview as informant interview considering it is primarily the interviewee's viewpoints that guides the flow of the interview.

In addition, Bryman and Bell (2007) highlighted that the interviewer generally will place the series of question in semi-structured interview schedule but will be able to have a various question sequence. Furthermore, in qualitative research, the random sequencing of questions has been widely practised to enable the participants to provide their own opinions and insights pertaining to the research area. This will benefit the researcher as he or she will have the opportunity to gain the richness and saturated data from the participants. On the other hand, Gillham (2000) proclaims that

the researcher should be able to understand the participants' implicit content to ensure the richness information can be obtained as reflected in the participant's subconscious actions. Accordingly, Yin (2001) stated the main characteristic of semi-structured interview that which sets it apart from the structured interviews as figure 3.2 below:

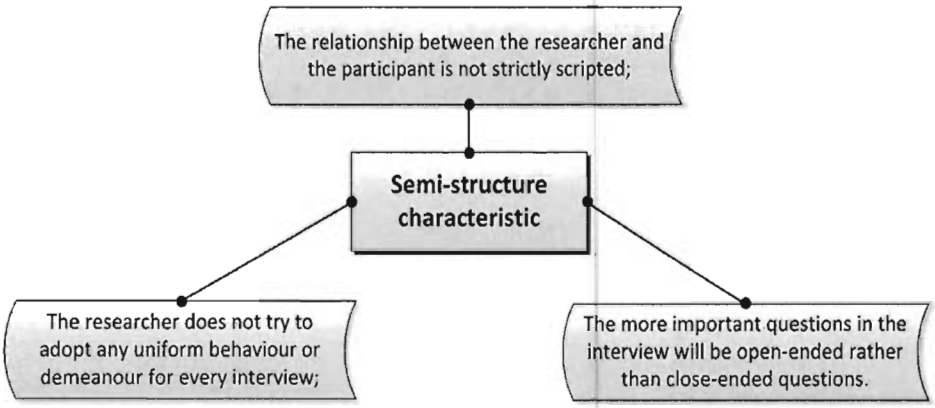


Figure 3.2: *Semi-Structure Interview Characteristics* (Yin, 2001)

Considering its many advantages and the relevance of the qualitative techniques with the nature of this research, semi-structured interviews are used to gather the valuable insights from the managing officers in the HEI maintenance department. An interview schedule or protocol was developed, to guide the researcher in navigating the interview session by providing a general guide for questioning. Not only this enables the researcher to obtain information to all standardized questions in the protocol, but this method also allows the researcher to adjust existing questions and add new questions if the need arises.

Furthermore, this usually happens when the participants are in the midst of answering a question and will continue to describe a matter that is not particularly included in the interview protocol but could be as equally important, as discovered by the researcher during the interview. The demographic details of each of the participants

were identified at the beginning of each interview sessions and Nvivo10 is then used to assist in the qualitative data management and analysis.

3.4.3 Surveyed Sample

In this research, the data were collected among the most professional in this field that are knowledgeable about the construction industry and having authority in making decision in the organisation. The participants have been interviewed in their premises at the university that has been selected for the research.

All of the participants interviewed for this research have been selected based on their capability, experience, knowledge, position and responsibility in the project in campus development as suggested by Crotty (2004). These samples were selected from three different universities, USM, UUM and UniMAP. All of those universities are located in the same region as there are in the Northern Region Higher Education Institution (HEI). Table 3.4 below displays the detail of the interview participants for this research;

Table 3.4: *Detail of Sample for Interview*

Label	Position	Experience	Institution Label
P1	Assistant Director	25 years	I1
P2	Engineer	12 years	I1
P3	Director	21 years	I2
P4	Surveyor	15 years	I2
P5	Director	22 years	I3
P6	Architect	13 years	I3

The reason of this HEI has been selected to be the sample for the research because of the factors such as the diversities of university location, course, building types, the university development needs and the age of the building in the university campus. This kind of verities can be sufficient enough for the researcher to understand the current situation of the campus development projects and the niche for the campus development.

With the details of the Table 3.4, this research requires the participant to be interviewed as the highest position in the organisation. The selection of the middle and top post in the organisation are due to the fact that these two groups are commonly involved in the important decision making in the organization. Their views are valuable for this research as they are the person that directly involved in the campus project from the beginning of initiating the projects to the end of the hand over the project.

This research will keep the anonymity of the participant and the location of the sample to comply with research ethical requirement. Therefore, all the participants in from the interview will be labelled as Participant 1 (P1), Participant 2 (P2), Participant 3 (P3), and so on, without any order of importance of their name and their position. Furthermore, all of the institution name also will be hidden from the data and will be labelled as Institution 1 (I1), Institution 2 (I2) and Institution 3 (I3).

3.5 Qualitative Data Using Template Analysis

Qualitative analysis in social science has been established many decades ago by philosophers in the psychology field. In 1990s, these analyses emerged into the grounded theory analysis in the USA, then years later Nigel King brought the technique into related fields in Europe. The origin of template analysis was developed from the organizational research to gather the unstructured qualitative data from the primary source. This template analysis is found to structuring the data using the technique by categorising the similarity of the subject gathered from the interview data or document data. The template analysis formats come with three stages that King developed. The King's templates analysis steps can be seen in figure 3.3 below:

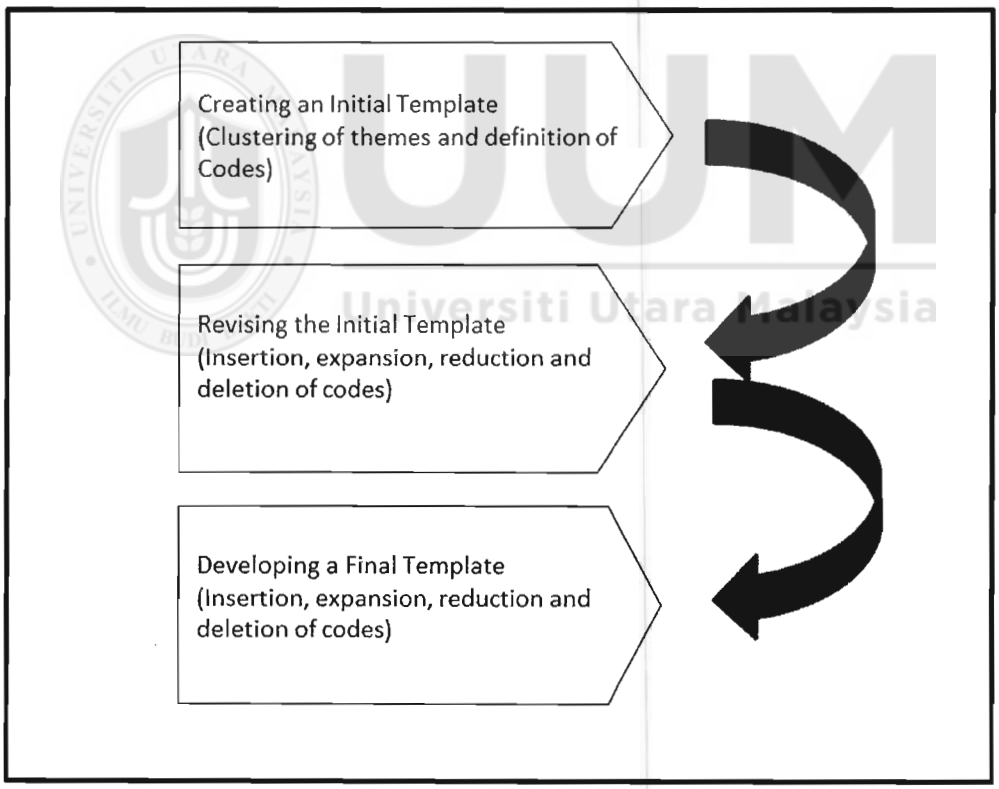


Figure 3.3: *The Steps of Template Analysis* (King, 2012)

This template analysis has some steps that need to be complied to ensure the data can be processed accordingly to gain as much knowledge and information from the participants. Therefore King (2006) described there are three steps for template analysis in the process to get the data, commonly the template would be the final when the data has been transcribed.

The significance of using template analysis in this research as an exploratory research that applies semi-structured interview among the expert and the practitioners in constructing and developing the campus. This data that gained from the participant are large and not structured in the research perspective order. These large data, it needs to be arranged into more structural form according to the respective template. King, (2004) applied this template analysis for the exploratory research methodology.

In the other hand, Warring & Wainright (2007) mentions the template analysis being used to explore the data from computer in National Health Services (NHS) in the United Kingdom. The Nigel King three steps of template analysis are suited to this research because this template was designed for the preliminary research that has been mentioned previously before in chapter two.

3.6 Research Objectives and Methods of Investigation

In the previous section has described in detail the selected research techniques that are required to fulfil the research objectives. The table 3.5 below indicates the objectives of this research which shall be achieved through the appropriate research methods that has been previously described.

Table 3.5: *Research Objectives in Relation to Methods of Investigation*

No	Research objectives	Methods of investigation	
		Literature review	Semi structured interviews
1	To investigate the current practice of design, construction and maintenance process in the northern region HEI campuses		X
2	To identify the key factors that significantly influence the effectiveness of an integrated team delivery to achieve sustainable building design	X	X
3	To validate an integrated project delivery (IPD) framework and provide recommendations towards a sustainable campus in the northern region HEI construction future projects.		X

With regards to data collection, qualitative survey design shall be implemented through semi-structured interviews in order to enable the researcher to collect the insightful and rich data and information from the participants. Accordingly, the interviews will be conducted with three specific themes that are parallel with the research objectives that shall be fulfilled in the qualitative data collection stage. Therefore, below these are three themes are as follows;

1. Standard processes currently practiced by university maintenance department
2. The maintenance department's awareness of IPD practices
3. Awareness in sustainable campus development

The themes above have led the formulation of the interview protocol for the use of qualitative data collection. Pertaining to the qualitative data, reliability and validity concerns in this research will be addressed in the following section.

3.7 Reliability and Validity Concerns in Qualitative Research

In research work, reliability refers to the ability of a research instrument to consistently produce accurate results. Reliability is a criterion that is typically used in evaluating the quality of a specific instrument such as; a questionnaire, a test or a coding frame (Schreier, 2012). The reliability test may be conducted in the coding frame to determine that it is reliable and therefore consistent. Table 3.6 shows two types of reliable test for qualitative analysis, as identified by Schreier (2012):

Table 3.6: *Comparison across Person and Time* (Schreier, 2012)

Comparisons across person	Comparison across point in time
Where two or more coders use in the same coding frame to analyse the same unit of coding, and they do so independently to each other. The coding frame is considered reliable if the results apply across different coders.	Where pone coder uses same coding frame to analyse same unit of coding, after a certain period of time. The coding frame is considered reliable if the result remains stable over time.

With regards to this study, the researcher has made comparisons at different points in time by comparing the output of the coding frame on separate occasions. On those occasions, the coding frame is deemed to be reliable if the results are consistent after several comparative coding by a single coder or done by multiple coders.

In terms of qualitative instrument validity, this can be signified the undertaking of several processes during the research in order to test the accuracy of the results.

Among the methods for qualitative validity testing suggested by Creswell (2009) are listed in Table 3.7 as follows;

Table 3.7: *Validating Testing on Qualitative Method* (Creswell, 2009)

Actions	Details
Member checking	Where the results of the analysis were shown to the interview participant determined whether the participants agree with the accuracy of the findings.
Thick and rich description	Where rich and thick descriptions were used in conveying the findings to show that it is genuine and furthermore enables the reader to be transported to the research setting.
Negative of discrepant information included	Where information that contradicts the general perspectives of the themes is also included in the discussion of findings.

3.8 Chapter Summary

In this chapter shows the understanding of the research structure that has provided for the selection of research methodology as a genuine path to completing this research. On the next stages of this research will be refining the data collection instrument and field work to gain input from this research.

CHAPTER FOUR

QUALITATIVE DATA ANALYSIS

4.1 Introduction

The viewpoint of research philosophy previously discussed in chapter three will be adapted into this chapter. This chapter shall elaborate in detail the method of qualitative data analysis undertaken for this research. Accordingly, there are 5 stages of analysis has been used to gather the data from the experts to ensure that the result will be sufficient for this research. The first stage is to verify the participant that qualifies as the expert in the area under research. The second stage is designing the interview protocol to achieve the right information through the interviews and later leads into the third stage conducting the interview. In the fourth stage, the data will be analysed using NVivo10 software and which are finally the results will be discussed. Last but not least the key findings from the data analysis are highlighted at the end of this section.

4.2 Qualitative Data Collection – Semi-Structured Interview

The qualitative data collection for this research has been mentioned in previous chapter three through semi-structured interviews. This data will be complemented with findings from the literature and case studies that relate to the research. This following section in this chapter will describe the details of the data analysis and the methodology in current research. The semi structured interviews are subdivided into themes in line with the research questions and objectives.

4.2.1 Aim of the Interview

This research investigates the current practice of construction design process in Northern Region Higher Education Institution (HEI). The sample comprised of three different HEI namely; Universiti Utara Malaysia (UUM), Universiti Sains Malaysia (USM) and Universiti Malaysia Perlis (UniMaP). The diversity of location, university age and operation, building era and the campus itself creates the variety and characteristics that fulfil the research context. The interviews will be conducted with the expert to gather data and information on the sustainable design and integrated project delivery on campus.

The interview is conducted to identify the key factors of sustainable design in campus practice and the understanding of integrated project delivery (IPD) in construction. As previously mentioned there are many literatures describing the effectiveness of IPD and cost savings. Some of the literature describes the relation of IPD and sustainability in construction; therefore the data and information from the expert practitioners are needed to clarify the current situation of the industry and practice in higher education institutions.

In the process of interviewing all of the expert participants will comprise a series of 'what' and 'how' which is delivered using the semi-structured interview question that held face-to-face. This action to ensure the interview process can enquire the manner and fully gain every aspect of potential information from the participants. This semi-structured interview method can be yielded to the richness and deep findings of this research. The essential of semi-structured interview is an interactive interaction in-between the researcher and the participants where the conversation aligned with the idea, knowledge and experience. Whereby, the researcher can extract exactly

information needed from the interviewed participant including the topics to be covered, (Babbie & Rubin, 2008) not a set of question that too rigid to be asked in. The question should not be too focused at the question, but identify the answer might answer some of other component needed for the objective of the research.

Furthermore, semi-structured interview provides a relaxed atmosphere that much suitable for the data mining in qualitative method where the participant can have interactively conversation without feeling distant rather than filling-up a survey questionnaire (Woods, 2011). Based on all of these benefits, surely the semi-structured interview is the most appropriate data collection method. Basically, the benefit of this method will enable the researcher to gather the 'proximity' with all of the participants for engaging the whole idea of the research context. During the interview session, the researcher should make a suggestion to the participants with the ideas, and the information that needed; this action to ensure the participants could provide the idea within the themes of the research.

4.2.2 The Process of Interview Design

In the data mining process of for the participants, the semi-structured interview has been used within the format that is designed to meet the research objective from the participant. To gain the accurate information that is needed, the interview question has been structured into three sub-categories of question times. The sub categories are as follows:

i. **Sub category 1 – IPD**

This sub category requiring the participant to describe the understanding about the integrated project delivery by describing the IPD characteristic either the characteristic is aligned or not with their current practices in construction. The characteristic of IPD had been explained earlier in Chapter Two of this research. Other than that, the questions demand the participant to express their knowledge in the construction project, experience, participation level, and awareness. The lesson learnt through the participant point of view will also be explored and requires the participant to input some suggestion as well as some of personal opinions on the current practice in construction development.

ii. **Sub category 2 – Sustainable Design**

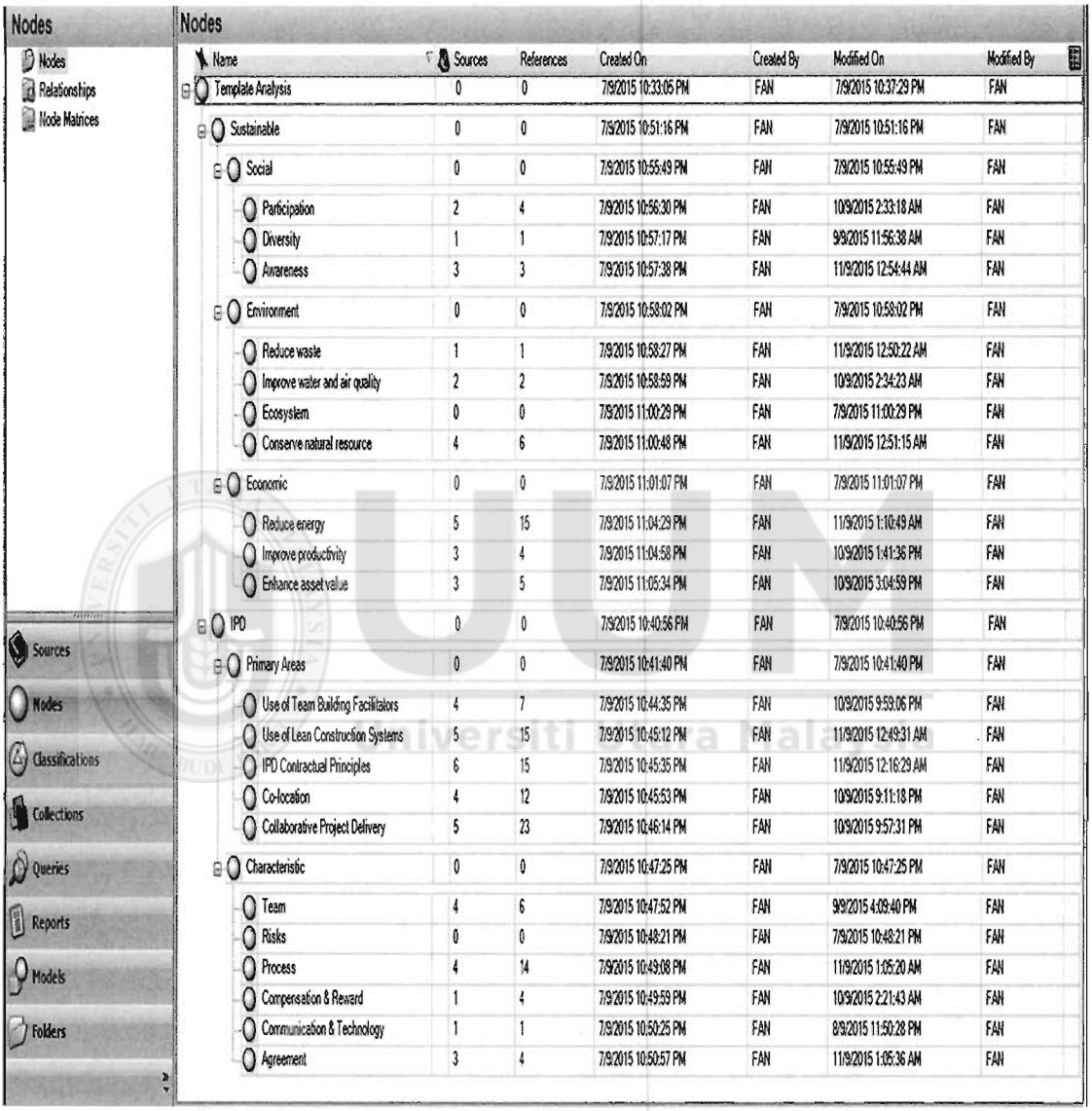
The sub category of sustainable design is requiring the participant to illustrate the how much the awareness in sustainable in current practice, literate the issue or the problem that the participant faced in applying the sustainable design of the project. Besides that, the participant needs to explain the consequences of the sustainable usage, what the benefit is and how extensive their experience is in the sustainable design.

iii. **Sub category 3 – Design and Planning**

Design and planning are phases that require the participant to describe the current practice of the designing process for a project and the problem or any issue that happen in these stages. Furthermore, the experience of the participants in handling the issue is also explored and the participant was being asked about his opinion whether negative impact or positive impact that arise from the design and planning process.

4.3 Application of Nvivo 10 Software in Data Analysis

As mentioned earlier in this chapter, this research will be conducted through qualitative analysis methods. Figure 4.1 below is the screen shoot of NVivo 10 software applications for this research.



Nodes

Name	Sources	References	Created On	Created By	Modified On	Modified By
Template Analysis	0	0	7/9/2015 10:33:05 PM	FAN	7/9/2015 10:37:29 PM	FAN
Sustainable	0	0	7/9/2015 10:51:16 PM	FAN	7/9/2015 10:51:16 PM	FAN
Social	0	0	7/9/2015 10:55:49 PM	FAN	7/9/2015 10:55:49 PM	FAN
Participation	2	4	7/9/2015 10:56:30 PM	FAN	10/9/2015 2:33:18 AM	FAN
Diversity	1	1	7/9/2015 10:57:17 PM	FAN	9/9/2015 11:56:38 AM	FAN
Awareness	3	3	7/9/2015 10:57:38 PM	FAN	11/9/2015 12:54:44 AM	FAN
Environment	0	0	7/9/2015 10:58:02 PM	FAN	7/9/2015 10:58:02 PM	FAN
Reduce waste	1	1	7/9/2015 10:58:27 PM	FAN	11/9/2015 12:50:22 AM	FAN
Improve water and air quality	2	2	7/9/2015 10:58:59 PM	FAN	10/9/2015 2:34:23 AM	FAN
Ecosystem	0	0	7/9/2015 11:00:29 PM	FAN	7/9/2015 11:00:29 PM	FAN
Conserve natural resource	4	6	7/9/2015 11:00:48 PM	FAN	11/9/2015 12:51:15 AM	FAN
Economic	0	0	7/9/2015 11:01:07 PM	FAN	7/9/2015 11:01:07 PM	FAN
Reduce energy	5	15	7/9/2015 11:04:29 PM	FAN	11/9/2015 1:10:49 AM	FAN
Improve productivity	3	4	7/9/2015 11:04:58 PM	FAN	10/9/2015 1:41:36 PM	FAN
Enhance asset value	3	5	7/9/2015 11:05:34 PM	FAN	10/9/2015 3:04:59 PM	FAN
IPD	0	0	7/9/2015 10:40:56 PM	FAN	7/9/2015 10:40:56 PM	FAN
Primary Areas	0	0	7/9/2015 10:41:40 PM	FAN	7/9/2015 10:41:40 PM	FAN
Use of Team Building Facilitators	4	7	7/9/2015 10:44:35 PM	FAN	10/9/2015 9:59:06 PM	FAN
Use of Lean Construction Systems	5	15	7/9/2015 10:45:12 PM	FAN	11/9/2015 12:49:31 AM	FAN
IPD Contractual Principles	6	15	7/9/2015 10:45:35 PM	FAN	11/9/2015 12:16:29 AM	FAN
Co-location	4	12	7/9/2015 10:45:53 PM	FAN	10/9/2015 9:11:18 PM	FAN
Collaborative Project Delivery	5	23	7/9/2015 10:46:14 PM	FAN	10/9/2015 9:57:31 PM	FAN
Characteristic	0	0	7/9/2015 10:47:25 PM	FAN	7/9/2015 10:47:25 PM	FAN
Team	4	6	7/9/2015 10:47:52 PM	FAN	9/9/2015 4:09:40 PM	FAN
Risks	0	0	7/9/2015 10:48:21 PM	FAN	7/9/2015 10:48:21 PM	FAN
Process	4	14	7/9/2015 10:49:08 PM	FAN	11/9/2015 1:05:20 AM	FAN
Compensation & Reward	1	4	7/9/2015 10:49:59 PM	FAN	10/9/2015 2:21:43 AM	FAN
Communication & Technology	1	1	7/9/2015 10:50:25 PM	FAN	8/9/2015 11:50:28 PM	FAN
Agreement	3	4	7/9/2015 10:50:57 PM	FAN	11/9/2015 1:05:36 AM	FAN

Figure 4.1: *Screen Shot for Template Analysis in NVivo 10 Software.*

Therefore, to make the interview straightforward and can consolidate the qualitative data to gain all of the richness information, encoding process of the data for interview transcribed using NVivo 10 software for the process of categorizing the information

based on template analysis schedule. During the analysis stage, the interview data and the participants' information will be validated through a member checking process to ensure the interview transcribe is verified. To simplify the long process of categorising the template analysis, NVivo 10 software will be used by the researcher where the software could help by displaying the number of responses that coded in every set of node applied. From the result of coding, the researcher will be able to identify the data pattern and flow existed and the conclusion of the information will be outlined.

4.4 Data Findings

The 'data findings' as described as a main contribution in this research as this finding has been deployed from the semi-structured interview session and based on the qualitative data analysis method. Referring to the methodology section, as has been mentioned, all of the data that gathered from the participants is analysed using the qualitative method through template analysis using the NVivo 10 software as an analysis platform. To be frank, this software empowers the researchers to present the complete analysis and taking in place with the result coded with the frequencies displayed. During the data interview collection, the interaction within the researcher and the participant, all of the conversation are recorded using the handheld digital voice recorder to absorb all of the information from the participants without any single word left. Then, this raw mp3 format interview information will be transcribed and translate into word format using Microsoft Word software application.

Finally, these entire translated interview data are rendered into a structured theme as has been planned in the interview schedule. All of the interview question that has

been responded by the participant with their own ideas and information will be encoded based on the particular scheme arranged in NVivo 10 software. In this NVivo 10, all of the data coding are organised into a scheme under the research needs which is named as node, every single node is aligned with their primary node. Therefore, to get further understanding of the structure of this research data the illustration from Figure 4.2 below shows the link of relationship for all of each single nodes;

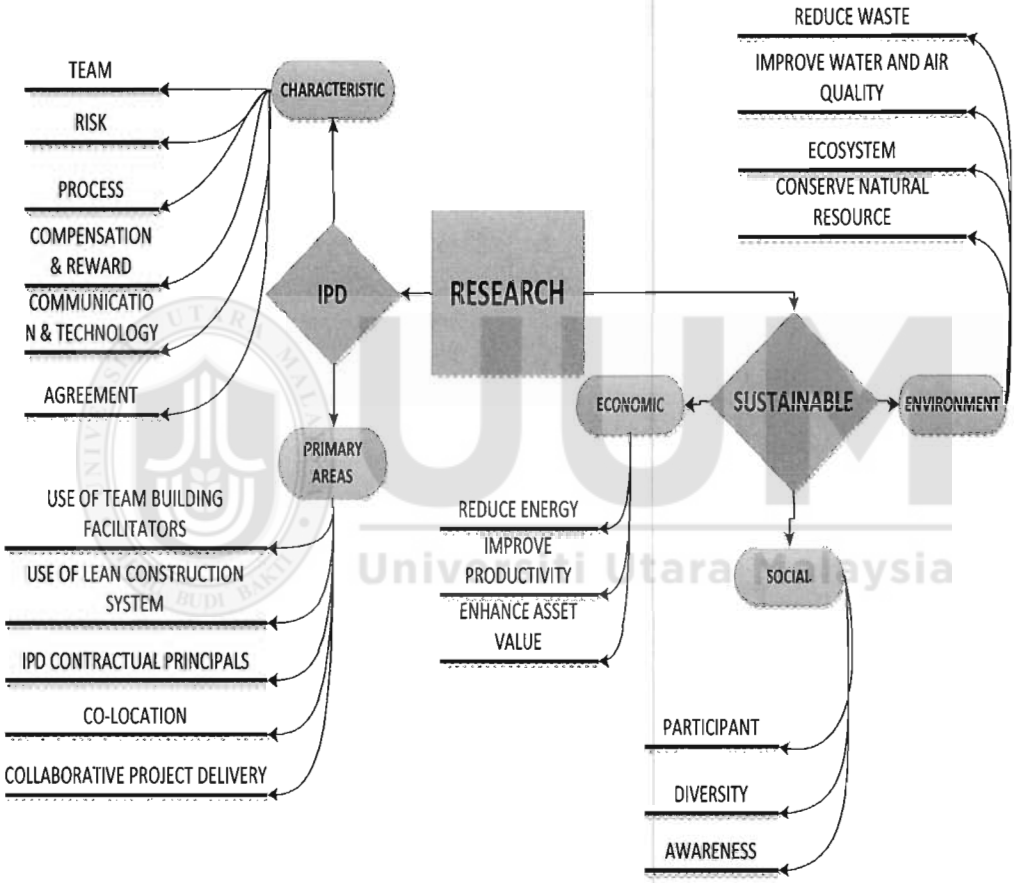


Figure 4.2: *The Relationship of Nodes for This Research*

For this research there are two primary nodes and each primary node line up three factor nodes for sustainable and two factor nodes for IPD. The factor nodes from IPD is the characteristic and the primary areas; in the other hand, the factor nodes for sustainable is economic, social, and environment. This factor nodes has bred a few

sub-factor nodes below them. The extraction of the interview data is transferred into NVivo10 and translated into nodes form. The nodes of the research understanding activities as shown in table 4.1:

Table 4.1: *The Categories of Nodes as Factors that has been used in NVivo 10.*

Primary Nodes	Factors (Nodes)	Sub-factors Nodes
Sustainable	Social	Participation
		Diversity
		Awareness
	Environment	Reduce waste
		Improve water and air quality
		Ecosystem
		Conserve natural resources
	Economic	Reduce energy
		Improve productivity
		Enhance asset value
IPD	Primary area	Use of team building facilitators
		Use of lean construction system
		IPD construction principles
		Co-location
		Collaborative project delivery
	Characteristic	Team
		Risk
		Process
		Compensation and reward
		Communication and technology
		Agreement

Based on the information gained from the participant, the data which is appeared is recorded and analysed according to the frequency underlying through parent nodes, nodes and child nodes. The further process of template analysis is explained included

in detail in the methodology section. In detail, for the following section is also explaining the result of pertaining to each theme based on the nodes to conclude the information from the participants. Therefore, the template analysis has been chosen to be a method of this qualitative research based on the fact that this method is matched with this research needs to achieve the research objective.

The qualitative analysis by using 'template analysis' that has been popularized by a qualitative researcher Nigel King (2014), he mentioned that the template analysis can be as purpose is to develop the code for exploring the huge unstructured data. King (2014); Warring & Wainwright (2007) also highlighted the template analysis data are suitable for the exploratory research. The data that involved in Template Analysis studies are usually for the interview transcripts (Brooks, 2015).

4.5 Understanding the Sustainable, IPD Characteristic and IPD Primary Area

The interview with the experts and those practitioners who are managing the development of the infrastructure and maintenance on campus aimed to gather their knowledge about the norms and nature of their work. This is done to fulfil the intention to retrieve the integrated project delivery characteristics and integrated project delivery primary areas currently practised in the campus Maintenance and Development Department.

Based on the research objective, this research seeks to determine two main dimensions which of IPD characteristics and IPD primary areas. These are the main factors in the dimensions to see whether the factors of IPD are present or not in Higher Education Institution. This is an important situation in this exploratory

research to understand and to form the pilot interviews, many practitioners in the Malaysian construction industry failed to describe their understanding about the overall concept of IPD. Figure 4.3 below illustrates the screenshot of NVivo 10 showing the nodes on understanding of IPD characteristic and the IPD primary area.

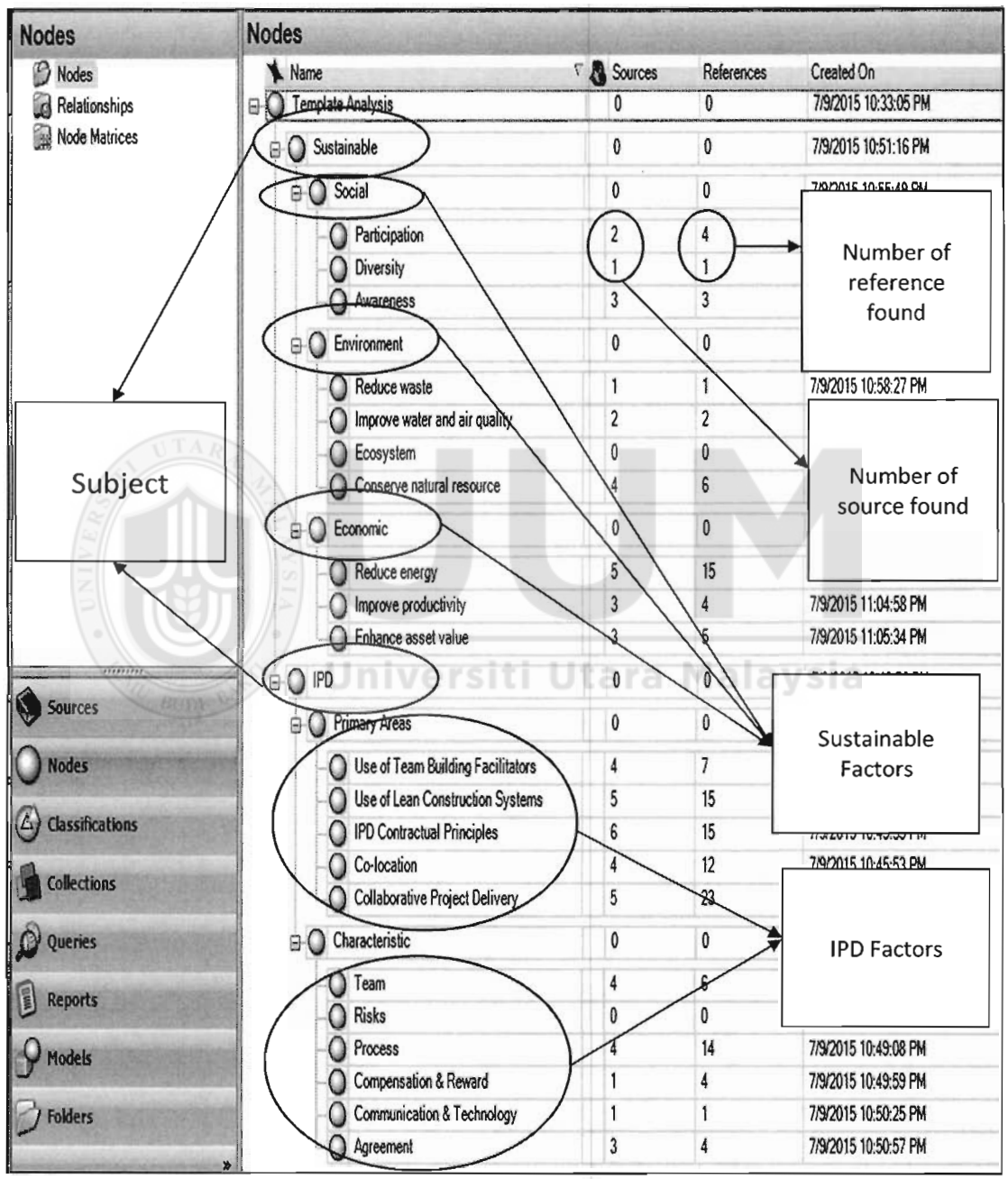


Figure 4.3: *Screen Shot of NVivo 10 Software Showing the Nodes on Understanding of IPD and Sustainable Concept.*

Based on the research objective, this research seeks to determine two main dimensions which of IPD characteristics and IPD primary areas. These are the main factors in the dimensions to see whether the factors of IPD are present or not in Higher Education Institution. This is an important situation in this exploratory research to understand and to form the pilot interviews, many practitioners in the Malaysian construction industry failed to describe their understanding about the overall concept of IPD.

In the main interview session, a similar result was found, where all of the participants interviewed have no knowledge about IPD and their understanding about the IPD concept are very limited. After the researcher explained to the participants about the general ideas and what IPD is all about, then only the participant can relate the IPD concept and IPD elements within their knowledge and experience.

During the data collection, some of the participants can elaborate the sustainable campus and all of the activities that going-on within the campus. The sustainable portion is based on the sustainable pillars or the true bottom line of sustainable by Adam (2009). From the figure 4.2, sustainable nodes have been divided into three factors; social, environment and economy. These three factors divided into another sub-factor.

4.6 Current Practices of Constructions Process in Northern Region HEI.

Northern Region Higher Education Institution (HEI) commonly practiced the traditional and conversational delivery method in many of their projects, but the design and build project delivery method applied in the big scale project as a part of

the requirements. The way a project is conducted depends on the size of the project, project requirement and project value. The traditional method is used in a smaller scale project, which value is less than RM50,000 per project. Based on the interview, the project that cost more than RM50,000 will employ design and build delivery system and this project will be monitored by 'Economic Planning Unit' (EPU) from start to finish. Therefore, the EPU will decide ether the project needs to be evaluated by Value Management (VM) or not to be valued *'Seksyen Pengurusan Nilai'* (SPN) or Value Management Section.

All of the building projects must comply with the EPU standard which can be found in the EPU guideline and can be downloaded from the EPU website. This guideline is to ensure that the buildings complies with the range of standard of measure for the room size, toilets, meeting room and many other factors in the building. This EPU standard creates the baseline for the architect and the contractor to build the building to be adequately sized and to ensure all the spaces are utilised in good manner. For example, for the Vice Chancellor room is about 37.00 square meters, the Deputy of Vice Chancellor room size is 28.00 square meters, Dean's room is about 23.00 square meters and all of the components in the building have been stated in the EPU standard guideline book. The type, size and range of furniture also have been mentioned in the EPU guideline book.

Mainly for public university campus development projects and new building constructions are funded by the Malaysian government, which funding is allocated by the Malaysian Treasury Ministry from the yearly budget that is allocated under the Malaysian Education Ministry. This budget should be requested through the proposal of the project by the university board for their campus development and building construction. The university can submit an application of the development budget to

the '*Kementerian Pelajaran Malaysia'* (KPM) or Malaysian Education Ministry in Putrajaya to request the new development of the campus. The project must be estimated and must be justified before proposing to the government. The KPM then reviews the project need before making the selection. That project if selected will be awarded to the university to proceed to the next stage. This fund will be locked to the amount requested at that time, apparently when the project started, cost for the project will be increased to the higher cost of the amount. This increment of the cost due to the time length from the proposal to the KPM to the project start, sometimes it took about three years to initially start the project.

4.7 Analysis and Discussion of Findings from the Interview.

As has been highlighted at the beginning of this chapter, this research is aiming for the interview to gain as much data and gather as much of the information from the selected experts in the Northern Region Higher Education Institution campuses. The main data and information for this research is mainly about understanding the current practise of the process of the construction and design in Higher Education Institution development. At the same time, this research would like to find the sustainable elements within the campus construction projects and development. At the end of this research, the data and the result gathered will be used for improving the current construction practices through the suggestion in the discussion at the end of this research. Furthermore, the findings in this research can be the foundation of the further research and publication.

4.7.1 The Current Issue of Project Delivery in HEI Northern Region Campuses.

The interview first question focuses into the current practise in campus development, with the question:

> *"Could you please describe the current issue in project delivery in your organization?"*

This question was asked in order to gain an understanding of the issue and current practise of overall of the process and flow in the project delivery in Northern region HEI campuses from the expert practitioner view.

From the interview data gathered is found that there are many participants responded that the current practise is not the best practise for the project delivery in campus development. There are many issues that occur in the project delivery from start to end. From six participants interviewed, all of the participants mentioned that the development of the construction on campus are still using traditional procurement methods for many small-scale projects, specifically with a project value less than Ringgit Malaysia (RM) five million. This is because they (the participant) believe that the traditional procurement method is easy to deal with and this method is quite simple to manage. For bigger projects, most of the procurement type will be using the design and build for the construction. P3 mentions that for a new project in HEI an IBS system was used for constructing the new lab for the campus development which cost more than RM 30 million.

"There is one campus that uses IBS precast for the outside the main campus for one of the science faculty and it was one of government requirements for this project."

Many other participants mentioned there are only traditional method procurement and design and build procurement type that has been used in their project for project delivery as P1, P2, P4, P5 and P6 said. Below is the statement made by P1 from I1, the participant mentions about the current method that's been used in the campus project development.

"We use the traditional method for our small project such as bid and build. Then, we open the tender for the contractor to bid; the winning tender will get the contract to build the building or the project."

Within the same theme of the question, P5 form I3 also stating about the current practice that's been used in the campus development.

"It was easier using traditional method procurement and project delivery. It is because all of the staff already aware and fully understand the way of this traditional method."

All of the participants' share the same thoughts in which the usual way is viewed as easy and IPD complicated. So then, the interview that was held with the participants. Therefore, we can recognize the issue that happens during delivering the project in campus development. From the interview, the main problem has been identified whereby there are four main issues is about the budget constraint for the construction project in campus and, other than that is the performance of the contractor. Table 4.2

shows the list of issues and in project delivery on campus development categorised by the participant:

Table 4.2: *List of Issues Mentions and Highlighted by Participant about the Construction Process.*

No	Issues	P1	P2	P3	P4	P5	P6
1.	Deference view between Maintenance and Development Department and lecturer	X				X	X
2.	Less technical knowledge among lecturer		X			X	X
3.	Maintenance and Development Department has too many projects	X	X	X	X	X	X
4.	The project doesn't fulfil the specification	X	X			X	
5.	Too many reworks		X		X		X
6.	Many project delay			X		X	X
7.	Design fail				X	X	
8.	Consultant doesn't perform			X		X	X
9.	Architect refuses redesign plan		X		X	X	
10	QS doesn't perform					X	X
11	Documentation not complete	X		X		X	X
12	Drawing not complete				X	X	
13	Communication problem	X	X	X	X	X	X
14	Problem doing a renovation	X	X				
15	Strict EPU guideline	X	X	X	X	X	X
16	Tender award			X	X		
17	JKR chooses own contractors			X	X		
18	The contractor doesn't have enough money		X	X		X	
19	Late payment by agency			X	X		
20	Budget too tight	X	X	X	X	X	X

The budget issue has become a main problem for the campus development and has been mentioned by all participants and they are P1, P2, P3, P4, P5 and P6. The other issues also have been mentioned by other participant such as design, performance, delay, rework, authority and the straight EPU guideline.

There are many issues that have been mentioned by all of the participants during the interview. The issue can be seen from the table above. The participant was asked by this question;

Is there any problem or issue in term of project delivery?

So there are 19 types of problem and issue that gathered from the participant. The main issue that mention by the entire participant is "Maintenance and Development Department has too many projects" "Communication problem" and "Straight EPU guideline".

There are three main issues that highlighted by all of the participants, "Maintenance and Development Department Has Too Many Projects", "The Communication Problem" and "Straight EPU Guideline".

A) Maintenance department has too many projects

The project that is managed by the Maintenance and Development Department currently is too much to handle, the shortage of staff leads the insufficient supervision on the project site. This issues mention by P1 from 'I1' about the Maintenance and Development Department are currently handling too many projects that on going in the campus.

"Currently I am handling 7 groups of projects in this campus development"

This participant shows that he is currently handling numerous of on-going campus development projects, when it come with the several of excessive big and important project. The massive workload could direct into the inefficiency during solving any issues and problems in the projects.

Meanwhile the P6 from I3 has also mentioned about the numerous projects are on-going on campus simultaneously. But, most of the projects running's are in smaller scale project that cost less than RM50, 000. Because of there is more than 10 projects are ongoing in the institution for a month and the project duration about 3 months or less so the monitoring of the project becomes less efficient. This P6 describing the issue that happens:

"...there is an insufficient number of staff to monitor the whole project that happen in the institution, more than 10 small projects concurrently happen on this campus, even though we trying to ensure all projects working well but there are sometimes two or three projects missed from our sight. Because of this, some of the project doesn't meet the quality standard that we want."

This P3 from I2 similarly faced the same delinquent and the same issue about controlling countless projects at the same time. This P3 mention about the issue:

"...the factor that we try to compromise the entire project in this campus is impossible, there is too many small projects need to monitor

as the man power are limited and we need to make sure the project delivered according the budget given."

The P4 from I3 also mention about the problem of job-burden while handling countless project at the same time.

"There are hundreds of projects currently on going at the campus; most of them are small project that only takes a few weeks to complete."

B) Communication problem

The communication problem became as a one of the biggest issues in the construction project, as wrong communication can cause many other problems to occur. So from the interview data, all participants mentioned about the communication issue that happen in between unit in Maintenance and Development Department. P2 from I1 has mentioned that:

"... The electrical and civil management on campus have some communication and understanding issue because both of them set difference priority."

The P2 is mentioned about the issue of lack of the communication that happen in the Maintenance and Development Department. This is because the understanding in between both parties is not synchronized. The desynchronization in construction project has become a common problem with traditional and conventional procurement method and project delivery.

This communication issue or problem also has been mentioned by P4 from I2. This communication issue also related to the organizational communication, the P4 said:

> *"... The communication is very hard to control because the organization such as JKR are too big and many branches. The communication between central JKR and state JKR normally are quite smooth because of the barrier and distance makes it harder to control."*

The other participant also has voiced about the communication problem in the project development in campus. The participant 6 (P6) from institution 3 (I3) mentioned:

> *"... During the project delivery, many problems happen in between the construction and the communication issue always becomes the barrier between Maintenance and Development Department and the contractors."*

P4 from I3 raising the issue about the communication problem in between the staff and the contractor;

> *"...sometimes when we set the orders to do the project, the contractor they did not comply the orders..."*

The small contractors that mostly from the F class sometimes could not be able to understand the order and the instructions made by the Maintenance and Development Department during completing the project construction in I3. This will increase the possibility that the contractor will make mistakes in the

project and will indirectly increase the project cost to repair and rework of the error.

C) Strict EPU guideline

The other main issue is the "strict EPU guideline" has been the most mentioned by all of the participant interviews. P1 from I1 mentioned;

> *"...project must follow the EPU guideline after the Parliament endorses the budget for the project and then in every single things construct in that project need to report to EPU and follow the EPU guideline."*

The P4 from I2 faced the same issue like the other participant as the EPU guideline was so tight. P4 said:

> *"...the EPU guideline must be followed by the university in any project constructing or renovating the building in the campus. The problem when to comply the EPU guideline is when the project renovating the old building that the measurements are not following the specification from EPU. Therefore, we need to do re-adjust many things to make sure the PU guideline is followed."*

The issue is quite the same with the other participant that the EPU guideline is too rigid to follow for the constructing the project in campus. The EPU guideline includes the size of the room, the type of furniture for the staff, the size of the meeting room. The things is, that sometime renovating the old building with odd size and to try to fit in some lecturer rooms in it is quite a

challenge. For example the building floor is about 300 square feet. Then the lecturer room for the position, rank as DS54 is about 24 square feet. Furthermore, at the project planning on the paper it is easy to divide the floor, but when the actual assessment is done, the technical parties will realize that the proposed project/area is not feasible for the project objective. For example the old building has 20 pillars in the middle and it's hard to adjust the size of the room. So the management has to justify why the size of the room needs to be reduced to make sure the room can be built in-between the pillars.

D) Finding on IPD factors

From the findings of question one from the interview made on the participants from P1 to P6 and from institution 1 to institution 3 shows the result, there is the lack of knowledge of IPD in the project delivery. There are many problems happen while delivering the project in the campus development. The problems have been highlighted are summarised as below;

i. **Knowledge and human capital** –According the interviews that have been conducted, there are all of the participants do not have the understanding about what the integrated project delivery IPD is. After the interview data been analysed using NVivo 10 software, it shows the participant have experienced a few of the IPD characteristic and the IPD primary area.

ii. **Process of delivery** – The result of the interview demonstrates that most of the design and specification of the project in the Higher Education Institution (HEI) are using the traditional method for the

project that below than RM5 million. Based on the interview data, Maintenance and Development Department is more comfortable to use the traditional method because it was the easiest way for them to execute the small project. Smaller projects, mostly have short project duration in between 2-6 month from start to complete. These small projects are about repairing, maintaining, and renovating the small rooms or halls.

iii. **The mentality of the practitioners in relying on a system** – Most of the participants agreed that the integrated project delivery is impossible to apply in current Malaysian because the difficulty in accepting the new way of the technology especially for the new innovation that opposite from the current discipline. Therefore, most of the industry players are more comfortable to stay in their familiar region other than try to comply with the new regulation and method.

In order to overcome the problems related to the lack integration and collaboration, the next section will try to identify the solution for the issues.

4.7.2 Identifying the Current Design Process and Practise in Sustainable Campus Development.

In terms of understanding of the current process of campus development will be identified using the question 2, the question:

"In term of campus development, could you please describe the design process that involved the project delivery?"

The question was asked for enabling the researcher to gain the understanding of the current practice and the process used by the Maintenance and Development Department in campus development.

Most of the participants agreed with the fact that the current campus developments have many issues within the process from all aspects. The understanding of the fundamental aspect of constructive behaviour leads the participant answer to be based on their past and existing experience in managing the project in campus development. In this case, campus development is focused into the sustainable building project. Therefore, the interview that conducted to the participant 1 to participant 6 is to gain the understanding of the process in campus development in Northern Region Higher Education Institution (HEI). Even though, none of the participant understands about the IPD – Integrated Project Delivery, the data are able to enrich the content about IPD from the participant.

In terms of Maintenance and Development Department projects, most of the campus development processes involve the construction projects such as new building development, retrofitting, renovating and landscaping in HEI campus areas. The project constructed is supported in the budget from the Ministry of Education and some other budget comes from the university itself.

The process of campus development has been explained by a P6, whereby the development in the campus comprises of the building structure and the infrastructure. This participant mentions the development process for the internal project that is using the university's own budget without asking financial support from the government incentive.

"The development of campus what we do currently is the project new building for Muslim prayer building (surau), the new building for the international affairs school and welcome centre for the university. Other than that we recently finished the renovation and retrofitting the offices for postgraduate centre and for the future projects is the renovating the varsity mall."

P6 statements have shown that the institutions always develop the campus and maximize the capability of the unit Maintenance and Development Department to ensure the facilities are adequate for the students use. The same response found from the P3 that mention the facilities and the infrastructures are the biggest contributor to the campus development process.

Accordingly, P5 also mentions the process that's involved in the campus development is the building and infrastructure for the campus.

"...The first stage that involve in developing the campus; we will present the paperwork about the project in front of Vice Chancellors (VC) them after VC omit the plan then we will work out the complete proposal. The first one just now just is just the draft of ideas for the project. Later, after the proposal accepted by VC then the architect will work out the complete plan include the model of the building. The internal building sketch will be proposed to the head of department and endorsed by the Pengarah. After that the design will be presented to VC to seek their approval. Then we will sit in a meeting with all of us; from unit civil, electrical, and mechanical, surveyor and architect to do the checking on the plan to ensure all of the part and component of the building is correct. Like example, the civil engineers will check the structure of the building, the size of the beam, roof, gutter and wall. The electrical

engineers will do the checking for wiring, cables flow and type of equipment in the building. So this is the common processes that involve when the project is initiated."

The P5 has explained about the current process that involved in Maintenance and Development Department in building the new infrastructure for campus development.

According to the other interviewer, the P1 in the process of the campus development in the higher institution is more to the new campus development. Because the institution 3 is the newest campus in the northern region, all of the building for the campus is newly build and many of the other buildings are still under the planning for future development. Based on the interview of P1;

"The campus development is started from the list of needs that has to be presented to the Malaysian Ministry of Education or 'Kementerian Pelajaran Malaysia' (KPM) and this proposed list will be checked by the Economic Planning Unit (EPU) for the value management (VM) for the project above RM50 million. By following the scope of the project key in SPP2 form under UPU for the human development with the elements needed in the project."

Some of these projects will be conducted using conventional method and some will be using design and build method.

Based on the findings identified from the interview, many participants still go through the old process in doing the project for the campus development. This old process is the easiest way in dealing the project with the contractors, the government agency and many other participants in the construction. From the data that gathered in the

interviews, some IPD characteristic can be absorbed directly in the process of construction.

Consequently, the key participant early involvement in the projects such as the owner of the project, consultant, engineer, architect and the end user for the buildings can generate the solid planning for the campus development. All of the participants must participate in the project before the project is initiated to share the ideas and structured planning that may reduce many problems during the construction such as waste, time and manpower in the campus development.

Another aspect of early involvement brings the fiscal transparency in between the participant which is it can manoeuvre the project into another level. There are quite a number of the mega high education institutions, construction projects in Malaysia with the high budget. However, the workmanship, finishes and the quality of the building was not satisfying. The IPD can be one of the barriers for the problem to occur more damage in the industry. Delivering the project within the platform of IPD concurrently happens in many advanced countries such as USA, Australia, Hong Kong, Japan, some of the Europeans region and the others.

4.7.3 To Identify the Collaboration Among Key Participant in Project Delivery Process.

The collaboration is highly related to understanding each other and it includes the people in between, the company or organisation in terms of work culture, habits, norm and perspective of doing something that related to their project objective. Although collaboration in the projects is not used, is very difficult to ascertain the level of

collaborating mind set among the members. Along the way of collaborating there are many factors that to be overseen whether they are advancing collaboration, beginner collaboration or intermediate of the collaboration.

From the interviews conducted, many participants had mentioned about the collaboration with the others, such as the contractors having a collaboration with the suppliers, the collaboration project with the other main contractor and so on. In this scenario of the Malaysian construction industry experience a negative impact from the current economy downturn, for that the fiscal activity and the monetary stability have become weaker. From this point, many collaborations are being established in between, the company, firm and others.

Retrieving from the NVivo 10 analysis that the P3 do mention about their collaboration are mostly between the unit within the Maintenance and Development Department to make the decisions:

> *"For the project, the architect must get the input from end users first, therefore we will become a team and gather the information and we will discuss about the information that we have with the architect, engineer, quantity surveyor, and the end user. In the discussion, the schematic design will draft with a few options to select and with the budget costing together with the plan. After the user agreed with all of the selections, then the plan will be presented to the Vice Chancellor together with the consultant to select which is the most desirable design and cost for them."*

In the case form P1, the level of collaboration is just among the members in between units in the Maintenance and Development Department office, the relationship is extensive within the ideas and the execution the project. This is because, the amount

of the members within the unit in Maintenance and Development Department relatively small. The other factors are the entire members in the Maintenance and Development Department are sharing the same culture. Therefore, there is not much different in between them to cross over about and easy for them to integrate into each unit.

The P5 also mentioning the about the collaboration within the project that involved in their institutions, the collaboration in between the consultant and the contractor having the synergy as both of them are working together. As the participant 5 is mentioned in their statement:

> "*...it has to look into the contract first, the design and build contractor will do the designing for the building based on the interpretation by the consultant. The interpretation of consultant is based on the need statement from the client to the drawing and the contractor will be collaborating with the consultant to create the design of the building.*

From booth of the scenarios, it can be seen that the collaboration in the construction project has been practiced by the key players in the construction of campus development from the beginning of the project. However, the type of collaboration that created in between key participants in the construction projects of campus development is limited to certain parts of the operation and it is not giving much impact of the process itself. Even though there are many key participants in the construction project of campus development, most of the small sub-contractors that involve in the project having difficulty in monetary payment and transfer because of unstable Malaysian economic. Most of the collaboration that they have is through the monetary merging. Although the Malaysian construction industry is facing the

problems in terms of transaction aspect, but for some extend the collaboration among the firms does survive from the fiscal issues during the construction period.

4.7.4 The Type of Procurement been used in the Campus Development Projects.

Nearly more than ninety percent of the government Campus University in Malaysia is still undergoing for the new project development and most of the development projects are consists of the physical development. This is due to the aspirations of the government to establishing the Malaysian Higher Education Institution facilities to become an education hub for Asia Pacific in 2020. There are many Higher Education Institution in Malaysia are expanding the knowledge to be more diversified and sustainable in order to offer the optimal educational experience for prospective student booth from local and international.

Therefore, from the interview data gathered from all of participant interpreted in NVivo 10 shows the projects are still ongoing in their campus. It is depending on the type of project and the project scale to determine the type of procurement that can be used in the project such as redeveloping, retrofitting, renovating, reconstructing and building a new structure for the Malaysian Higher Education Institutions. All of these factors must have combined with the project scale project length, project cost and project priority determine the type of procurement is more suitable.

P3 mentioned about the procurement system that's been used in the project on the I2 campus;

"The project process in this institution, if the new project mostly we use the traditional approach procurement. Like an example, we just get the budget from the government around RM 20 million, and if the JKR let us do the project on ourselves so we need to register to "e-Perunding" and need to explore the Ministry of Treasury website to get the list of consultants that registered under them. Within this process, from the list of consultants, we can ask them to submit CTK (cadangan teknik dan kewangan) or the proposal of monetary and technical within the budget of RM20 million. Therefore the consultant will submit their design complete with the budget and fees. For that matter, we will bring shortlisted of the selected architect, civil engineer, quantity surveyor and contractor under the report in recommendation to tender committee for the endorsement."

The P3 further explained about the tender and procurement that has been used in the same institution;

"The consultant role after the tender closed, they have to submit the technical plan report, which includes the fiscal strength of the company that bidding in the tender, how strong the manpower in the company and any track record or the profile of the company also their past experience. Furthermore, in this institution, it will be easier using the traditional method of procurement because it is clear and we can see the list based form the price offered, their financial strength, the experience and their knowledge. All of these factors will contribute in the marks as a point based as higher point more chance to receive the tender to be awarded. Once the list completed, the consultant will come out with complete report to present to the university committee to agree with the selection of the contractors for the project."

From the government side, the officers those hands long the procurement system always finds the traditional procurement system is always the best way project to deliver. Intentionally, most of the officers like to be agreed with the traditional procurement system is so much in perfect for them. As mentioned by P3, most of the government tend to use the traditional procurement because it is easy to use has been in the system since before and also the traditional method of procurement workflow is very clear and easy to implement by them. In the traditional method of procurement there is a point system based to mark the contractor level. Therefore, using the point based to appoint the contractors will help the government officers to eliminate the low marks contractor be easier and faster. But there are various of loopholes around the traditional procurement system; it can easily abused by the contractor to get the tender and also another problem such as the lack of the transparency will direct to bribery, cronyism, nepotism, discrimination, and favouritisms.

P3 also mentions about the traditional system of procurement method that has been used in their institution:

> *"... most projects in this institution are currently using the traditional method which is the cost below RM1 million, we do the design and construct our own buildings..."*

P6 also mentioned I3 that the procurement that has been used in the institution is various from one to another project for the campus development:

> *"This institution mainly using the conventional procurement on the most of the projects, but some of the small tiny projects to have quick decisions so we do sometimes that we just use the direct award to appoint the contractors. Mostly smaller projects have a short duration of completion like one to fifteen weeks*

of completion of the task time frames and the budget of those small projects are not more than RM 500K. These projects always like repairing the building that needs to be very quick to be done. Thus the direct appoint contractor normally have a good track record with us and always deliver the clean job and also does not have any problem and strong financial background"

The other type of procurement that has been used in the institutions is closed tender; this close tender will be appointed by the institutions to the only selected appointed bidder to submit their price.

P4 mentions about the direct negotiation and close tender for the contractor to apply the tender from university;

"...there is many urgent major repairing that need to be done in the campus, sometime our team cannot cope with the problems and the issue here, so we need to hire the contractor to help us to settle the problem, the issue to handle is the manpower, we cannot hire people, but we can hire the contractor, and the contractor can get the man power so we just direct deal with the contractors to get the job done."

The P5 has mentioned about the design and build method for the project in the institutions;

"As the follow on what we work out in the early part of the planning, in this project we using the design and build system procurement..."

There are many different approaches of the procurement used by another institution, the selections of the procurement as has been mentioned before in earlier in the topic. Most of the procurement that used in the project on campuses is based on

conventional and traditional procurement type. Although, there is no IPD method has been implemented in the construction project in any of these institutions.

4.7.5 The Sustainable Elements in the Campus Project and Development.

The sustainable concept has become the main focus of modern construction building in this new era of the industry. The sustainable design campus has become a new a new trend in many Malaysian campuses such as in UPM, USM, UKM UM, UMT and many other university. Some of the university started to renovate and retrofit the old antic buildings into more sustainable design and energy saving. From the interview, many participants mention about the sustainable campus project, the planning and many constructed or under construction building with sustainable and green elements in the design.

From the interview data, P5 has mentioned about the elements in the construction project at the institution;

> *"...the new building that we construct has some of the sustainable and green elements in it, the Welcome Centre and Inasis Muamalat prayer hall. This Welcome Centre we use glass wall to get the natural lighting from the sun, the type of glass wall that we use can reduce the heat from the sun but still allow the light to enter the building. In this building we didn't use the air-condition for cooling, we use a giant fan for cooling, and the air from the small garden below and surround the area will keep the freshness in the building. Other than that we have a plan to build the water retention like a small pool to*

collect the rain water and pump it for garden use such watering the plant surrounding the Welcome Centre area."

The other participant in the same institution also mentions the same things about the Welcome Centre. P6 also elaborates the Inasis Muamalat prayer hall that using the green and sustainable concept for the building;

"The Inaasis Muamalat prayer hall basically we use the open plan which is it can allow the fresh air to circulate in the prayer hall. In this prayer hall we also use the giant fan to help the more air circulation in the building. We are also planning to build a water tank to gather the rain water to be used for Muslim prayer wash purpose."

P5 added about the recycling centre in the university and this centre currently help to generate some money to the university.

"In Maintenance and Development Department we have one unit that manage the garbage and wastage from the university, from the garbage, this unit tries to separate the wastage and the recyclable items to the other side and sell it."

The other institution P1 has mentioned about the sustainable building design in their institution;

"The building that we construct such as the main library, halls, lecturer offices and lecture hall are based on sustainable and green concept. Manly for the main library we use the glass dome, this glass dome can allow the light to enter the building and we do not need to use the light to enlightening the entire library ant the day time. The other is the lecture halls that have big

glass windows and automated smart sensor that can detect the motion in the hall and smart temperature control to control the temperature in the hall."

There are somewhat of the sustainable elements in institution I2 as mentioned by P4. These P4 has mentioned about the sustainable practice, sustainable building, sustainable transportation and sustainable environment.

"For the electricity consumption, we are using smart sensors for our buildings which are the light will turn on when a motion detected near the sensor. So this sensor can save a lot of electric usage for the building in the long run. Other than that we are also using the smart air-condition for the lecture hall, this air-condition will dim when there is nobody in the lecture room, we cannot turn off the air-condition systems because the lecture hall is quite big and it takes time to get cool, so we just use the dimmer to dim the temperature in the hall. As we know, the air-condition unit will consume a lot of energy when the start up to cooling the entire hall. Some of the buildings in this university, we have applied the building auto system (BAS) using the remote to control the lighting for the entire building, this system just applied to some of the building not at all buildings in the campus and this system can help us to reduce the energy usage. We also use the LED light of the building to make sure the usage of electricity can be reduced."

The sustainable practice and environment in the I2 that has been mentioned by the P4;

"We always in this university do our best to reducing the usage of the energy and we do recycle the papers, can plastic. The recycle bin is everywhere scattered in the campus to make sure everyone in this campus, take their part to ensure our environment can be saved. We have also had our green team

that always does the environmental activity in outside the campus; they always help to clean the beach, some area to keep the clean environment. On this campus, we always take care of the trees in, all the trees are inspected every year and we cannot just simply cut the tree, we need to get the endorsement from VC and we must present the reason why we need to cut."

The transportation to the campus has the green element which the management has recently changed the bus service with more environmentally friendly bus;

"Now the buses from UNIC vendor are friendlier to the environment, we are trying to reduce the number of cars on the campus as we know on campus the parking space is limited and more cars will lead to carbon footprint."

From interview results in this research, these sustainable criteria have been a popular factor to all universities and campus in northern region. The effort of the university to maintain and create the sustainable campus to be greener cannot be denied, the university also tries to be more proactive to improve the quality of the campus environment and the surrounding area. The approach that's been used by the university will lead the students to be more environmental concern and will lead to the better society.

4.8 Chapter Summary

The discussion about the interview findings derived from the methodology of the research has been explained in the first topic in this chapter. The discussion of the findings and NVivo 10 software used in the data analysis to understand the result will be held in the final chapter of this research in chapter five.

Within the issue that had been raised by all of the participants in the interview, the understanding of the main issues in the construction of the campus developing project becomes clearer. An undertaking of the issues can be made by suggesting more comprehensive IPD factors in to the campus project planning.

CHAPTER FIVE

DISCUSSION AND CONCLUSION

5.1 Summary of the Research

The previous chapters have described in detail the process undertaken in this research. The foundation of this research is established in Chapter One through the identification of research problems, aim and objectives, resulting in the formulation of research questions which guided the inquiry of this study. An extensive literature review has been conducted in Chapter Two of this research, exploring the concepts of IPD in the construction industry as well as highlighting the current IPD knowledge. With respect to the scope of this research, an overview of the Malaysian construction industry is included, as well as the campus development within the sustainable design in Malaysian university. Chapter Three of this research has described the design and methodologies employed in this research, which selection are guided by the research questions previously formulated. With considerations on the research questions and other methodological issues, this research embarks on a semi-structured methodological survey design to achieve its aim and objectives, which findings were reported in Chapters Four and Five.

This research aims to understand the current practice of the Higher Education Institution (HEI) in Northern Region specifically targeted in Universiti Utara Malaysia (UUM), Universiti Sains Malaysia (USM) and Universiti Malaysia Perlis (UniMAP) in how the construction development in their campus. Recap from the objective in section 1.5, this research will be achieved the understanding of the

current practise of design, construction and development process in the northern region HEI campuses. The second objective is identifying the key factors that significantly influence the effectiveness of integrated team delivery to achieve sustainable design and proposed guideline towards integrated practice for construction process in sustainable design of the campus development project.

This final chapter will be discussed and summarising the research finding based on the objective through the literature review, interviews and the investigation conducted by the researcher in this research. In conjunction with finalizing the research, the limitation and the contribution to the body of the knowledge will be presented in this chapter concluding with a recommendation of future work.

The research validation process can be determined by consolidating information's gathered from the interview and the literature in Chapter Three and Chapter Four. It was determined that the data gained from the participants align with the objective and has answered the research question. Therefore, in the following sections shall discuss the consolidation of the findings within the research scope.

Apart from that, this chapter will also include the limitations of this research, and reflections by the researcher for future work extending from the ideas gathered in this research. This chapter will finally end this research with the conclusions of this research. The following section will summarize the key findings from the literature review as well as the investigations made by the researcher as they are presented in this research.

5.2 Discussions and Key Findings

This discussion is to achieve the understanding of the information and the data gained in literature and interview. Then in this discussion also will validate the data through the consolidation of the information based on the objective that has been set in chapter one of this research. The aforementioned objective of this research will be the guideline to ensure the research will be within the scope and achieve the objective. This section will revisit and summarize the key findings from the literature review and data collection conducted in this research, in the order of the research objectives.

5.2.1 Investigating the Current Procurement and Project Delivery in the Northern Region HEI Campuses.

The Northern regions with campuses within the selected universities have a different set of needs and space in regards to the development of the campus. The diversity of the age, location, crowd, maturity and areas are the contributing factors making each university campus unique than the other university.

A) Traditional method

As shown by the interview findings, the traditional method is the most popular type of procurement in this northern region HEI. Many issues and problems arise during the project works, the main such as fragmentation of work task by contractor and sub-contractor. The other main problems during the HEI project development, construction are the issues of communication in-between main contractors, sub-contractors and consultant during the construction project

planning and construction project. The other issue that highlighted by the participants is wastage during the construction process. As highlighted before in Chapter Two, by following the integrated project delivery (IPD) it can be the best solutions for all of the issue and problem that arise as mentioned by (Singleton & Hamzeh, 2011).

B) Design and Build method

This design and build are less popular compared to the other traditional method of procurement in the northern region HEI. But most of the participants do mention the usage of this type of the procurement is quite frequent in the campus project planning and delivery. The design and build procurement method are commonly used for the bigger scale of the construction project in the campus development. As well-known project procurement in the government sector, this design and build project procurement is straightforward to apply into many types of project, as the design stage is incorporated throughout the project period. Design and build procurement methods have been noticed having many flawed with the system. The weakness of the system will be easy to exploit, violate and disrupted by irresponsible person.

This type of procurement creates the cost, time, manpower and waste issue in the construction project and requires highly experience contractors and consultant to work together to ensure the project can be proceed smoothly. Most of the issues in design and build come from the lack of knowledge and experience of the contractors and communication problem in between parties. As has been highlighted by Jayasena & Senevirathna, (2012); IPD as a philosophy occurs

when integrated practices are applied to design and build where the owner is not a party to a multi – party contract. The following chart 5.1 below shows the issue addressed by all of the participants.

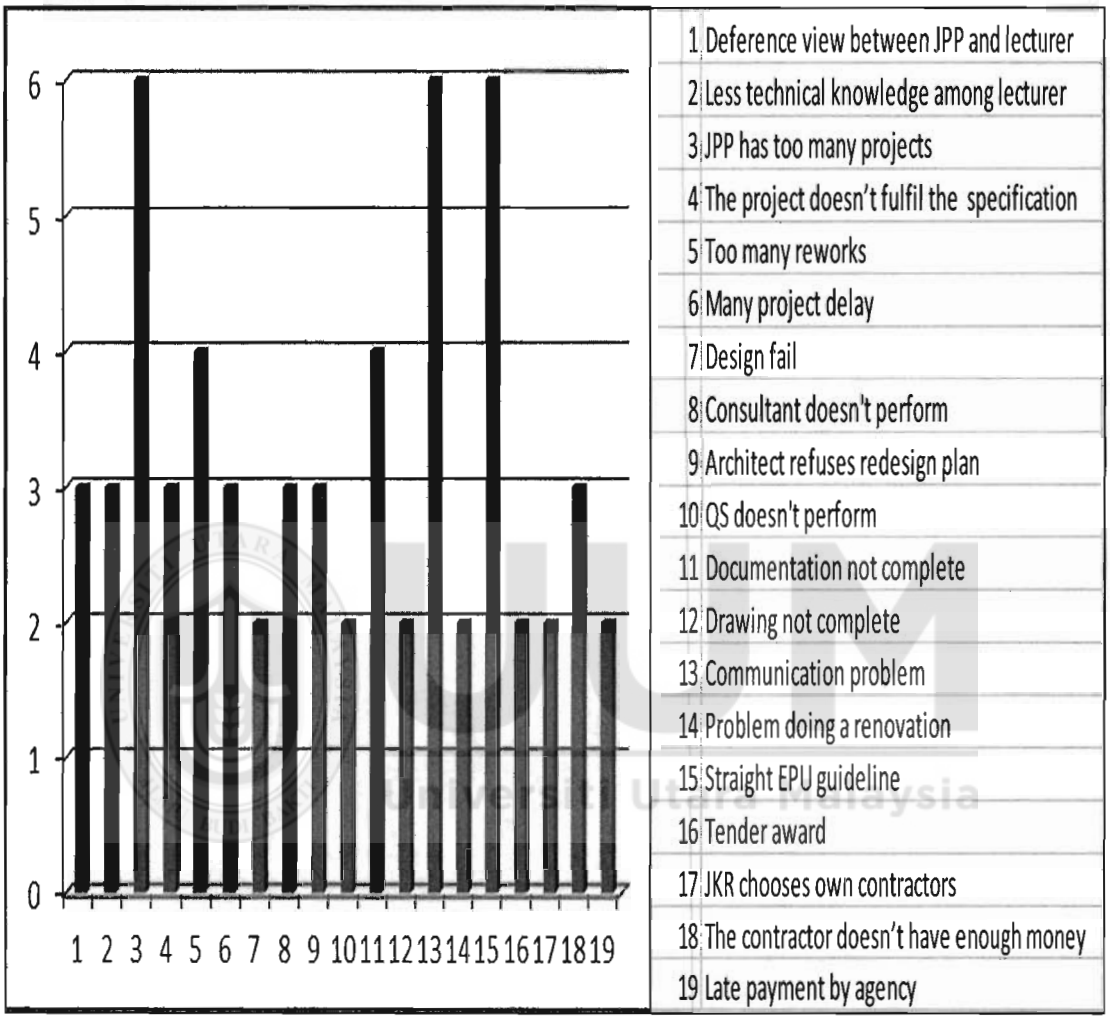


Figure 5.1: *The Issues Raised by the Participant*

There are three main issues that have been mentioned by all of the participants from the I1, I2 and I3. The majority of the participant mentions the issue about the Department of, Maintenance and Development has too many projects to handle, communication problems and straight EPU guideline. Those issues can be solved

through the IPD, as has been mentioned in Chapter Two and Three; IPD as a solution of the communication problem and teams. Through the five IPD characteristic as this is shown in figure 5.2 below;

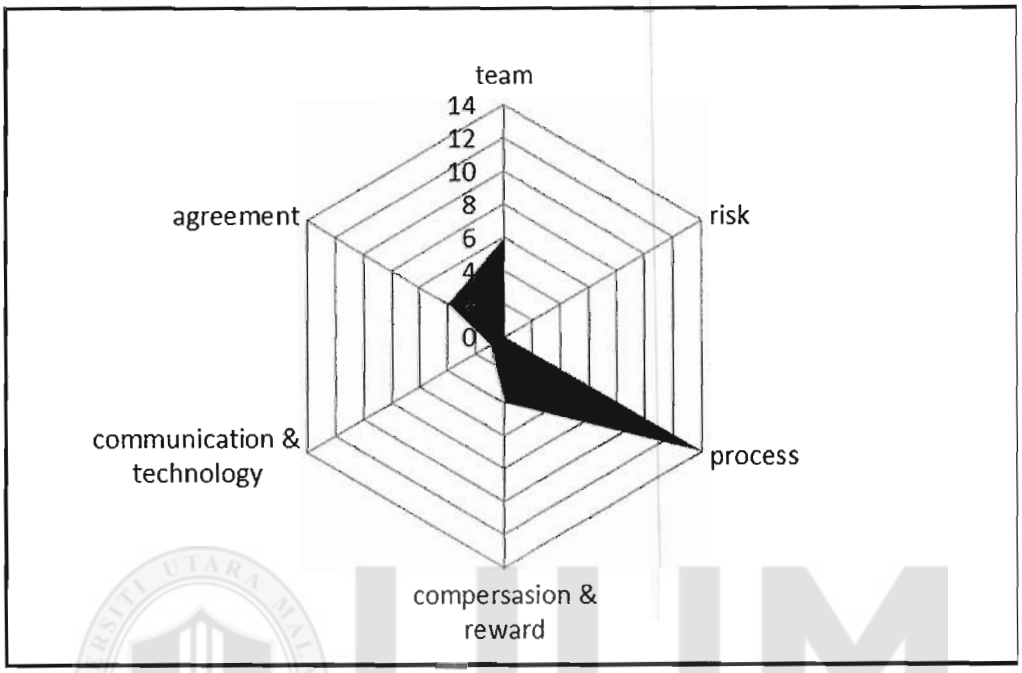


Figure 5.2: *IPD Characteristic Mention by All of the Participants*

From the figure 5.2, the construction process is commonly in the right track almost near to IPD characteristic. In IPD the process revolves on concurrent and multi-stage early contribution of knowledge and expertise among all of the members and the information shared within the parties. Most of the integration processes only happen during the project, not in the beginning of the early stage of project initiation.

As a conclusion the IPD in construction is a holistic solution to the problem and issues in the construction. In the modern construction, key players in the construction industry facing very tough challenges from the monetary, management, policy and cost aspects, such the material price hikes, competition in the market, new technology and many other challenges.

5.2.2 Identify The Current Design Process and Practise in Sustainable Campus Development.

The third objective of this research is to propose a guideline towards integrated practice for construction process in sustainable design campus building. Therefore, the identifying the current design process and practice in Northern Region of Higher Education Institution is one of the steps to obtain in depth knowledge about the real situation of the campus development. In campus development, there are many ways that are currently practiced in designing process in the project. As fully government sponsored higher education institutions, the budget for campus development are coming from the government. Many of the projects in campus development have a difficulty in terms of the budget received from the government. The lap time in between proposing the budget planning to the government takes quite a long time to get it approved and the cash to be ready. In the meantime, the price of material, service and equipment will be change and increase, therefore the budget requested would not be sufficient for the project. By the way, in this situation the project has to be redesigned to reduce the cost to ensure the structure can be built according to the specifications needed by client. As for the interview result, most of the participant mention about their convenience of using the traditional methods in campus development.

The three pillars of sustainability have been used for identifying the designing process for sustainable campus development. These three pillars have been mentioned in the literature review in Chapter Two, and template analysis in Chapter Four, the analysis that conclude the social, environment and economic factor as the bottom line for

understanding the designing process in the campus. These sustainable three bottom line factor divided into sub factors as seen in Chapter Four in Table 4.2 and have been analysed using NVivo 10 software to categorising the data form interview. The sustainable pillars, according to the literature reviewed shows in the sustainable development contain the three pillars as economic growth, environmental protection and social progress. In the literature review the pillar is illustrated as above, however, from the date of this research the wattage of each component appears slightly different than the literature which is the environment and social are quite similar to each other. In the literature the environmental factor is quite smaller than the social factor.

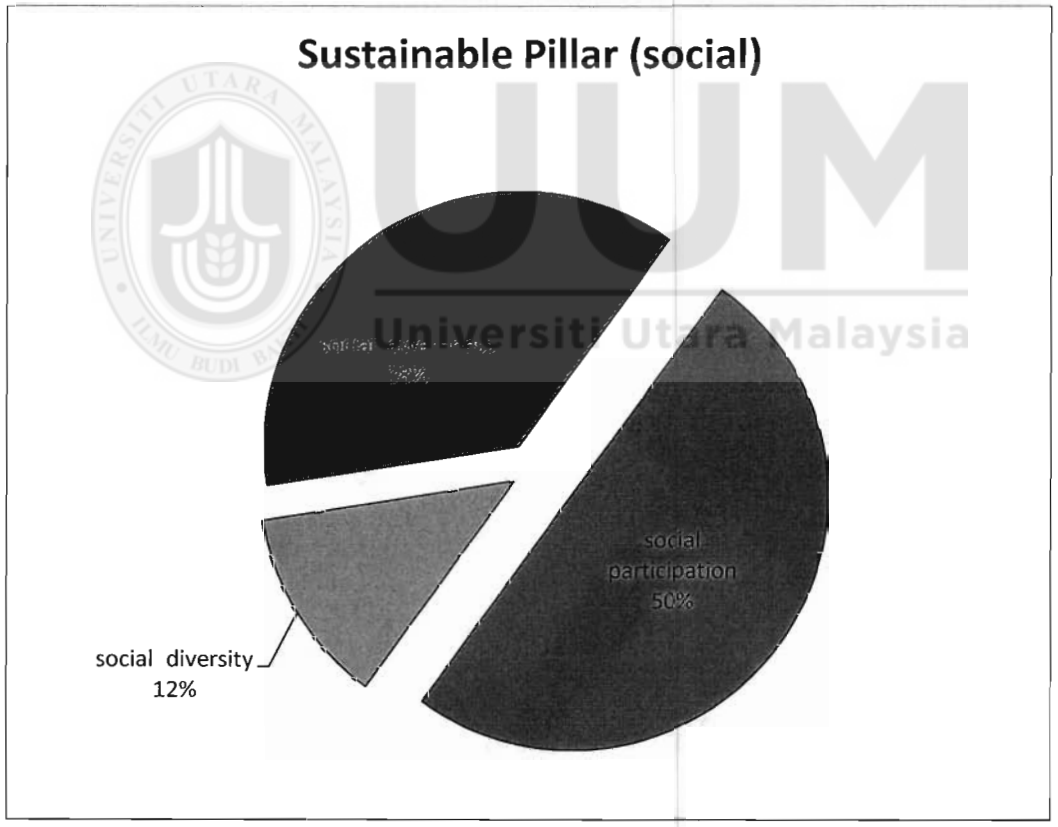


Figure 5.3: *Social Sub Factor*

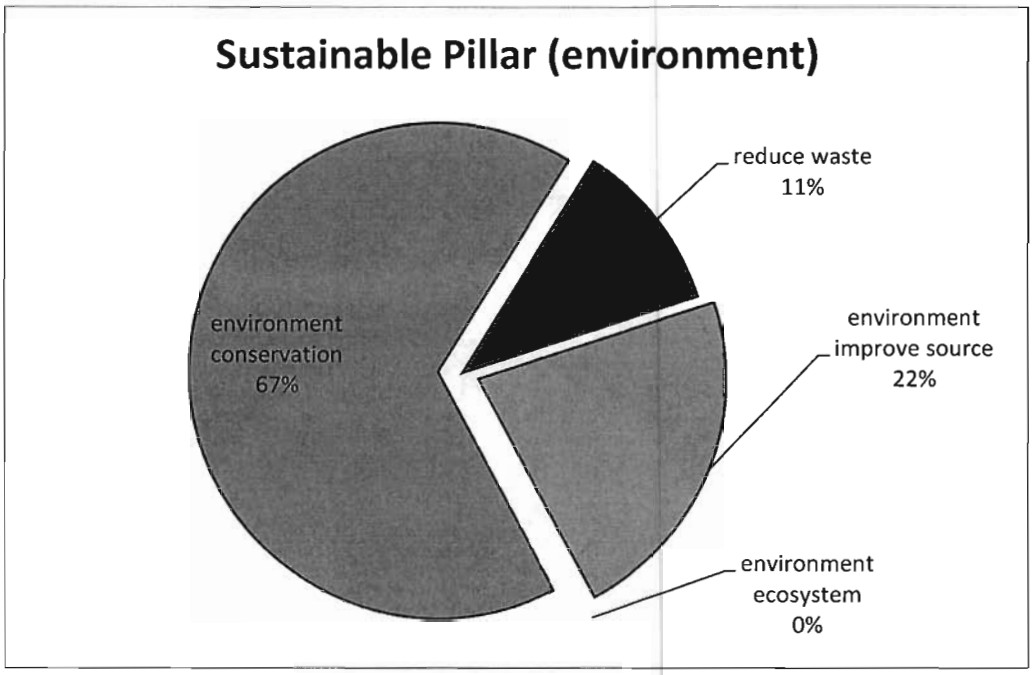


Figure 5.4: *Environment Sub Factor*

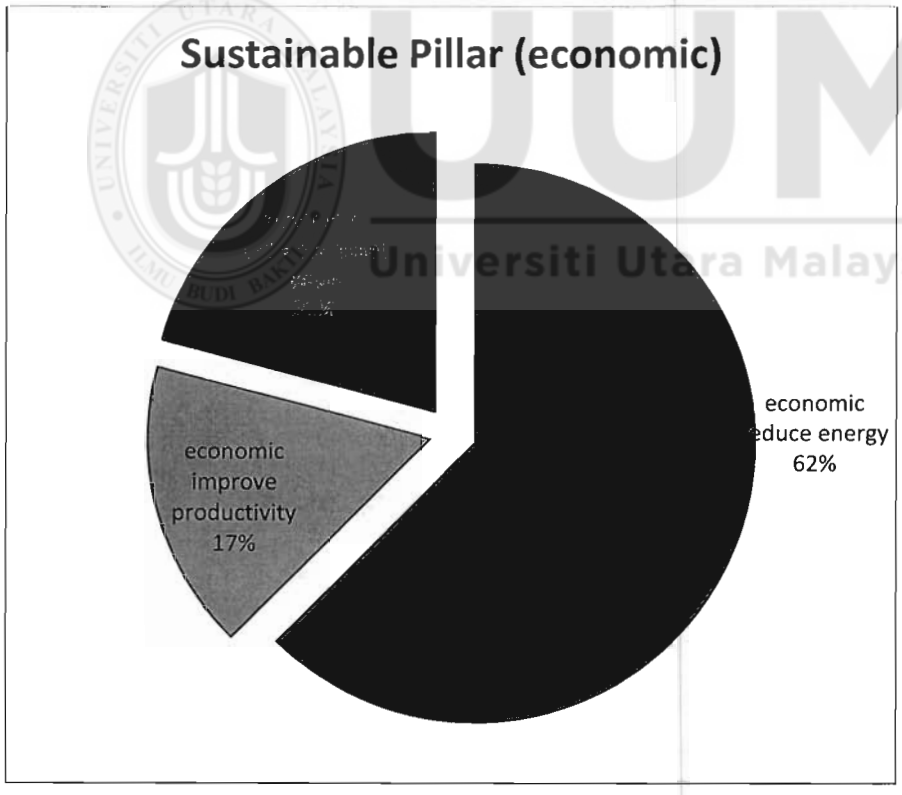


Figure 5.5: *Economic Sub Factor*

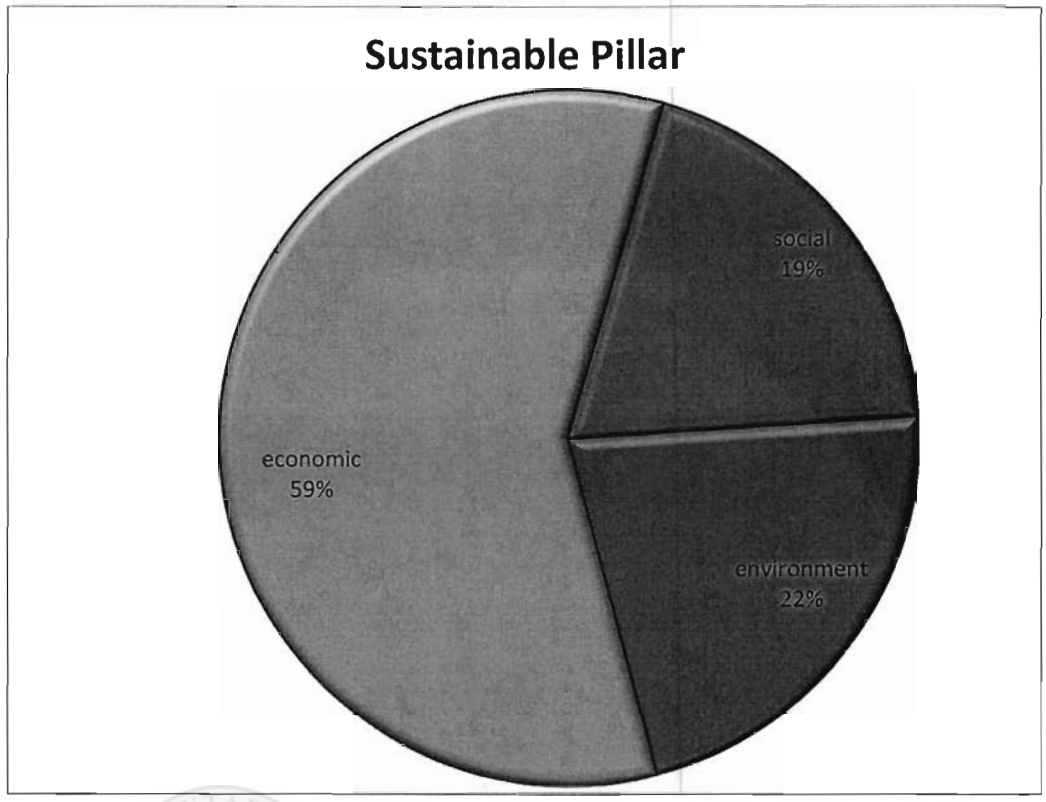


Figure 5.6: *Sustainable Pillar Factors from Interview Compare to Sustainable Pillar Factors from the Literature Review.*

From the Figure 5.2 to Figure 5.6 shows the significant comparison between literature and result from the interview. As seen in Figure 5.6, the 3 pillars of sustainability it shows the theory part and the reality part of sustainability. The theory shows the ideal of sustainability to achieve, beside, the reality is showing that the similarities from what the findings in the interview.

5.2.3 Identify The Collaboration Among Key Participant in Project Delivery Process.

In the Malaysian construction industry, there is some issue in the collaboration in between key participant of certain construction projects. Nawi, (2010) mentions the issue of fragmentation in the construction industry is causing the many problems in the industry. The result from interview gains the information from the participant that shows the level of integration in between the key participant in the construction projects in northern region higher education institutions. The participants of the interview have mentioned and are fully aware of the collaboration in the construction project in the northern region institutions.

The 'collaboration' is a part of the IPD factor in the IPD primary area. In IPD primary area there are five factors as mentioned by AIA 2009. Figure 5.8 below shows the result of interview based on the IPD primary areas;

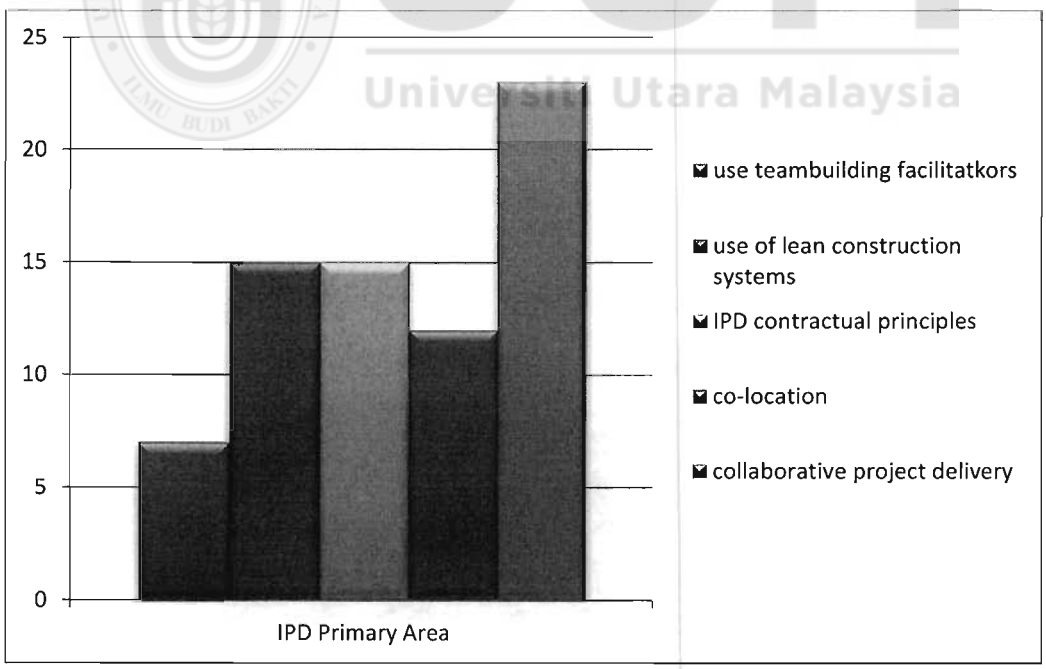


Figure 5.7: *Interview Result for IPD Primary Areas.*

The literature shows that the collaboration in the construction project is not really good in the Malaysian construction industry. But in this research it shows the opposite of what has been found in the literature. The collaboration in the construction project in northern region of Higher Education Institution has been mentioned by the participant quite frequent in the interview. Therefore that can be seen in the Figure 5.7 shows that the collaboration value is the highest although in contradicts the finding from the literature review reports. The collaboration in the construction project has been practiced in Northern Region Higher Education Institution but in very limited situations. For that so, many participants mention the collaboration in the project always in a small party. Furthermore, the participants have described the collaboration only happen in-between the contractors and sub-contractors or the contractors and supplier.

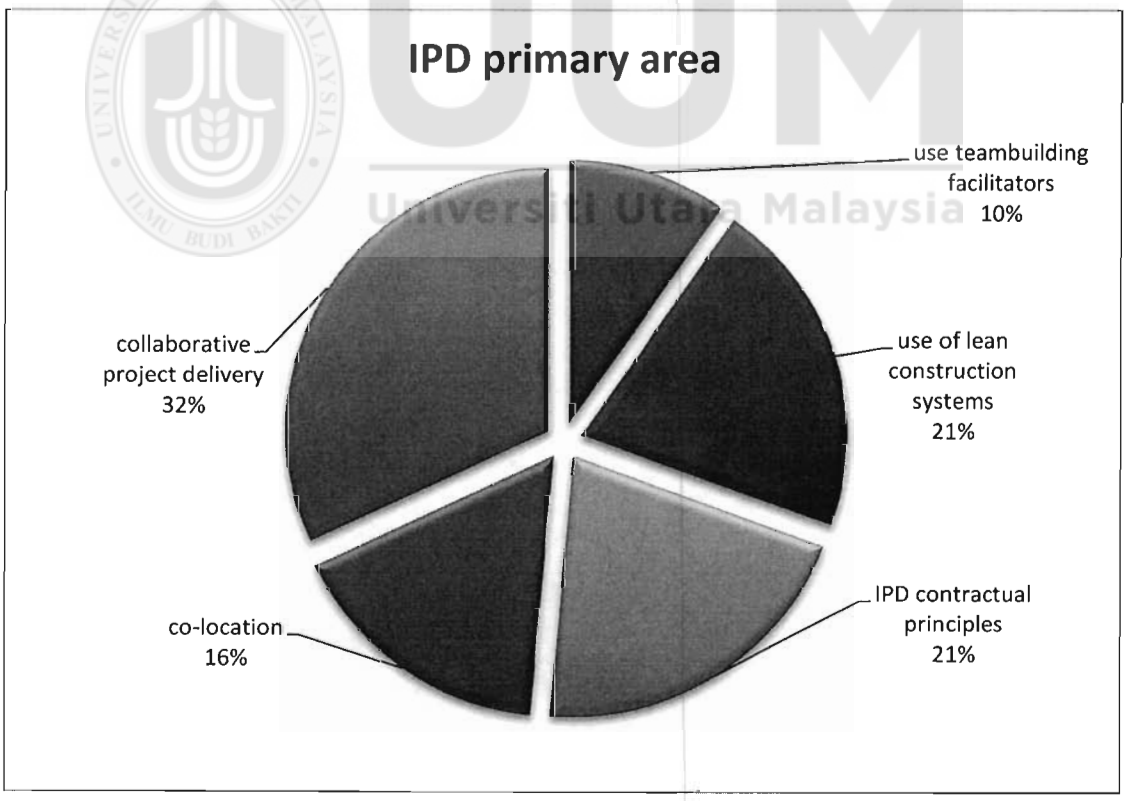


Figure 5.8: *IPD Primary Area by Percentage.*

The IPD primary area shows in Figure 5.8 the percentage on the sub factors result from the interview. All of the factors in IPD have been imposed in the Northern Region Higher Education Institution construction project. Although all of the factors being practiced in the northern region HEI construction projects, the method of implementation does not comply with the IPD procedures.

The next sub-chapter on this research will propose the IPD-sustainable campus guideline that may bring the understanding to the other researcher and the Malaysian construction player in managing and execute the project in campus development. In that sense, this guideline can be a base of the next construction project for sustainable campus development in Malaysian university setting. Beside as a base, this guideline can be another way for cost saving and achieving integration among key participant in a project.

5.2.4 Type of Project Delivery Used in Construction Project for Campus Development.

The Northern Region Higher Education Institution are a government funded universities whereby almost all of the expenditure in the university is funded by the Malaysian government. Therefore, most of the system in the university complies with the government systems, which systems include the structure hierarchy, positioning task, financial management, staffing and also procurement system in project delivery. All of the government sectors are tied to the government guidelines, and this guideline must be followed and imposed by all sectors and sub-sectors in the government.

In the Northern Region Higher Education Institution project constructions delivery, procurement and the whole of the project execution processes also comply with the guideline by the Malaysian government. Although the guideline is compulsory, some projects in the campus development were given some leeway to the university to manage the projects on their own. Many of the procurement and project delivery that has been used in campus development are using the conventional method. Furthermore, this method can be divided into four main delivery methods that have been used in the construction project for campus development.

From the literature reviewed in chapter two, the commonly used delivery method of construction is Construction Management at Risk (CMR), Design-Bid Build (DBB) and Design-Build (DB). Although in the literature shows the there are four common delivery methods that commonly used in the construction project delivery, the result gathered from the interview shows that only three variants of the delivery method are commonly used in the project campus development for the northern region higher education institutions. The usage of project delivery methods can be in the table below that shows the delivery method has been used in campus development;

Table 5.1: *The Project Delivery Method for Campus Development.*

Delivery Method	P1	P2	P3	P4	P5	P6
CMR	X	X	-		X	-
DBB	X	X	X	X	X	X
DB	X	X	X	X	-	X

Table 5.1 shows the delivery method that design, bid and build (DBB) is the most popular delivery method in campus development. The DBB method is the easiest method to use because it already well known in the global construction industry. The DB delivery method come to the second favourite in the Northern Region Higher Education Institution in terms of selected for the campus development project and followed by the CMR. All of these delivery methods have their positive factors and negative factors. This IPD as has been described earlier can be seen as the most comprehensive delivery method that is flexible for any construction type and enable cost savings.

From the analysis of NVivo 10 software, the interview data that have been analysed indicates the generated values of the IPD characteristic in the percentage form. The resulting outcome of the values of the IPD characteristic that generated form NVivo 10 software can be seen from the figure 5.10 below;

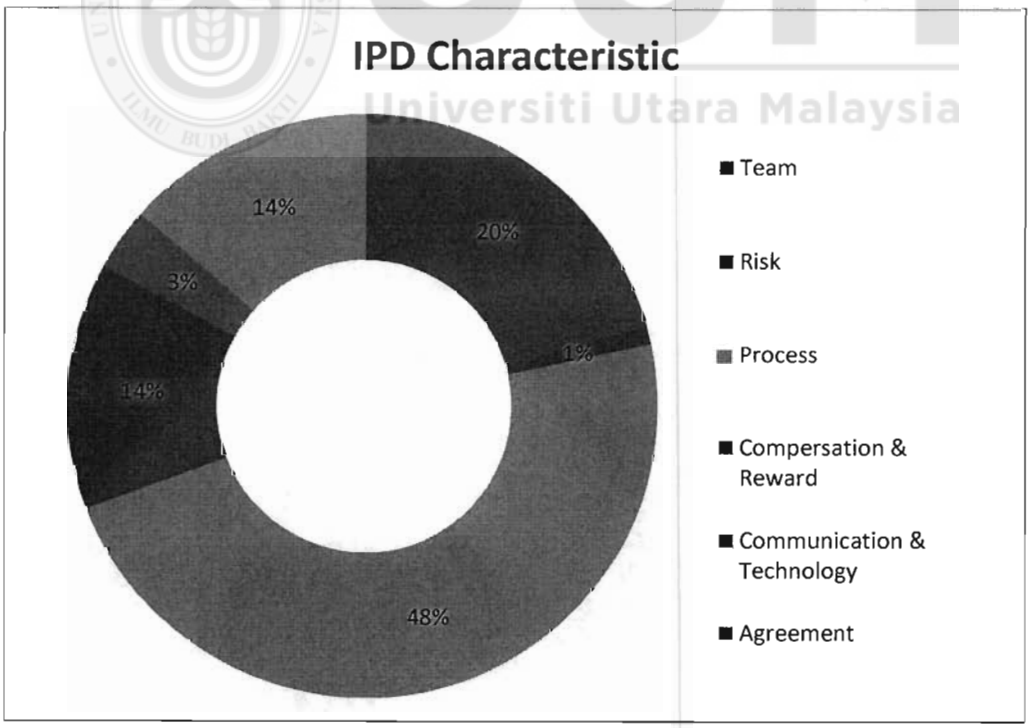


Figure 5.9: *IPD Characteristic From NVivo 10 Analysis.*

The doughnut chart in figure 5.9 above shows the IPD characteristic factors that has been extracted from the interviews of the expert participants in northern region higher education institutions. This doughnut chart shows the IPD characteristic of the process in project development has scored 48% is the highest compared form the others. The process of the construction is involved from the beginning of the project ideas initiating until the project handover. Other than that, is the communication and technology, compensation and reward, agreement team and risk.

5.3 IPD Sustainable Campus Development Guideline.

The core of this research is to get the guideline for the sustainable design campus development through integrated project delivery (IPD) as it is has been stated earlier in the research objective. Furthermore, the integrated project delivery (IPD) is seen as the most comprehensive and solid project delivery of the construction project. Therefore, the guideline for IPD sustainable campus development is an important segment of the research niche in the campus sceneries.

In this research, the target area is in the design process for sustainable campus development in northern region higher education institutions. Those guidelines are limited to that stage as the reference for the campus development unit to do the project planning. IPD will be the base of the guideline to achieve sustainable campus development.

As a standard for IPD sustainable campus development, there are some factors that contributing into the guideline. Based on the factors of the IPD primary area and IPD characteristic, this guideline will be performed towards the sustainability in HEI

campus development project delivery. Primarily, it will focus on the project planning and in initial stage of the construction projects of higher education institutions.

A. Campus Planning & Site Design

Good campus planning supports the wise use of land, creates operational efficiencies, minimizes negative impacts on the land and surrounding uses, and improves the aesthetics of the campus and neighbouring communities. All siting decisions will assess and consider the long-term impacts of current decision-making on the campus community as well as the university's resources, academic programs and operating costs.

B. Goal:

- Accommodate campus development on the sites which enhance the mission while minimizing environmental impacts to the existing open spaces and natural features and schemes.

C. Campus Strategies:

- Ensure regularity with the current campus plan
- Reduce the quantity of capitals needed to sustain the campus
- Reducing the impact of the campus on communal service area
- Reduce site disturbance associated with construction projects
- Continue to support a compact, walk able campus, with the majority of academic buildings accessible within easy walking distance.

- Maintain and renovate existing buildings to optimize the use of existing academic space
- Utilize surface parking lots within the Ring Road for building sites

D. Pre-Design:

- Select a site which reflects campus plan policies and objectives.
- Reuse development sites or previously paved/altered sites where possible.
- To locate sites where infrastructure is easily accessed or can be provided with minimal site disturbance and environmental impact.
- Assess and document site-specific environmental conditions, including storm water runoff, vegetation, and soil conditions.
- Incorporate sustainability goals and objectives in the program of requirements, consultant selection criteria and project terms of reference.

E. Design:

- Minimize the area of the site dedicated to building and parking and access roads to the extent possible for the building program, user comfort and campus aesthetics.
- Maintain building setbacks that effectively utilize the site while respecting the surrounding environmental conditions and campus aesthetics.
- Site building to minimize pedestrian and vehicular traffic conflicts Construction Documentation & Specifications
- Specify site construction practices that support or enhance the ecological integrity of the site.

- Specify procedures to protect the site during construction which include, at minimum, tree protection requirements, soil removal, and erosion control.

F. Construction:

- Protect vegetation, topsoil, and ecologically sensitive areas during construction.
- Select a staging area for construction equipment and materials which minimizes site disturbance and traffic impacts

G. Post-Construction:

- Educate building users on sustainable building features, natural systems and environmental features.

5.3.1 Sustainable in IPD for Campus Development Guideline for Design Process

Integrated Project Delivery (IPD) has been mentioned as a good way for the construction project to be conducted. The IPD has many benefits to the construction project that can reduce many costs, solve many problems and issues. Below is the guideline for the campus development, project planning process:

A) Project planning

1. Early involvement of key participant in a project plan
   - Sustainability can achieve through a comprehensive early stage of design and planning process.
   - In the initial stage of planning

2. Lean system of the project planning
    - The lean system can ensure the construction project can be done at minimal cost and risk.
3. Collaboration with all participants
    - All of the project participants collaborate in the early stage of the construction project planning to ensure the timeline of the material delivery, construction works on site can be punctual.
4. Communication and information sharing
    - The communication and information will be shared with all of the participants in the construction project to ensure the project can run smoothly.
5. Agreements
    - The participants will be tied together under the agreement that all of the must sign and follow the timeline and sequels of the project. The agreement will be a mutual contract that requires the understanding from each participant from the owner down to the contractor workers and suppliers.

Clearly, this guideline is adequate for the early stage of the project planning for the northern region higher education institution sustainable campus development project.

5.4 Research Limitation

This study has been made for the Master of Science research, there are some factors that limiting the research to be more extensive. In the course of conducting this research, the following obstacles were encountered:

1. **Having a limited number of appropriate participants** – The data collection and validation of the Integrated Project Delivery and sustainable campus development has limited number of participants.
2. **Participants busy and rushing for something during the interview** – The participants have limited slot of time and had to rush for other things.
3. **Difficulties in obtaining and accessing information from the participants** – Many participants lack of understanding of IPD.
4. **The issue of translation** – As the Malay is the main language; it is emerged and proved to be a major challenge to the researcher. Although the researcher has assigned specialists to transcribe the conversations, not all Malay words can be translated to English.
5. **Research is focused within the Malaysian context** – The research only includes findings from the Malaysian construction context. It would be expected if the research context is expanded to include other countries.

The research of IPD is an exploratory research, as this IPD is a new concept in the project delivery for campus project development. Many of the participants do not have any understanding and knowledge about the IPD.

5.5 Contributions to the Knowledge

This research focuses on identifying the link between sustainable campus planning and the use of integrated project delivery (IPD) to achieve this. Therefore the contribution of this research to the knowledge can be viewed in several aspects as follows; the awareness of IPD concept among the industry experts and practitioners,

the sustainable campus ideology in the Malaysian context and the novelty of approach to solving the issues in this exploratory research.

Due to the infancy of IPD in the Malaysian construction industry, there is a lack of discussion and evidence of IPD being implemented in the country, as well as in sustainable campus development. This research has closed the gap in identifying the awareness of industry experts and practitioners in regards to IPD implementation in construction projects. It has also highlighted how the specific characteristics of IPD can help in synchronising all parties involved to get on board with the sustainable campus planning.

This research has specifically observed the planning aspects in the Malaysian northern region campus universities which will lead to sustainable development and operations of the campus. Through data collection and analysis of findings, it was determined that out of the three campus universities observed in this research, only one of the universities have taken official measures leading towards sustainable campus operations. The remaining two universities which are significantly less in years of establishment and revenue are making efforts in parts of its campus development. This indicates that sustainable campus is an effort that requires not only experience, but also a sound source of income to enable initial investments in green infrastructures and facilities around the campus. Hence, in identifying the necessary elements for sustainable campus development in the Malaysian context, it will be worthwhile to take into considerations of experience and funding required for these projects.

This research has contributed to knowledge in the novelty of its approach to solving the challenges of planning for a sustainable campus development by matching it with

a collaborative project procurement method such as IPD. Although the results are preliminary in form at present, it is indicative of the positive impact that IPD can bring to sustainable campus development in the future.

5.6 Recommendations for Future Work

This research can be expanded to be more extensive in the whole Malaysian construction industry. The limitations of time, budget and resource have become a barrier for the research into this. For the next research and future work can be done in the whole Malaysian construction industry for the sustainable integrated project delivery;

- Framework
- Policy

This recommendation is important to achieve to ensure the understanding of IPD not only use in Northern Region Higher Education Institution but all sectors in Malaysia.

5.7 Chapter Summary

This chapter has answered all of the research objective and the research question from chapter 1 at the beginning of the research. In this chapter also synergising the findings from a literature review and the data collection stage witch found the base that inspired the development of the guideline for sustainable IPD in campus development.

APPENDIX 1

INTERVIEW QUESTION

Section A: Profile of the Respondents

1. What is your job title? :

   _____

2. What is your highest level of qualification? : -

   _____

3. In which country did you study for this qualification? :

   _____

4. What is your age category? (please mark 'X' where applicable)

   a. 20 to 24 yrs ☐
   b. 25 to 34 yrs ☐
   c. 35 to 44 yrs ☐
   d. 45 to 54 yrs ☐
   e. 55 to 64 yrs ☐

5. How long have u been with your current organization? :

   _____

6. How long have you been in current organization? :

   _____

7. Do you formally supervise other employees? (please mark 'X' where applicable)

   a. Yes ☐ b. No ☐

8. How many employees formally report to you? (please mark 'X' where applicable)

   a. 1 to 10 ☐
   b. 11 to 20 ☐
   c. 21 to 50 ☐
   d. 51 to 100 ☐
   e. 101 to 150 ☐
   f. More than 151 ☐

9. How many current projects involvement in the organization? (please mark 'X' where applicable)

   a. 1 to 5 ☐
   b. 6 to 10 ☐
   c. 11 to 15 ☐
   d. 16 to 20 ☐
   e. 21 to 25 ☐

Section B: Integrated Project Delivery (IPD)

1. Have U ever heard about IPD?

2. Can you tell me your understanding about IPD?

3. Have you ever involve in any integrated project? / describe

4. What are the challenges of implementing IPD project?

5. How do you feel about IPD?

Section C: Sustainable design and development

1. What do you think about sustainable?

2. Do you have any experience in any project that involving any field of sustainable?

3. What are the challenges of implementing sustainable in construction?

4. In what position of involvement in the project?

5. What do you feel about implementing sustainable campus?

Section D: Design and planning

1. What are the current practices of construction process?

2. What are the main issue / problem / challenge / barriers in construction (campus development)

3. Can you describe your experience (positive / negative)?

4. What would you change in system to make it more efficient and effective?

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