CHAPTER FIVE

RESEARCH FINDINGS:
QUANTITATIVE ANALYSIS

5.1 INTRODUCTION

This chapter discusses on findings gathered from questionnaire survey with the purpose of seeking understanding mainly on research question five of this study – ‘What are the most significant sustainability principles of buildings and how the principles should be integrated into the planning process of Malaysian building project?’ from the views of Malaysian project stakeholders. This chapter also proceeds to refine the preliminary framework that has been constructed throughout the literature review process in Chapter Two and Chapter Three of this study. The findings are mainly based on an analysis of data using the Statistical Package for Social Science (SPSS) version 17.0 for Windows and Microsoft Office EXCEL 2007.

This chapter focuses the discussion on four main sections. The first section analyses of the questionnaires on the key stakeholders’ background including their education, involvement in sustainable building project and its planning process. It then investigates further stakeholders’ views on the cycle of building which sustainability principles should be incorporated and their understanding on the impact of the sustainability integration towards successful project performance in the second section. The third section reports on the problems related to this type of project among the project stakeholders. Ultimately, these three sections have revealed the relevant facts, views and the perceived thoughts of various project stakeholders involved in Malaysian building industry. Frequency and descriptive statistic and cross tabulation statistic have been employed in analyzing the data for this section. The fourth section critically analyses the opinions of project stakeholders of the importance of the 50 factors (29 sustainability principles and 21 strategies of sustainability integration into the planning process) identified in the preliminary framework (refer the details in Table 3.8, p132 and Part B and C of the questionnaires, pp312-315). This section reports the results of four stages of data analysis that has been utilized: Cronbach’s Alpha Measurement, Factor Analysis, Descriptive statistic (frequency and descriptive analysis) and Relative Important Index (RII). The finding from Cronbach’s Alpha Measurement, Factor

Analysis and Descriptive statistic analysis is significant in providing accurate estimate of internal consistency and indicates how well the factors in the set are correlated each other. It is also important in reducing the factors and selects only the important factors from the preliminary framework.

A specific conclusion of the research by bringing together the findings of different measures is addressed. This is called triangulation of measures (Neuman, 2003) as he highlighted ‘by measuring something in more than one way, researchers are more likely to see all aspects of it’ (Neuman, 2003:138). From the findings, ‘Framework of Integrating Sustainability into the Project Planning Process (stage 1)’ is proposed. RII was employed to indicate the weighting value of each factors and assigning the appropriate weighting levels to each of the final selected factors. ‘Framework of Integrating Sustainability into the Project Planning Process (stage 2)’ is developed before concluding the chapter.

5.2 STAKEHOLDERS BACKGROUND

Table 5.1 shows the response rates for questionnaire survey on Malaysian building project stakeholders. Respondents were divided into seven major groups of stakeholders namely developers, architects, engineers, planners, contractors, public universities and local authorities. One hundred eighty eight (188) samples were successfully obtained, making the overall response rates of 100%.

Table 5.1: List of Respondents

Project Stakeholders	No. of responses
Developers	37
Engineering Firms	9
Architect Firms	48
Town Planning Firms	10
Contractors	71
Local Authorities	11
Universities	2
Total	**188**

5.2.1 Educational Qualification, Working Experiences and Career Development

According to Saarinen (1976), perception and attitude of individuals are very much influenced by their knowledge in the subject matter, education level and social upbringing. To gain understanding of respondents, the survey includes questions on gender, level of education, professional institution membership, training, length of service in construction industry and involvement in sustainable building project and the planning process. The background of respondents who took part in the survey is presented in Table 5.2.

Table 5.2: Background of the Respondents

Characteristic		**Frequency**	**Valid Percent (%)**
Gender	Male	133	70.7
	Female	55	29.3
Total		**188**	**100.0**
Highest Educational Level	Degree	168	89.4
	Masters	17	9.0
	PhD	3	1.6
Total		**188**	**100.0**
Membership and Training	Professional Institution Membership	112	59.6
	Professional Institute Membership and CSCS Card	4	2.1
	Professional Institute Membership and Ongoing CPD	14	7.4
	Others	58	30.9
Total		**188**	**100.0**
Experiences in Construction Industry	11-15 years	154	81.9
	16-20 years	20	10.6
	21-25 years	13	6.9
	26+ years	1	0.6
Total		**188**	**100.0**
Involvement in Sustainable Building Project	0 project	71	37.8
	1-5 projects	110	58.5
	6-10 projects	5	2.7
	11-15 projects	2	1.1
Total		**188**	**100.0**

Through the analysis that has been done, it was found that construction industry in Malaysia is predominantly male. It was proved by the result shown in Table 5.2 which revealed that 71% of the respondents were male. A hundred percent (100%) of the respondents are degree holders, which is 11% of them are also master’s degree and PhD holders based on the responses regarding their highest educational level. Meanwhile, it was found that 69% of the respondents have related professional institution membership. Besides, 30% of them are not involved in any professional membership and training that listed in the questionnaire. Alternatively, they obtained their career development from the other sources which were not mentioned in the questionnaire.

A total of 62% of the respondents have been directly involved in sustainable building project. This percentage is considered unquestionable because this project is still new and unusual among the construction stakeholders in Malaysia (Zainul Abidin, 2010b). It was revealed that majority (81.9%) of the respondents have been active in the industry between 11 to 15 years and 62% of them also having experiences in sustainable building project. The rest of 18.1% respondents have been active in the industry between the ranges of 16 to 26 years and above, 62% of them are also involved in sustainable building project. The duration of working experiences between 11 to 15 years are considered fairly long for construction industry. Moreover it was found that the respondents within this group were also the majority (82%) out of the total respondents who have been involved in between 1 to 15 sustainable building projects (62%) as shown in Table 5.3.

Table 5.3: Respondents' Working Experiences in Construction Industry and their Involvement in Sustainable Building Project

		Involvement in sustainable project				Total
		0 projects	1-5 projects	6-10 projects	11-15 projects	
Length of service in construction industry	11-15 years	58	95	1	0	154
	16-20 years	11	5	2	2	20
	21-25 years	2	9	2	0	13
	26+ years	0	1	0	0	1
Total		71	110	5	2	188

Majority of the respondents (79 out of 117 respondents) who have been involved in sustainable building project were also occupied in the planning process of the project as shown in Table 5.4. Considering the level of education, working experiences and career development, the respondents who gave their responses in the survey are considered to be competent to give their ideas on the subject matter.

Table 5.4: Respondents' Involvement in the Planning Process of Sustainable Building Project

		Involvement in the planning process of sustainable building project				Total
		0 project	**1-5 projects**	**6-10 projects**	**11-15 projects**	
Involvement in sustainable building project	0 project	71	0	0	0	71
	1-5 projects	37	73	0	0	110
	6-10 projects	1	0	4	0	5
	11-15 projects	0	0	0	2	2
Total		**109**	**73**	**4**	**2**	**188**

5.3 STAKEHOLDERS' VIEWS ON SUSTAINABILITY INTEGRATION INTO THE PROJECT PLANNING PROCESS OF BULDINGS

'Green building is better regarded as a process rather than a product' (Wu and Low, 2010:65). According to several researchers such as Wu and Low (2010); Halliday (2008) and Gottfried (1996), sustainability principles should be integrated into the whole life of building process including conceptual and design, construction, operation and maintenance and disposal and the sustainability integration should be made since the planning process of early project stage. This study attempted to probe respondents' perception in clarifying this issue further (Question 11, Appendix A, p310).

Figure 5.1 (p170) shows that majority of the respondents (91%) agreed that sustainability principles of building should be incorporated into the whole life of building and the integration should be made at the beginning project stage. The finding supports the previous mentioned views that sustainability integration into whole life of building through the planning process since the early project stage is the critical importance to realize the goal of sustainability. Planning process is the starting point to achieve sustainability and the decisions made at the first phase of building design can significantly affect the cost and efficiencies of later phase (Gottfried, 1996).

The respondents were then asked to response on sustainability integration into the planning process whether it is beneficial towards successful project performance or otherwise (Question 12, Appendix A, p310). Respondents were allowed to choose more than one answer for this question. Four choices of successful project performance measures - cost, time, quality and stakeholders' satisfaction (Zwikael, 2009 and Chan and Chan, 2004) were given. The findings are indicated in Figure 5.2 (p171) and summarized by each category in Figure 5.3 (p171).

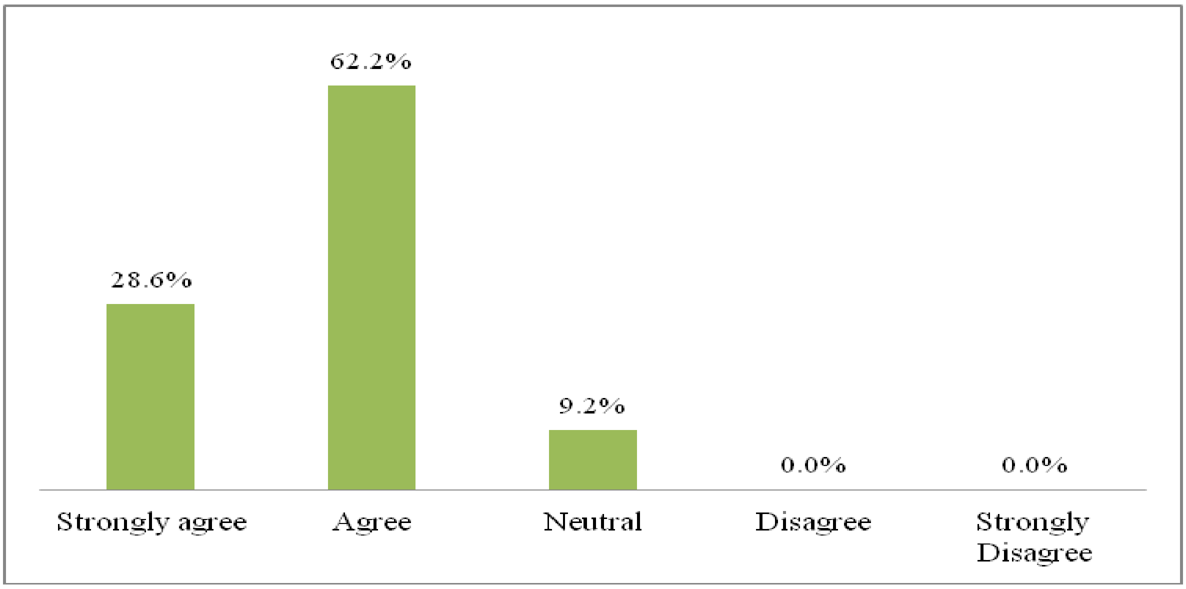


Figure 5.1: Respondents' feedback on sustainability integration into the whole life of building through planning process.

Table 5.2 and Table 5.3 show that there are only 14.5% of the respondents considered the sustainability integration into the project planning process benefit towards four given successful project performance measures. Quality measure was the highest choice of benefit by majority of the respondents where returned the Total Influencing Percentage (TIP) of more than half of them which is 55.1%. Meanwhile, the rest of the three measures which are cost, schedule and stakeholders satisfaction were considered as secondary benefits from application of the sustainability integration into the project planning process. It was revealed that majority of the respondents are currently less appreciate the sustainability integration into the project planning process as significantly affect towards cost reduction, schedule effectiveness and stakeholders satisfaction as at the same level as the quality target.

This finding was quite contradicted with studies by several researchers such as Doyle et al (2009) who stated that sustainability integration into the project planning process such as through integrated design approach is not only able to increase the quality of a sustainable project but also able to reduce of implementation costs without lengthen the total project duration. Even though, several studies found that the planning and design process for a sustainable building will require 20% -50% more time than for a conventional building due to the need of integration sustainability practices into projects

(Kats et al, 2003), however there is an improved probability that the number of change orders on the project will be less than those conventional project through careful planning during the early planning process (Doyle et al, 2009). Ultimately, it is not only save the time but it will also save the changes cost of the project.

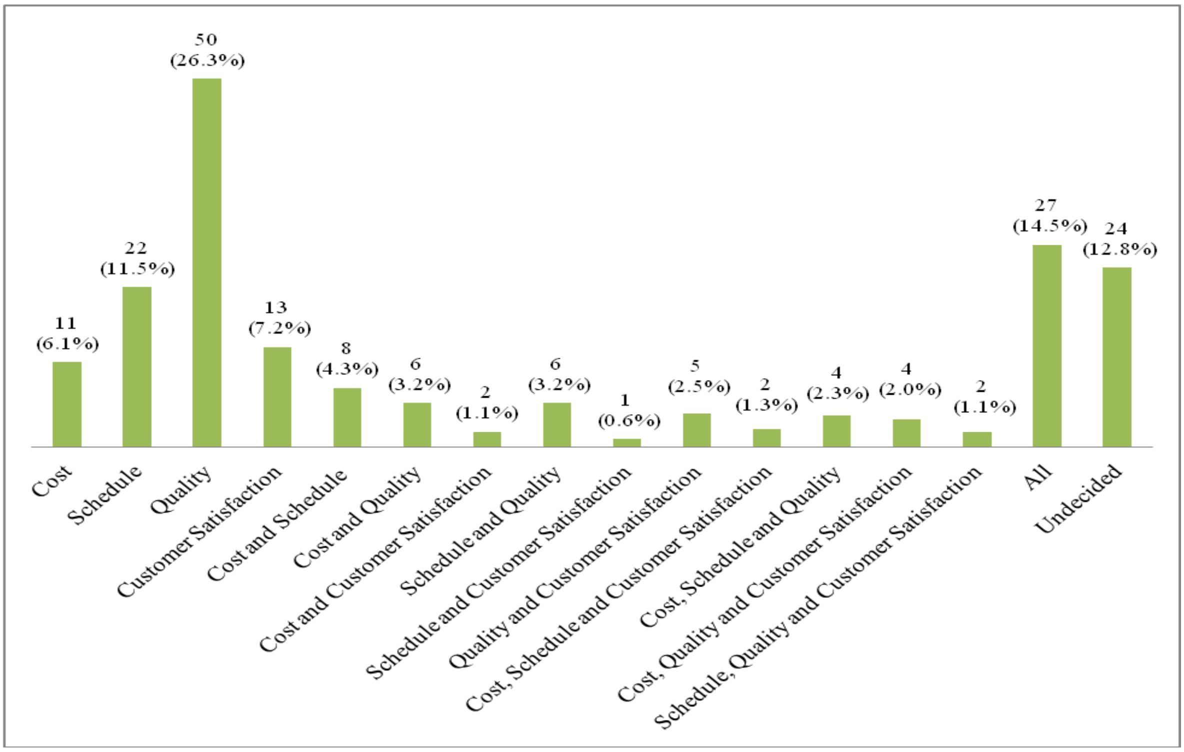


Figure 5.2: Respondent's feedback on the benefit of sustainability integration into the planning process towards successful building project performance

Figure 5.3: Summary of respondents' feedback on the benefit of sustainability integration into the planning process towards successful building performance

5.4 THE PROBLEMS OF INTEGRATING SUSTAINABILITY IN MALAYSIAN BUILDING PROJECT

In understanding the sustainability practices in Malaysian building project, this study attempted to probe respondents' feedback on the problems or obstructions with regards to the integrating of sustainability in building project in the country. The respondents were allowed to tick more than one answer for this question on what they perceived based on their experience and knowledge on this subject matter (refer to Table 5.5). Each of the problems is described, in turn, below.

Table 5.5: Respondents' Feedback on the Problems of Integrating Sustainability into the Malaysian Building Projects

The Problems of Integrating Sustainability in Building Project in Malaysia	Frequency	%
No clear aspect concerning sustainability and the integration strategies in building and the project planning standards and guidelines	45	24
Lack of collaboration and integration among the project team members and stakeholders	34	18
Lack of understanding on sustainability integration process and the technical issues	16	9
Financial constraints/ High cost	21	11
Lack of sustainability knowledge among project stakeholders	14	7
Lack of awareness among project stakeholders	22	12
* Lack of understanding on sustainability integration process and the technical issues AND *High cost	2	1
* No clear aspect concerning sustainability and the integration strategies in building and the project planning standards and guidelines AND * Lack of understanding on sustainability integration process and the technical issues	10	5
*all	24	13
Total	**188**	**100**

*Note: *Respondents answered more than one*

5.4.1 No Clear Aspect Concerning Sustainability and the Integration Strategies in Building and the Project Planning Standards and Guidelines

Analysis of findings as shown in Table 5.5 revealed that majority (42%) of respondents considered the main problem of the failure of sustainability integration into Malaysian building projects was due to 'unclear aspect concerning sustainability and the integration strategies in the current building and the project planning standards and guidelines'. At this junction, this finding supports the thesis aim, that an efficient sustainability integration framework should be proposed as sustainability concept is still impenetrable in the country. GBI Malaysia is the only rating tool for the tropical zones other than Singapore Government's BCA Green Mark (Tan, 2009). Buildings are awarded the GBI Malaysia rating based on the criteria of energy efficiency, indoor environmental quality, sustainable site planning and management, material and resources, water efficiency and innovation, which most of the points are allocated to environmental sustainability aspects and certification activities as Tan (2009:7) highlighted: 'Achieving points in these targeted areas will mean that the building will likely be more environment-friendly than those that do not address the issues'. Most current Malaysian Sustainability code and guidelines are tend to concentrate on evaluating environmental performance of building as a product and less considering is given to the sustainability integration throughout the building whole life. Meanwhile, the standards and guidelines of sustainability in building that have the holistic consideration of environmental, social and economic aspects are rarely found. Furthermore, there is no clear framework or guidelines in Malaysia were recognized regarding the strategies of integrating sustainability into the planning process of building projects. Building codes that were written for conventional development often not equipped to handle sustainability integration in the project. This situation has hindered GBI, Environmental Protection Act or any other future sustainable building framework from reaching their full potential.

5.4.2 Lack of Collaboration and Integration among the Project Team Members

Table 5.5 (p172) illustrates that 31% of the respondents measured that the main problem of integrating sustainability in the current Malaysian building project was due to 'lack of collaboration and integration among the project team members and the project stakeholders. Several respondents explained that the traditional planning process moves linearly through owner programming, conceptual and design and construction stage. It was usually minimal input from engineering disciplines until design development and very little input from the operation and maintenance groups or outside stakeholders. Doyle et al (2009:PS.08.2) stated 'unlike conventional design, green or sustainable design works best when designers and engineers work together to concentrate the majority of their creative efforts very early in the design process'. Table 5.6 (p174) shows that the respondents who have been involved in sustainable building project were also involved in the project planning process except of the contractors. Result found that it was very minimal input from the contractors' side which only 4 out of 37 or 11% of them were involved in the planning process of the project.

Table 5.6: Project stakeholders' Involvement in the Planning Process of Sustainable Building Project

Type of company			Involvement in the planning process of sustainable building project				Total
			No project	1-5 projects	6-10 projects	11-15 projects	
Engineering firms	Involvement in sustainable project	No project	5				5
		1-5 projects		4			4
	Total		**5**	**4**			**9**
Architect firms	Involvement in sustainable project	No project	9				9
		1-5 projects		39			39
	Total		**9**	**39**			**48**
Developers	Involvement in sustainable project	No project	11				11
		1-5 projects		21			21
		6-10 projects			4		4
		11-15 projects				1	1
	Total		**11**	**21**	**4**	**1**	**37**
Town planning firms	Involvement in sustainable project	No project	8				8
		1-5 projects		2			2
	Total		**8**	**2**			**10**
Local authorities	Involvement in sustainable project	No project	7	0			7
		1-5 projects		3			3
		11-15 projects				1	1
	Total		**7**	**3**		**1**	**11**
Universities	Involvement in sustainable project	No project	1				1
		1-5 projects	1				1
	Total		**2**				**2**
Contractors	Involvement in sustainable project	No project	30				30
		1-5 projects	36	4			40
		6-10 projects	1				1
	Total		**67**	**4**			**71**
Total Involvement in Sustainable Building Project			**109**	**73**	**4**	**2**	**188**

The result revealed that traditionally, stakeholders from the construction and operation and maintenance categories were not usually involved in the planning process of building project. It was highlighted that communication loss among stakeholders in certain cycle of project resulted in the lack of integration between designers, contractors and builders (Mochal and Krasnoff, 2010; Zwikael, 2009 and Choi, 2009). The pointing fingers culture also made the implementation of this type of project in this country became poor (Zainul Abidin, 2009). Green Globes suggests that individuals that represent different disciplines such as the owner's representative, green design and delivery coordinator, architect, contractor, civil engineer, and other stakeholders, are to be involved in a planning session to discuss and establish performance goals and measurements (Wu and Low, 2010). It is because of their up-front collaboration able to minimize complications (Choi, 2009). The implementation is improved if the various stakeholders play their role in advising the developers on the benefits of pursuing sustainable practices (Zainul Abidin, 2009).

5.4.3 Lack of Understanding on Sustainability Integration Process and the Technical Issues

There are 28% of the respondents agreed that the 'lack of understanding on sustainability integration process and the technical issues' is one of the main problem of integrating sustainability in the current Malaysian building project. The issues such as sustainability consideration after the design stage of building project has resulted for plan redesign and additional cost to be incurred (CIDB, 2007a). Sustainability issues should be considered as early as the planning process of project to improve the level of implementation (Zainul Abidin, 2010b) as Doyle et al (2009:PS08.2) highlighted '..it is critical that the owner/occupants clearly communicate their vision, priorities, needs and expectations to the design team during the planning phase. The lack of sustainability integration process and technical understanding on sustainable project among the project team members has led to several process issues in delivering sustainable projects (Shari, 2011). The finding concurs with studies by Zainul Abidin (2010b) that claimed, presently only large Malaysian developers are beginning to take heed towards sustainability implementation in their projects due to limited understanding and the concern about cost.

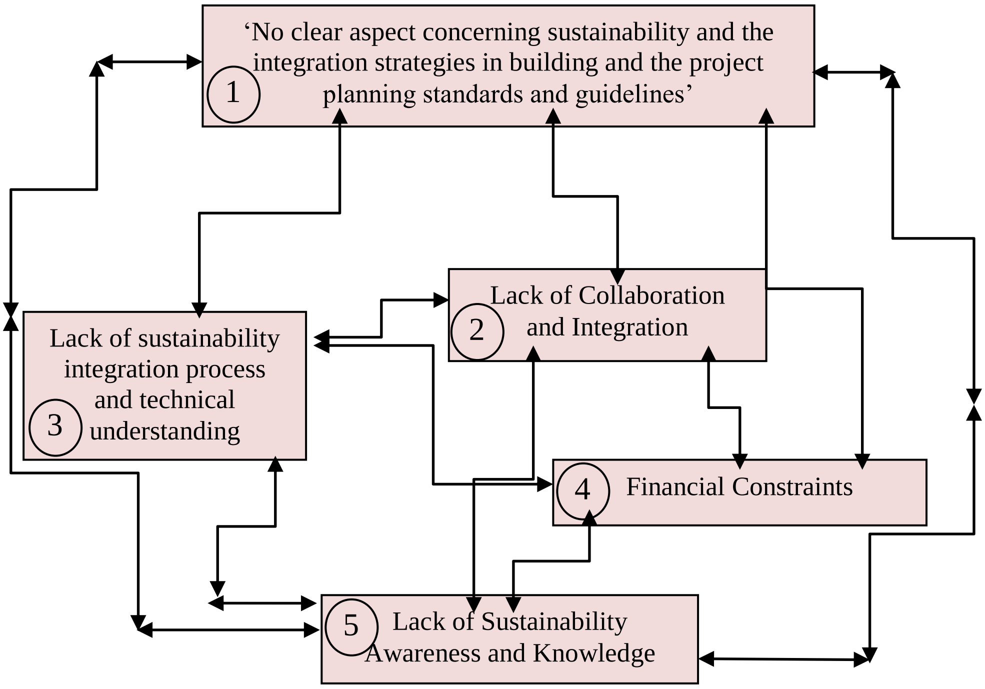
5.4.4 Financial Constraints

There are 25% of the respondents believed that the main factor that obstructs integration of this concept in Malaysia is the financial constraints. This finding concurs with studies by Zainul Abidin (2010b) that Malaysian developers tend to agree in pursuing a sustainable project when there is a market for it then the cost is transferred to the buyers. Developers would be willing to implement sustainability considerations if they could charge higher rents or gains a marketing edge through sustainability (Shari, 2011). Concerned about profit lost has led the Malaysian stakeholders to be more anxious to implement sustainable development concept in their construction project. Unluckily, the beneficiaries of cost savings are often not the decision makers in charge of design, improvement, and development decisions. Under typical short-term leases where the tenant is responsible for utilities, owners may not want to go through the hassles or costs of energy-efficient system retrofits (Choi, 2009). Yet, Robichaud and Anantatmula (2011) believed that sustainability consideration in construction project will improve its chance for financial success by involvement of cross-disciplines team at the earliest stages and throughout the project.

5.4.5 Lack of Awareness and Knowledge

One of the major problems that the respondents highlighted is the lack of awareness (25%) and sustainable development knowledge (20%) among the project stakeholders. The type of information such as how to deliver a sustainable building project effectively, its proper planning process, quantification of sustainable building energy savings, lower utility bills, building longevity, lower environmental impact, increased occupant productivity, and the public health benefits of sustainable building over those that are conventionally built is required if sustainable building project is to be widely accepted among the project stakeholders in Malaysia. The process issues due to the lack of awareness, expertise and sustainability knowledge among the project stakeholders cause problems such as cost overrun, delay, change and so forth. Some Malaysian building professionals are open to learn about sustainability in building project but have not adequate knowledge and training in it (Shari, 2011). Thus, even though they aware about sustainability but they are not willing to shift from the conventional way of project and undertaking the sustainable project which may incur more upfront cost (Zainul Abidin, 2010b).

As a summary, the study identified six main problems of integrating sustainability in Malaysian building projects as presented in Figure 5.4 (p177). They are numbered in order of frequency citation. It is interesting to note which reasons appeared most regularly in stakeholders' interview. All of those six problems are seen as closely related to each other. For instances, 'no clear aspect concerning sustainability and the integration strategies in building and the project planning standards and guidelines' has resulted in the lack of collaboration and integration among project stakeholders due to their ignorance and lack of awareness about the subject matter. At the same time, 'no clear aspect concerning sustainability and the integration strategies in building and the project planning standards and guidelines' also resulted several conflicts on the sustainability integration process issues.



Note: Numbers show the degree of problems

Figure 5.4: The Relationship between Problems

In public sector, approvals and permitting processes, many of which are not equipped to handle sustainable construction may cause delays. Building codes that were written for conventional developments often do not allow sustainability systems. Choi (2009:111) stated that, 'when people have fears about legal liability, they often default to rules that are in place and well tested rather than adjusting them to meet the different requirements of green systems'. Meanwhile, the lack of collaboration and integration among project stakeholders are due to the lack of certainty, knowledge and understanding on sustainability procedures in carrying out the sustainable project.

The lack of expertise and knowledge often creates an environment that lengthens development time frames. The difficulty in identifying appropriate project stakeholders, construction materials, and other sources can also lengthen the project schedule that ultimately lead to greater risks and higher costs (Choi, 2009). On the other hand, the lack of knowledge and awareness of sustainable development are also seen as the primary cause of 'no clear aspect of sustainability and the integration strategies in building and the project planning standards and guidelines'. All of those problems prompted the ignorance and misinterpretation of sustainability principles in the planning process undertaken. As a result, much further problems such as cost overrun, project delay and stakeholders' dissatisfaction arise and become barriers in the integration of sustainability in Malaysian building projects.

5.5 STAKEHOLDERS' PREFERENCES ON THE SUSTAINABILITY PRINCIPLES OF BUILDING AND THE STRATEGIES TO INTEGRATE THE PRINCIPLES INTO THE PROJECT PLANNING PROCESS

One of the objectives of this research is to find out local stakeholders' perceptions about the most important sustainability principles of building and the strategies to integrate the principles into the project planning process relevant to the Malaysian context. There are 29 sustainability principles of building and 21 strategies of sustainability integration into the project planning process as identified in the preliminary framework (refer to Table 3.8, p132) are listed in Part B and Part C of the questionnaire (refer to Appendix A, p310). This part of questionnaire aimed to reduce the number of factors (principles and strategies) and select only the important factors to be addressed throughout the framework development.

Respondents were required to rank the importance factors on a scale of 1 to 5 where a score of '1' represents 'not at all important', '2' represents 'not important', '3' represents 'neutral', '4' represents 'important' and '5' represents 'very important'. Throughout this part of questionnaire, spaces were provided for respondents to suggest additional factors that were not included. In the effort to analyze the collected data for the most important sustainability principles of building and the integration strategies into the planning process, there were four stages of data analysis that have been utilized which are Cronbach's Alpha measurement, Factor Analysis, Frequency and Descriptive analysis and RII.

5.5.1 Reliability Test: Cronbach's Alpha Measurement

The first stage of quantitative analysis is related to the reliability test where the reliability of the questionnaire was tested according to the Cronbach's alpha measurement. The Cronbach's alpha was used to measure the internal consistency and indicates how well the items in the set were correlated to one another (Brown, 2001). Through the analysis that was done, the alpha reliability of the scale in this study was 0.939 for sustainability principles of sustainable (refer to Table 5.7) and 0.950 for the strategies to integrate sustainability principles into the project planning process (refer to Table 5.8, p180).

Table 5.7: Reliability Test on Sustainability Principles of Building

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.939	.939	29

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Environmental Sustainability					
Optimise materials and resources used	53.61	23.030	.526	.470	.860
Sustainable materials and resources	53.61	23.105	.482	.633	.862
Energy efficient	53.58	22.213	.663	.684	.852
Efficient water consumption	53.50	23.193	.533	.652	.860
Noise control	53.62	21.680	.665	.771	.851
Urban Design, visual impact and aesthetic	53.79	22.586	.477	.552	.863
Site Planning and management	53.78	21.543	.577	.625	.857
Transport management	53.45	23.478	.485	.415	.862
Concern on quality of land, river and sea	53.76	21.606	.585	.653	.856
Air and emissions quality	53.44	22.344	.658	.477	.853
Conserving heritage	53.57	22.160	.616	.724	.854
Efficient environmental management	53.74	23.392	.296	.294	.876
Sustainable method	53.44	22.804	.555	.586	.858
Total no. of items	13	Coefficient Value – Cronbach 's Alpha			0.874
Economic Sustainability					
Economic benefit to the stakeholders	12.47	3.983	.729	.556	.832
Improve local market presence	12.41	4.565	.730	.543	.827
Whole life cost efficiency	12.34	4.363	.801	.642	.798
Indirect economic impact	12.45	4.934	.636	.424	.862
Total no. of items	4	Coefficient Value – Cronbach 's Alpha			0.867
Social Sustainability					
Employment Benefits	36.10	33.980	.657	.624	.902
Labor/Management Relations	36.27	35.001	.711	.625	.898
Occupational Health and Safety	35.69	35.883	.628	.556	.903

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach 's Alpha if Item Deleted
Training, Education and Awareness	35.81	34.348	.797	.732	.894
Fairness	36.14	35.781	.597	.556	.905
Human right performance	36.03	33.727	.802	.714	.893
Society Performance	36.08	33.817	.716	.702	.898
Product responsibility	35.75	36.670	.631	.557	.903
Stakeholders participation	35.89	34.763	.593	.584	.906
Macro social performance	35.91	35.452	.639	.571	.903
Total no. of items	10	Coefficient Value – Cronbach ‘s Alpha			0.910
Design and Innovation					
Sustainable Design	4.60	.455	.904	.817	-
Sustainable Innovation	4.54	.592	.904	.817	-
Total no. of items	2	Coefficient Value – Cronbach ‘s Alpha			0.945

Table 5.8: Reliability Test on the Strategies to Integrate Sustainability Principles into the Project Planning Process

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.950	.951	21

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach 's Alpha if Item Deleted
Sustainable Project Orientation					
Specific sustainability goals and project priorities	4.32	.563	.819	.671	-
Sustainable concern during establishment of project scope, project charter, drawing, contract and detailed project plan	4.29	.634	.819	.671	-
Total no. of items	2	Coefficient Value – Cronbach ‘s Alpha			0.900
Integrated Design Process					
Involve diverse set of stakeholders on the team	34.03	20.994	.696	.609	.868
Committed and collaborative team throughout the process	34.14	20.862	.632	.530	.873
Bringing the team together as early as possible during planning process	33.91	21.591	.728	.641	.867
Sustainability and integrated design requirements and the process are included into the project documentations, strategic and comprehensive plan.	33.97	20.844	.770	.701	.862
Do whole building design and systems analysis	34.05	20.639	.679	.564	.869
Commissioning process is added during this process and described in a specific section	34.24	21.809	.545	.423	.880
Planning should reflect all the project stakeholders	33.97	21.331	.626	.457	.873
Design should reflect all the user community	34.20	21.603	.607	.506	.875
Effective communication and incorporation of charette process	34.21	22.508	.471	.402	.886
Total no. of items	9	Coefficient Value – Cronbach ‘s Alpha			0.885
Integrated Project Team					

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach 's Alpha if Item Deleted
The project team is involved and maintained throughout the planning process	26.01	9.460	.786	.678	.823
Local community representative is involved in support of the project	26.16	9.946	.610	.605	.851
An integrated design/ sustainability coordinator is appointed as one of the project's team members	26.04	10.640	.565	.448	.855
The team should have the core knowledge of sustainable building project	25.69	10.332	.687	.589	.839
Team members are educated on sustainability issues and process including vendors	25.78	10.471	.614	.592	.849
Team members' selection with sustainable development quality and capability	25.85	11.072	.567	.474	.855
Team members are fully informed on sustainability goals and priorities of the project.	25.81	10.198	.640	.458	.845
Total no. of items	7	Coefficient Value – Cronbach 's Alpha			0.865
Regulations and Code Compliances					
Government policies to encourage sustainable development	8.83	2.292	.695	.580	.810
Compliance with code and regulatory tool to encourage sustainable development	8.69	2.257	.828	.692	.690
Incentive to encourage sustainable development	8.76	2.357	.642	.469	.863
Total no. of items	3	Coefficient Value – Cronbach 's Alpha			0.849

Since both set of factors achieved above 0.7, the results revealed that all proposed factors have indicated internal consistency and achieved high reliability. According to Gliem and Gliem (2003), the closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the factors in the scale which as stated by George and Mallery (2003), the rule of thumb are >0.9 is excellent, >0.8 is good, >0.7 is acceptable, >0.6 is questionable, >0.5 is poor and <0.5 is considered unacceptable. Thus, due to the high coefficient values of Cronbach's Alpha, it can be concluded that the respondents were admitted that the sustainability principles of building and the strategies to integrate the sustainability principles into the project planning process as identified in the preliminary framework are significant to be suggested for the proposed framework. Nevertheless, even if a high value for Cronbach's alpha indicates good internal consistency of factors in the scale, dimensionality of the scale is still need to be determined by factor analysis method (Gliem and Gliem, 2003).

5.5.2 Factor Analysis

In the second stage of data analysis process, the data was analyzed using factor analysis. As discussed in Chapter Four, the purpose of applying factor analysis in this research is to enhance the results of Cronbach's Alpha. Even though the alpha reliability of the scale in this study was excellent for the factors but it was only indicated good internal factors in the scale. Factor Analysis was employed in order to reduce a large number of variables to a smaller set of underlying factors that summarise the essential information contained in the variables. This study adopted PCA to set up which factors could capture the aspects of same dimension of sustainability principles and the integration strategies and examine the underlying structure or structure of interrelationships among the 29 sustainability factors and the 21 strategies factors. The sample was first examined for its suitability to the factor analysis application by employing the Kaiser-Meyer-Olkin (KMO) Sampling Adequacy Test and Barlett's Test of Sphericity. The value of overall measure of sampling adequacy (MSA) of 0.5 point and above and significant coefficient of Bartlett's test of sphericity of less than the significance level of 0.01 explains that the data suited for factor analysis method (Hair, et al, 2005). Table 5.9 shows MSA scores and its interpretation tabulated by Jantan and Ramayah, (2006).

Table 5.9: Measure of Sampling Adequacy (MSA)

Measure of Sampling Adequacy (MSA)	Comment
0.80-1.00	Meritorious
0.70-0.80	Middling
0.60-0.70	Mediocre
0.50-0.60	Miserable
0-0.50	Unacceptable

Source: Jantan and Ramayah (2006)

Factor analysis was then carried out to examine the communalities. The communality is defined as amount of shared or common variance among the variables. Communalities indicate the proportion of the variance in the original variables that is accounted for by the factor solution. Initial communalities are estimates of the variance in each variable accounted for by all components or factors. Higher variance means higher importance of the variables (Marko Pahor, 2011).

Extraction communalities are estimates of the variance in each variables accounted for by the factors or components in the factor solution. The general guidelines mentioned that the factor solution explain at least half of each original variable's variance, thus the communality value (score after extraction) should be more than 0.5 point for the data to be justifiable for application of the factor analysis method (Alias, 2009). Communalities less than 0.5 were considered too low, since this would meant the variable share less than half of its variability with other variables (Larose, 2006). Thus, variables with loadings less than 0.5 were removed from the analysis due to low communality.

To examine which variable significantly contribute to dependent variable, a PCA was applied with varimax rotation to validate which constructs to be distinct as perceived by the respondents. The eigenvalue criterion stated that each component explained at least one variable's worth of variability, and therefore only components with eigenvalue greater than 1 should be retained (Larose, 2006).

Rotation is a method used to simplify interpretation of the extracted components. Rotation assigns uniquely each variable to only one factor that is highly correlated with them (Alias, 2009; Hair et al, 2005). An item that has significant value of more than 0.3 is loaded on more than one factor which consequently, the problem of cross-loading existed (Alias, 2009). Applying Varimax rotation results a clearer pattern of assignment with minimal problem of cross-loadings. Each item should load 0.5 or greater on one factor and 0.35 or lower on the other factors (Igbaria, 1995). Hair et al (2005) indicated that a component loading of ±0.3 meant the item was of minimal significance, ±0.4 indicated it was more important and more than ±0.5 indicated that the component was significant.

5.5.2.1 PCA for Sustainability Principles of Buildings

This section examines PCA for the 29 sustainability principles of building as indicated in the Preliminary Framework that has been proposed throughout Chapter Two and Chapter Three of this study.

5.5.2.1.1 Environmental Sustainability Principles of Building

Table 5.10 shows that the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (MSA) scored at 0.710 which is exceeded the minimum requirement of 0.5 point and significant coefficient of Bartlett’s test of sphericity was less than the significance level of 0.01. The results shows that the data were appropriate for factor analysis method

Table 5.10: KMO and Bartlett’s Test of Environmental Sustainability Principles of Building

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.710
Bartlett's Test of Sphericity	Approx. Chi-Square	1238.991
	Df	78
	Sig.	.000

The result in Table 5.11 shows that all variables scored more than 0.5 except the factor of ‘conserving heritage’. Since the ‘conserving heritage’ factor was less than 0.50, thus the variable was not acceptable and removed from the next iteration of the PCA.

Table 5.11: Communalities of Environmental Sustainability Principles of Building

Sustainability Principles of Building	Initial	Extraction
Optimise materials and resources used	1.000	.609
Sustainable materials and resources	1.000	.527
Sustainable method	1.000	.601
Energy efficient	1.000	.748
Efficient water consumption	1.000	.716
Noise control	1.000	.617
Urban Design, visual impact and aesthetic	1.000	.743
Conserving heritage	1.000	.429
Transport management	1.000	.781
Concern on quality of land, river and sea	1.000	.548
Air and emissions quality	1.000	.635
Site Planning and management	1.000	.676
Efficient environmental management	1.000	.564

Extraction Method: Principal Component Analysis.

Table 5.12 shows KMO and Bartlett’s test of environmental sustainability principles of building which was reproduced after removing of ‘conserving heritage’ factor. The result revealed that KMO measure of sampling adequacy was 0.714 which exceeds the minimum requirement of 0.5 point for overall MSA which indicating the sufficient inter-correlations. The probability associated with the Bartlett’s test of sphericity was <0.001which significant and satisfied the requirement of factor analysis application.

Table 5.12: KMO and Bartlett's Test of Environmental Sustainability Principles of Building (reproduced after removing of 'conserving heritage' factor)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.714
Bartlett's Test of Sphericity	Approx. Chi-Square	1143.500
	Df	66
	Sig.	.000

Table 5.13 shows the communalities table of environmental sustainability principles of building which was reproduced after removing of 'conserving heritage' factor. The result shows that the communalities for all of the variables included in the components were greater than 0.5. Therefore, the PCA for environmental sustainability principles has been completed and the data input is justifiable for application of the factor analysis method.

Table 5.13: Communalities of Environmental Sustainability Principles of Building (reproduced after removing of 'conserving heritage' factor)

Environmental Sustainability Principles	**Initial**	**Extraction**
Optimise materials and resources used	1.000	.606
Sustainable materials and resources	1.000	.523
Sustainable method	1.000	.604
Energy efficient	1.000	.763
Efficient water	1.000	.717
Noise control	1.000	.657
Urban design, visual impact and aesthetic	1.000	.749
Transport management	1.000	.806
Concern on quality of land, river and sea	1.000	.554
Air and emissions quality	1.000	.636
Site planning and management	1.000	.684
Efficient environmental management	1.000	.558

Extraction Method: Principal Component Analysis.

Table 5.14 shows that the total variance explained for all variables under environmental sustainability principles of building component. The results shows that there were three (3) components with eigenvalue greater than 1 and the total variance explained was 65.483% of the total variance in the variables which are included in the components. The three (3) components solution explained a sum of variance with component 1 contributing 41.939%; component 2 contributing 13.164% and component 3 contributing 10.379%. The three (3) components would explain 65.483% of the total variance in the 12 sustainability principles of building.

Table 5.14: Total Variance Explained of Environmental Sustainability Principles of Building

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.033	41.939	41.939	5.033	41.939	41.939	3.649	30.405	30.405
2	1.580	13.164	55.104	1.580	13.164	55.104	2.495	20.795	51.199
3	1.246	10.379	65.483	1.246	10.379	65.483	1.714	14.284	65.483
4	.959	7.992	73.475						
5	.665	5.543	79.018						
6	.634	5.283	84.301						
7	.507	4.228	88.529						
8	.444	3.698	92.228						
9	.349	2.908	95.136						
10	.249	2.079	97.215						
11	.230	1.919	99.134						
12	.104	.866	100.000						

Extraction Method: Principal Component Analysis.

Table 5.15 (p187) shows the results after applying rotation method of Varimax with Kaiser Normalization. The result showed that the environmental sustainability principles of building can be represented by three (3) components (factors) which each variable on each factor was highly correlated each other.

Factor 1 consists of the variables of ‘energy efficient’, ‘air and emissions quality’, ‘efficient water consumption’, ‘optimise materials and resources used’, ‘sustainable materials and resources used’, ‘sustainable method’ and ‘concern on quality of land, river and sea’. Factor 2 consists of the variables of ‘transport management’, ‘urban design, visual impact and aesthetic’ and ‘noise control’ and Factor 3 consists of variables of ‘site planning and management’ and ‘efficient environmental management’. The summary of the overall results is summarised in Table 5.16 (p187).

Table 5.15: Rotated Component Matrix of Environmental Sustainability Principles of Building

Environmental Sustainability Principles	Component		
	1	2	3
Energy efficient	.810	.216	-.246
Air and emissions quality	.754	.221	.134
Efficient water consumption	.750	.350	-.047
Optimise materials and resources used	.727	-.029	.277
Sustainable materials and resources	.648	-.030	.321
Sustainable method	.585	.256	.344
Concern on quality of land, river and sea	.553	.350	.350
Transport management	.127	.864	.206
Urban design, visual impact and aesthetic	.113	.814	.271
Noise control	.212	.778	-.082
Site Planning and management	.001	.119	.819
Efficient environmental management	.328	.165	.582

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 4 iterations.

Table 5.16: Summary of Results by Applying PCA for Environmental Sustainability of Building

Environmental Sustainability Principles of Building	Component			Communalities
	1	**2**	**3**	
Energy efficient	.810	.216	-.246	.763
Air and emissions quality	.754	.221	.134	.636
Efficient water consumption	.750	.350	-.047	.717
Optimise materials and resources used	.727	-.029	.277	.606
Sustainable materials and resources	.648	-.030	.321	.523
Sustainable method	.585	.256	.344	.604
Concern on quality of land, river and sea	.553	.350	.350	.554
Transport management	.127	.864	.206	.806
Urban design, visual impact and aesthetic	.113	.814	.271	.749
Noise control	.212	.778	-.082	.657
Site Planning and management	.001	.119	.819	.684
Efficient environmental management	.328	.165	.582	.558
Eigenvalue	**3.649**	**2.495**	**1.714**	
Variance (65.483%)	**30.405**	**20.795**	**14.284**	

5.5.2.1.2 Economic Sustainability Principles of Building

Table 5.17 and Table 5.18 (p188) revealed the results of its suitability for factor analysis method. KMO measure of sampling adequacy was 0.820 indicating sufficient inter-correlations while Barlett's Test of Sphericity was significant with chi-square of

371.095 and probability of less than 0.01, and the values extracted communalities for all factors were higher than 0.05. Thus, the data suited for factor analysis method.

Table 5.17: KMO and Bartlett's Test of Economic Sustainability Principles of Building

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.820
Bartlett's Test of Sphericity	Approx. Chi-Square	371.095
	Df	6
	Sig.	.000

Table 5.18: Communalities of Economic Sustainability Principles of Building

Economic Sustainability Principles of Building	Initial	Extraction
Economic Benefit to the stakeholders	1.000	.729
Improve local market present	1.000	.728
Whole life cost efficiency	1.000	.807
Indirect economic impact	1.000	.619

Extraction Method: Principal Component Analysis.

Table 5.19 depicts that the results of total variance explained for all variables of economic sustainability principles of building. The results shows that there was only one (1) component with eigenvalue greater than 1 and the total variance explained was 72.088% of the total variance in the variables which are included on the components. Therefore, only one (1) component was extracted which consists of factors 'whole life cost efficiency', 'economic benefit to the stakeholders', 'improve local market present', and 'indirect economic impact' (refer to Table 5.20, p189). The summary of the overall results are summarised in Table 5.21 (p189).

Table 5.19: Total Variance Explained of Economic Sustainability Principles of Building

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.884	72.088	72.088	2.884	72.088	72.088
2	.500	12.506	84.594			
3	.351	8.775	93.369			
4	.265	6.631	100.000			

Extraction Method: Principal Component Analysis

Table 5.20: Component Matrix (a) of Economic Sustainability Principles of Building

Economic Sustainability Principles of Building	Component 1
Whole life cost efficiency	.898
Economic benefit to the stakeholders	.854
Improve local market presence	.853
Indirect economic impact	.787

Extraction Method: Principal Component Analysis.

a. 1 components extracted. The solution cannot be rotated

Table 5.21: Summary of Results by Applying PCA for Economic Sustainability Principles of Building

Economic Sustainability Principles of Building	Component 1	Communalities
Whole life cost efficiency	.898	.807
Economic benefit to the stakeholders	.854	.729
Improve local market presence	.853	.728
Indirect economic impact	.787	.619
Eigenvalue	**2.884**	
Variance (72.088%)	**72.088**	

5.5.2.1.3 Social Sustainability Principles of Building

Table 5.22 and Table 5.23 (p190) reveals the results of its suitability for factor analysis method. KMO measure of sampling adequacy was 0.852 indicating sufficient inter-correlations while Barlett's Test of Sphericity was significant with probability of less than 0.01, and the values extracted communalities were higher than 0.05, except the communality for the variable ' fairness' and 'macro social performance'. Therefore, both of the variables were removed and PCA was recomputed (refer to Table 5.24 (p190) and Table 5.25 (p191).

Table 5.22: KMO and Bartlett's Test of Social Sustainability Principles of Building

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.852
Bartlett's Test of Sphericity	Approx. Chi-Square	1192.322
	Df	45
	Sig.	.000

Table 5.23: Communalities of Social Sustainability Principles of Building

Social Sustainability Principles of Building	Initial	Extraction
Employment Benefits	1.000	.797
Labor/Management Relations	1.000	.645
Occupational Health and Safety	1.000	.636
Training, Education and Awareness	1.000	.760
Fairness	1.000	.475
Human right performance	1.000	.784
Society Performance	1.000	.756
Product responsibility	1.000	.646
Stakeholders participation	1.000	.658
Macro social performance	1.000	.497

Extraction Method: Principal Component Analysis.

Table 5.24 and Table 5.25 (p191) revealed the results of its suitability for factor analysis method which was reproduced after removing of 'fainess' and 'macro social performance' factor. The result revealed that KMO measure of sampling adequacy was increased to 0.862 which exceeds the minimum requirement of 0.5 point for overall MSA which indicating the sufficient inter-correlations. The probability associated with the Bartlett's test of sphericity was less than 0.001 and the values extracted communalities were higher than 0.05, which significant and satisfied the requirement. Thus, this set of data input is justifiable for the application of factor analysis method.

Table 5.26 (p191) shows that the total variance explained for all variables under social sustainability principles of building. The results showed that there were two (2) components with eigenvalue greater than 1 and consequently, there were two (2) components were extracted for these variables which would explain 72.521% of the total variance.

Table 5.24: KMO and Bartlett's Test of Social Sustainability Principles of Building (reproduced after removing of 'fairness' and 'macro social performance' factor)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.862
Bartlett's Test of Sphericity	Approx. Chi-Square	903.201
	Df	28
	Sig.	.000

Table 5.25: Communalities of Social Sustainability Principles of Building (reproduced after removing of 'fairness' and 'macro social performance' factor)

Social Sustainability Principles of Building	Initial	Extraction
Employment Benefits	1.000	.818
Labor/Management Relations	1.000	.630
Occupational health and safety	1.000	.726
Training and education	1.000	.751
Human right performance	1.000	.787
Society performance	1.000	.770
Product responsibility	1.000	.684
Stakeholder participation	1.000	.635

Extraction Method: Principal Component Analysis.

Table 5.26: Total Variance Explained of Social Sustainability Principles of Building

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.757	59.462	59.462	4.757	59.462	59.462	2.951	36.883	36.883
2	1.045	13.059	72.521	1.045	13.059	72.521	2.851	35.638	72.521
3	.614	7.679	80.200						
4	.451	5.640	85.840						
5	.412	5.148	90.988						
6	.307	3.839	94.827						
7	.239	2.984	97.811						
8	.175	2.189	100.000						

Extraction Method: Principal Component Analysis.

Table 5.27 (p192) shows the results after applying rotation method of Varimax with Kaiser Normalization. The result showed that the social sustainability principles for sustainable building can be represented by two (2) components (factors) which each variable on each factor was highly correlated each other. Factor 1 consists of the variables 'society performance', 'product responsibility', stakeholder participation' and 'human right performance'. Meanwhile, factor 2 consists of the variables 'employment benefits', 'occupational health and safety', 'training and education' and 'labor/management relations'.

However, as highlighted by Igbaria et al (1995), each item should load 0.5 or greater on one factor and 0.35 or lower on the other factors. Therefore, there are 3 more factors are removed which are 'society performance', 'human right performance' and 'labor/management relations'. The summary of the overall final results is summarized in Table 5.28.

Table 5.27: Rotated Component Matrix of Social Sustainability Principles of Building

Social Sustainability Principles of Building	Component	
	1	2
Society performance	.833	.375
Product responsibility	.785	.261
Stakeholder participation	.776	.182
Human right performance	.773	.436
Employment benefits	.165	.889
Occupational health and safety	.235	.819
Training and education	.259	.735
Labor/management relations	.385	.694

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

Table 5.28: Summary of Results by Applying PCA for Social Sustainability Principles of Building

Social Sustainability Principles of Building	Component		Communalities
	1	2	
Product responsibility performance	.785	.261	.684
Stakeholder participation	.776	.182	.635
Excellent labour practices	.165	.889	.818
Occupational health and safety	.235	.819	.726
Training and education	.259	.735	.751
Eigenvalue	**2.951**	**2.851**	
Variance (72.521%)	**36.883**	**35.638**	

5.5.2.1.4 Design and Innovation Principles of Sustainability in Building

Table 5.29 and Table 5.30 revealed the results of its suitability for factor analysis method. KMO measure of sampling adequacy was 0.500 indicating sufficient inter-correlations while Barlett's Test of Sphericity was significant with probability of less than 0.01, and the values extracted communalities were higher than 0.05, thus, the principles are justifiable for application of the PCA.

Table 5.29: KMO and Bartlett's Test of Design and Innovation Principles of Sustainability in Building

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	314.795
	Df	1
	Sig.	.000

Table 5.30: Communalities of Design and Innovation Principles of Sustainability in Building

Sustainable Development Principles	Initial	Extraction
Sustainable design	1.000	.952
Innovation in Sustainability	1.000	.952

Extraction Method: Principal Component Analysis.

Table 5.31 shows that the total variance explained for all variables under the design and innovation principles of sustainability in building. The results showed that there was only one (1) component with eigenvalue greater than 1 and consequently, there was only a component was extracted for these variables which would explain 95.188% of the total variance. The component consists of the factors of 'sustainable design' and 'sustainable innovation' (refer to Table 5.32). The summary of the overall results are summarized in Table 5.33 (p194).

Table 5.31: Total Variance Explained of Design and Innovation Principles of Sustainability in Building

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.904	95.188	95.188	1.904	95.188	95.188
2	.096	4.812	100.000			

Table 5.32: Component Matrix (a) of Design and Innovation Principles of Sustainability in Building

Design and Innovation Principles	Component 1
Sustainable Design	.976
Sustainable Innovation	.976

Extraction Method: Principal Component Analysis

a. 1 component extracted. The solution cannot be rotated

Table 5.33: Summary of Results by Applying PCA for Design and Innovation Principles of Sustainability in Building

Design and Innovations Principles	Component 1	Communalities
Sustainable Design	0.976	.952
Sustainable Innovation	0.976	.952
Eigenvalue	**1.904**	
Variance (95.118%)	**95.118**	

5.5.2.2 PCA for the Strategies to Integrate Sustainability Principles into the Project Planning Process

This section examines PCA for the 21 sustainability integration strategies as indicated in the Preliminary Framework that have been proposed previously.

5.5.2.2.1 Sustainable Orientation Project

Table 5.34 and Table 5.35 revealed the results of its suitability for factor analysis method. KMO measure of sampling adequacy was 0.500 indicating sufficient inter-correlations while Barlett's Test of Sphericity was significant with chi-square of 206.387 and probability of less than 0.01, and the values extracted communalities for all factors were higher than 0.05. Accordingly, this set of data input is justifiable for the application of factor analysis method.

Table 5.34: KMO and Bartlett's Test of Sustainable Orientation Project

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.820
Bartlett's Test of Sphericity	Approx. Chi-Square	371.095
	Df	6
	Sig.	.000

Table 5.35: Communalities of Sustainable Orientation Project

Strategies of Sustainable Orientation Project	Initial	Extraction
Specific sustainability goal and project priorities	1.000	.910
Sustainability concern during establishment of project details	1.000	.910

Extraction Method: Principal Component Analysis.

Table 5.36 depicts that the results of total variance explained for all variables of sustainable orientation project strategies for sustainability integration purpose during project planning process. The results shows that there was only one (1) component with eigenvalue greater than 1 and the total variance explained was 90.966% of the total variance in the variables which are included on the components. Therefore, only one (1) component was extracted which consists of factors 'specific sustainability goal and project priorities' and 'sustainability concern during establishment of project details' (refer to Table 5.37). The summary of the overall results are summarised in Table 5.38 below.

Table 5.36: Total Variance Explained of Sustainable Orientation Project

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	1.819	90.966	90.966	1.819	90.966	90.966
2	.181	9.034	100.000			

Extraction Method: Principal Component Analysis

Table 5.37: Component Matrix (a) of Sustainable Orientation Project

Strategies of Sustainable Orientation Project	Component 1
Specific sustainability goal and project priorities	.954
Sustainability concern during establishment of project details	.954

Extraction Method: Principal Component Analysis.

a. 1 component extracted. The solution cannot be rotated

Table 5.38: Summary of Results by Applying PCA for Sustainable Orientation Project

Strategies of Sustainable Orientation Project	Component 1	Communalities
Specific sustainability goal and project priorities	.954	.910
Sustainability concern during establishment of project details	.954	.910
Eigenvalue	**1.819**	
Variance (90.966%)	**90.966**	

5.5.2.2.2 Integrated Project Team

Table 5.39 and Table 5.40 (p196) revealed that KMO measure of sampling adequacy was 0.810 which exceeds the minimum requirement of 0.5 point for overall MSA which indicating the sufficient inter-correlations. The probability associated with the Bartlett's test of sphericity was less than 0.001 and the values extracted communalities were higher than 0.05, which significant and satisfied the requirement. Thus, this set of data input is justifiable for the application of factor analysis method.

Table 5.39: KMO and Bartlett's Test of Integrated Project Team

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.810
Bartlett's Test of Sphericity	Approx. Chi-Square	659.684
	Df	21
	Sig.	.000

Table 5.40: Communalities of Integrated Project Team

Strategies of Integrated Project Team	Initial	Extraction
The project team members are involved and maintained throughout the planning process	1.000	.778
Local community representative is involved in support of the project	1.000	.812
An integrated design/ sustainability coordinator is appointed as one of the project's team members	1.000	.704
The team should have the core knowledge of sustainable building project	1.000	.723
Team members are educated on sustainability issues and process including vendors	1.000	.800
Team members' selection with sustainable development quality and capability	1.000	.671
Team members are fully informed on sustainability goals and priorities of the project.	1.000	.563

Extraction Method: Principal Component Analysis

Table 5.41 shows that the total variance explained for all variables of integrated project team strategies for sustainability integration reason during project planning process. The results showed that there were two (2) components with eigenvalue greater than 1 and consequently, there were two (2) components were extracted for these variables which would explain 72.174% of the total variance.

Table 5.41: Total Variance Explained of Integrated Project Team

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.899	55.693	55.693	3.899	55.693	55.693	2.619	37.416	37.416
2	1.154	16.481	72.174	1.154	16.481	72.174	2.433	34.758	72.174
3	.623	8.900	81.074						
4	.469	6.695	87.769						
5	.385	5.493	93.262						
6	.265	3.793	97.054						
7	.206	2.946	100.000						

Extraction Method: Principal Component Analysis.

Table 5.42 shows the results after applying rotation method of Varimax with Kaiser Normalization. The result showed that the strategy of integrated project team can be represented by two (2) components which each variable on each factor was highly correlated each other.

Table 5.42: Rotated Component Matrix of Integrated Project Team

Strategies of Integrated Project Team	Component 1	Component 2
Team members are educated on sustainability issues and process including vendors	.884	.138
Team members' selection with sustainable development quality and capability	.806	.145
The team should have the core knowledge of sustainable building project	.787	.322
Team members are fully informed on sustainability goals and priorities of the project	746	.315
Local community representative is involved in support of the project	.143	.890
An integrated design/ sustainability coordinator is appointed as one of the project's team members	.137	.828
The project team members are involved and maintained throughout the planning process	.480	.740

Extraction Method: Principal Component Analysis. a. Rotation converged in 3 iterations.
Rotation Method: Varimax with Kaiser Normalization.

Factor 1 consists of the variables 'team members are educated on sustainability issues', 'team members' selection with sustainable development quality and capability', 'the team should have the core knowledge of sustainable building project ' and 'team members are fully informed on sustainability goals and priorities of the project'. Factor 2 consists of the variables 'local community representative is involved in support of the project, 'an integrated design/ sustainability coordinator is appointed as one of the project's team members' and 'involve and maintain the project team throughout the whole process'.

As highlighted by Igbaria (1995), each item should load 0.5 or greater on one factor and 0.35 or lower on the other factors. Therefore, there are 1 factor are removed which are 'involve and maintain the project team members throughout the planning process'. The summary of the overall final results is summarized in Table 5.43 (P197).

Table 5.43: Summary of Results by Applying PCA for Integrated Project Team

Strategies of Integrated Project Team	Component 1	Component 2	Communalities
Team members are educated on sustainability issues and process	.884	.138	.800
Team members' selection with sustainable development quality and capability	.806	.145	.671
The team should have the core knowledge of sustainable building project	.787	.322	.723
Team members are fully informed on sustainability goals and priorities of the project	.746	.315	.563
Local community representative is involved in support of the project	.143	.890	.812
An integrated design/ sustainability coordinator is appointed as one of the project's team members	.137	.828	.704
Eigenvalue	**2.619**	**2.433**	
Variance (72.174%)	**37.416**	**34.758**	

5.5.2.2.3 Integrated Design Process

Table 5.44 and Table 5.45 (p199) revealed that KMO measure of sampling adequacy was 0.810 which exceeds the minimum requirement of 0.5 point for overall MSA which indicating the sufficient inter-correlations. The probability associated with the Bartlett's test of sphericity was less than 0.001 and the values extracted communalities were higher than 0.05, which significant and satisfied the requirement. Thus, this set of data input is justifiable for the application of factor analysis method.

Table 5.44: KMO and Bartlett's Test of Integrated Design Process

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.846
Bartlett's Test of Sphericity	Approx. Chi-Square	860.575
	Df	36
	Sig.	.000

Table 5.45: Communalities of Integrated Design Process

Strategies of Integrated Project Team	Initial	Extraction
Committed and collaborative team throughout the process	1.000	.648
Involve diverse set of stakeholders on the team	1.000	.630
Bringing the team together as early as possible during planning process	1.000	.669
Sustainability and integrated design requirements and the process are included into the project documentations, strategic and comprehensive plan.	1.000	.761
Do whole building design and systems analysis	1.000	.693
Commissioning process is added during planning process	1.000	.657
Design should reflect the end user community	1.000	.554
Planning should reflect all the project stakeholders	1.000	.553
Effective communication and incorporation of charette process	1.000	.699

Extraction Method: Principal Component Analysis

Table 5.46 shows that the total variance explained for all variables of integrated design process during planning process for the purpose of sustainability integration strategies. The results showed that there were two (2) components with eigenvalue greater than 1 and consequently, there were two (2) components were extracted for these variables which would explain 65.160% of the total variance.

Table 5.46: Total Variance Explained of Integrated Design Process

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.792	53.249	53.249	4.792	53.249	53.249	3.688	40.974	40.974
2	1.072	11.911	65.160	1.072	11.911	65.160	2.177	24.187	65.160
3	.792	8.796	73.956						
4	.635	7.059	81.015						
5	.494	5.485	86.500						
6	.408	4.529	91.029						
7	.374	4.160	95.189						
8	.225	2.498	97.687						
9	.208	2.313	100.000						

Extraction Method: Principal Component Analysis.

Table 5.47 (p200) shows the results after applying rotation method of Varimax with Kaiser Normalization. The result showed that the strategy of integrated project team can be represented by two (2) components which each variable on each factor was highly correlated each other. Factor 1 consists of the variables 'sustainability and integrated design requirements and the process are included into the documents', 'involve diverse set of stakeholders on the team, 'committed and collaborative team throughout the process', 'bringing the team as early as possible during planning process', 'planning should reflect all the project stakeholders' and 'planning should reflect the end user community'. Meanwhile, factor 2 consists of the variables 'effective communication and incorporation of charette process', commissioning process is added during planning process', and 'do whole design and system analysis'. The summary of the overall results is summarized in Table 5.48.

Table 5.47: Rotated Component Matrix of Integrated Design Process

Strategies of Integrated Design Process	Component 1	Component 2
Integrated design requirements and the process are included into project documents	.819	.299
Involve diverse set of stakeholders on the team	.785	.119
Committed and collaborative team throughout the process	.747	.300
Bringing the team together as early as possible during planning process	.732	.350
Planning should reflect all the project stakeholders	.728	.152
Design should reflect the end user community	.709	.226
Effective communication and incorporation of charette process	.114	.828
Commissioning process is added during this process and described in a specific section	.247	.772
Do whole design and system analysis	.346	.703

Extraction Method: Principal Component Analysis. a. Rotation converged in 3 iterations.
Rotation Method: Varimax with Kaiser Normalization.

Table 5.48: Summary of Results by Applying PCA for Integrated Design Process

Strategies of Integrated Project Team	Component 1	Component 2	Communalities
Integrated design requirements and the process are included into project documents	.819	.299	.761
Involve diverse set of stakeholders on the team	.785	.119	.630
Committed and collaborative team throughout the process	.747	.300	.648
Bringing the team together as early as possible during planning process	.732	.350	.669
Planning should reflect all the project stakeholders	.728	.152	.553
Design should reflect the end user community	.709	.226	.554
Effective communication and incorporation of charette process	.114	.828	.669
Commissioning process is added during this process and described in a specific section	.247	.772	.657
Do whole design and system analysis	.346	.703	.693
Eigenvalue	**3.688**	**2.177**	
Variance (65.160%)	**40.974**	**24.187**	

5.5.2.2.4 Regulations and Code Compliances

Table 5.49 and Table 5.50 revealed the results of its suitability for factor analysis method. KMO measure of sampling adequacy was 0.659 indicating sufficient inter-correlations while Barlett's Test of Sphericity was significant with chi-square of 278.011 and probability of less than 0.01, and the values extracted communalities for all factors were higher than 0.05. Accordingly, this set of data input is justifiable for the application of factor analysis method.

Table 5.49: KMO and Bartlett's Test of Regulations and Code Compliances

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.659
Bartlett's Test of Sphericity	Approx. Chi-Square	278.011
	Df	3
	Sig.	.000

Table 5.50: Communalities of Regulations and Code Compliances

Strategy of Regulations and Code Compliances	Initial	Extraction
Compliance with code and regulatory tool of sustainability	1.000	.757
Government policies to encourage sustainable development	1.000	.871
Incentive to encourage sustainable development	1.000	.691

Extraction Method: Principal Component Analysis.

Table 5.51 (p202) depicts that the results of total variance explained for all variables of regulations and code compliances strategy for the purpose of sustainability integration during project planning process. The results shows that there was only one (1) component with eigenvalue greater than 1 and the total variance explained was 77.337% of the total variance in the variables which are included on the components. Therefore, only one (1) component was extracted which consists of factors 'government policies to encourage sustainable development', 'compliance with code and regulatory tool of sustainability' and 'incentive to encourage sustainable development' (refer to Table 5.52, p202). The summary of the overall results are summarised in Table 5.53 (p202).

Table 5.51: Total Variance Explained of Regulations and Code Compliances

Component	Initial Eigenvalues Total	Initial Eigenvalues % of Variance	Initial Eigenvalues Cumulative %	Extraction Sums of Squared Loadings Total	Extraction Sums of Squared Loadings % of Variance	Extraction Sums of Squared Loadings Cumulative %
1	2.320	77.337	77.337	2.320	77.337	77.337
2	.480	15.989	93.326			
3	.200	6.674	100.000			

Extraction Method: Principal Component Analysis

Table 5.52: Component Matrix (a) of Regulations and Code Compliances

Strategies of Regulations and Code Compliances	Component 1
Government policies to encourage sustainable development	.934
Compliance with code and regulatory tool of sustainability	.870
Incentive to encourage sustainable development	.831

Extraction Method: Principal Component Analysis.
a. 1 components extracted. The solution cannot be rotated

Table 5.53: Summary of Results by Applying PCA for Regulations and Code Compliances

Strategies of Regulations and Code Compliances	Component 1	Communalities
Government policies to encourage sustainable development	.934	.871
Compliance with code and regulatory tool of sustainability	.870	.757
Incentive to encourage sustainable development	.831	.691
Eigenvalue	**2.320**	
Variance (77.337%)	**77.337**	

5.5.3 Descriptive Statistics

In the third stage, the data was analyzed using descriptive statistic to analyze respondents' preferences of the factors (21 sustainability principles of buildings and 29 sustainability integration strategies into the project planning process) to be addressed in the framework. In determining the most important factors, their total influencing frequency (TIF) value and total influencing percentage (TIP) for answer scale 5 (very important), their mean score (MS) and standard deviation (SD) were calculated. It was decided that only the factors that recorded a MS of 4.0 and above (range 'important to very important'), are considered as the most important factors to be included in the framework. The advantage of the mean approach is that, should respondents have answered 'not at all important' on one or two of the questions, a mean can still be calculated based on those questions that were answered (Johns, 2010). The central tendency and dispersion of the questionnaire responses also could be measured. The measure of central tendency was used to get an overview of typical value for each variable by calculating the mean, median and mode, meanwhile, the measure of dispersion was used to assess the homogenous or heterogeneous nature of the collected data by calculating the variance and the standard deviation (Bernard, 2000). This information is very useful to the researcher in order to find the most important factors to be addressed in the development of the framework. The results of the analysis output are discussed in the following section.

5.5.3.1 Descriptive Statistics for Sustainability Principles of Buildings

This section examines the descriptive statistics of the relative importance of the 29 sustainability principles of building as indicated in the Preliminary Framework. The frequency and descriptive analysis as shown in Table 5.54 revealed the result of the stakeholders' preferences of the most important sustainability principles of building to be integrated through the project planning process and incorporated in the framework.

Table 5.54: Frequency and Descriptive Analysis of Sustainability Principles of Building

No.	Sustainability principles of building	*Total Influencing Frequency (TIF)	**Total Influencing Percentage (TIP)	Mean Score (MS)	Standard Deviation (SD)	Stakeholders' Preference
Category 1: Environmental sustainability						
1.	Optimise materials and resources used	93	49%	4.5	0.560	Very Important
2.	Sustainable materials and resources	94	50%	4.5	0.588	Very Important
3.	Energy efficient	111	59%	4.6	0.527	Very Important
4.	Efficient water consumption	102	54%	4.5	0.656	Very Important
5.	Noise control	74	39%	4.3	0.688	Important
6.	Urban design, visual impact and Aesthetic	85	45%	4.3	0.758	Important
7.	Site Planning and Management	121	64%	4.6	0.517	Very Important
8.	Transport Management	85	45%	4.3	0.740	Important
9.	Concern on quality of land, river and sea	127	68%	4.6	0.565	Very Important
10.	Air and emissions quality	105	56%	4.5	0.625	Very Important
11.	Conserving heritage	89	47%	4.3	0.767	Important
12.	Efficient environmental management	128	68%	4.6	0.574	Very Important
13	Sustainable method	101	54%	4.5	0.580	Very Important
Category 2: Economic sustainability						
14.	Economic benefit to the stakeholders	68	36%	4.1	0.938	Important
15.	Improve local market presence	62	33%	4.1	0.778	Important
16.	Whole life cost efficiency	74	39%	4.2	0.783	Important
17.	Indirect economic impact	58	31%	4.1	0.745	Important
Category 3: Social sustainability						

No.	Sustainability principles of building	*Total Influencing Frequency (TIF)	**Total Influencing Percentage (TIP)	Mean Score (MS)	Standard Deviation (SD)	Stakeholders' Preference
18.	Employment Benefits	56	30%	3.9	1.007	Omitted
19.	Labor/Management Relations	33	18%	3.7	0.834	Omitted
20.	Occupational Health and Safety	84	45%	4.3	0.818	Important
21.	Training, Education and Awareness	72	38%	4.2	0.823	Important
22.	Fairness	43	23%	3.8	0.865	Omitted
23.	Human right performance	52	28%	3.9	0.881	Omitted
24.	Society Performance	57	30%	3.9	0.957	Omitted
25.	Product responsibility	71	38%	4.2	0.722	Important
26.	Stakeholder participation	76	40%	4.1	0.995	Important
27.	Macro social performance	64	34%	4.1	0.857	Important
Category 4: Design and innovation						
28.	Sustainable Design	125	66%	4.5	0.769	Very Important
29.	Sustainable Innovation	130	69%	4.6	0.675	Very Important

Note:1= Not at all important 2= Not important 3= Neutral 4=Important 5= Very Important
*TIF = Frequency score for answer scale 5
**TIP = Percentage for answer scale 5

Findings concur with study by Zainul Abidin (2009) that most construction players in Malaysia valued sustainable construction more towards environmental perspective. It was revealed by this research as tabulated in Table 5.54 above that majority of project stakeholders recommended that environmental sustainability aspect as the most significant principles to be integrated through the project planning process with the range of total influencing percentage (TIP) and mean score (MS) between TIP of 39% and MS of 4.3 (important) for 'noise control' to TIP of 68% and MS of 4.6 (very important) for 'concern on quality of land, river and sea' and 'efficient environmental management'.

Besides, final product as measured by the design and innovation aspect is another aspect that has been valued to be the most important sustainability principles of building among the project stakeholders as this aspect returned TIP of 66% to TIP of 69% and MS of 4.5 to MS of 4.6 (very important). The highest scores of TIF (≥50%) and the MS of sustainability principles of building are shown in Table 5.55 (p205) by considering TIP value of more than 50% (TIF of 94 and above).

Table 5.55: The Highest Score of TIF and the Mean Value (MS)

Sustainability principles of building	TIF of Respondents' feedback on sustainability principles of buildings						
	5	**4**	**3**	**2**	**1**	**Total feedback**	**Mean Score (MS)**
Category 1: Environmental Sustainability							
1. Efficient environmental management	128	51	9	0	0	188	4.6
2. Concern on quality of land, river and sea	127	53	8	0	0	188	4.6
3. Site planning and management	121	64	3	0	0	188	4.6
4. Energy efficient	111	74	3	0	0	188	4.6
5. Air and emissions quality	105	74	7	2	0	188	4.5
6. Efficient water consumption	102	69	17	0	0	188	4.5
7. Sustainable method	101	79	8	0	0	188	4.5
8. Sustainable materials and resources used	94	89	3	2	0	188	4.5
Category 4: Design and Innovation							
9. Sustainable innovation	130	44	11	3	0	188	4.6
10. Sustainable design	125	47	11	3	2	188	4.5

Note: 1= Not at all important 2= Not important 3= Neutral 4=Important 5= Very Important

Sustainable project is a project that delivers a sustainable product which is planned, constructed and operated in a sustainable manner. It considers the integration of environmental, social, and economic in its innovative design through its whole life. Unfortunately, the result shows that the views of the respondents seem less of exploring the holistic process of the building which should also considered economic and social aspects as the first priority. Findings, as shown in Table 5.54 (p203) reveals that economic and social aspects of sustainability in building was only score an influencing frequency percentage of less than 50% with TIP of 18%, to TIP of 45% and MS of 4.3. The result shows the fact that economic and social aspects of sustainable building have been rated by Malaysian project stakeholders as secondary compared to environmental and design and innovative aspects. This also indicates that the importances of economic and social aspect are still not widely accepted as parts of sustainability aspects of building project in Malaysia. Hence, this result also supports the earlier issue forwarded in this study that social and economic have been given less priority and valued as separated entities (Shari, 2011; Zainul Abidin, 2009). Since most project stakeholders' views skewed toward environmental and the final product (design and innovation) categories to be the most important sustainability principles of building, it is likely that this result were reflected the current Malaysian sustainable building projects' objectives and strategies.

As a summary, the description above is only a discussion on the current scenario in Malaysian building project. However, for the purpose of developing the framework, it was decided that only the principles that recorded a MS of more than 4.0 and above (range 'important to very important') are considered as the most important sustainability principles of building to be considered for the framework. Luckily, all 4 principles of economic aspect and 5 out of 10 principles of social aspects have achieved mean values of more than 4.0 which are MS of 4.1 for 'stakeholders participation', MS of 4.1 for ''macro social performance', MS of 4.2 for 'product responsibility', MS of 4.2 for 'training, education and awareness' and MS of 4.3 for 'occupational health and safety', meaning that the respondents appreciated the principles as important sustainability principles of building. Based on the parameter and the analysis outputs therefore, 24 out of 29 principles have been determined as the most important sustainability principles of building to be proceeded for further investigation. The rest of 5 principles which are 'employment benefits', 'labor/management relations', 'fairness', 'human right performance' and 'society performance' were not considered as important sustainability principles of building, as they only achieve MS value below than 4.00.

5.5.3.2 Descriptive Statistics for the Strategies to Integrate Sustainability Principles through Project Planning Process

This section examines the descriptive statistics of the relative importance of the 21 strategies to integrate sustainability through project planning process as indicated in the Preliminary Framework. It attempts to explore respondents' preferences of the most important strategies to integrate the sustainability principles through project planning process. Table 5.56 (p207) shows a summary results of the questionnaire, which was developed by computing the results of variables and sub-variables of the questions in the questionnaire. There are 2 out of 21 strategies were rated as 'very important' by majority of the respondents to be the most important strategies to integrate sustainability into the planning process of building project in Malaysia. The strategies are 'the team should have the core knowledge of sustainable building project' and 'government policies to encourage sustainable development'. However, all strategies are considered to be 'important' and 'very important' to be practiced and addressed during the framework development towards successful sustainability integration into building projects in the country.

Table 5.56: Frequency and Descriptive Analysis of the Strategies to Integrate Sustainability into the Project Planning Process

No.	The Strategies to Integrate Sustainability into the project planning process	*Total Influencing Frequency (TIF)	**Total Influencing Percentage (TIP)	Mean Score (MS)	Standard Deviation (SD)	Stakeholders' Preferences
Category 1: Sustainable Project Orientation						
1.	Specific sustainability goals and project priorities	80	43%	4.3	0.796	Important
2.	Sustainable concern during establishment of project scope, project charter, drawing, contract and detailed project plan	85	45%	4.3	0.750	Important
Category 3: Integrated Project Team						
3.	The project team members are involved and maintained throughout the planning process	69	37%	4.2	0.760	Important
4.	Local community representative is involved in support of the project	59	31%	4.1	0.809	Important
5.	An integrated design/ sustainability coordinator is appointed as one of the project's team members	66	35%	4.2	0.701	Important
6.	The team should have the core knowledge of sustainable building project	112	60%	4.5	0.665	Very Important
7.	Team members are educated on sustainability issues including vendors	100	53%	4.4	0.695	Important
8.	Team members' selection with sustainable development quality and capability	83	44%	4.4	0.604	Important
9.	Team members are fully informed on sustainability goals and priorities of the project.	99	53%	4.4	0.730	Important
Category 2: Integrated Design Process						
10.	Involve diverse set of stakeholders on the team	79	42%	4.2	0.871	Important
11.	Committed and collaborative team throughout the process	82	44%	4.3	0.788	Important
12.	Bringing the team together as early as possible during planning process	95	51%	4.4	0.679	Important
13.	Sustainability and integrated design requirements and the process are included into the project documentations, strategic and comprehensive plan.	89	47%	4.4	0.746	Important
14.	Do whole building design and systems analysis	93	49%	4.3	0.854	Important
15.	Commissioning process is added during this process and described in a specific section	70	37%	4.1	0.818	Important
16.	Planning should reflect all the project stakeholders	66	35%	4.1	0.785	Important
17.	Design should reflect the end user community	98	52%	4.4	0.807	Important
18.	Effective communication and incorporation of charette process	68	36%	4.1	0.787	Important
Category 4: Regulations and Code Compliances						
19.	Government policies to encourage sustainable development	112	60%	4.5	0.782	Very Important
20.	Compliance with code and regulatory tool of sustainability	94	50%	4.3	0.853	Important
21.	Incentive to encourage sustainable development	107	57%	4.4	0.867	Important

Note:MS 1= Not at all important 2= Not important 3= Neutral 4=Important 5= Very Important

**TIF = Frequency score for answer scale 5*
***TIP = Percentage for answer scale 5*

Table 5.56 above and Table 5.57(p209) tabulated that, there are 8 strategies have been revealed as the most popular choice by majority respondents where a half and above of them ranked the strategies as 'very important' to be implemented during the project planning process in order to deliver a successful performances of sustainability in building projects. Three (3) out of the 8 strategies, which are the 'team should have the core knowledge of sustainable building project' (TIP of 60%), 'team members are educated on sustainability issues' (TIP of 53%) and 'team members are fully informed on sustainability goals and priorities of the project' (TIP of 53%) come from the sub-factors of 'integrated project team'. Another 2 strategies which are 'bringing the team together as early as possible during planning process' (TIP of 51%) and 'design should reflect the end user community' (TIP of 52%) come from the sub-factors of 'integrated design process'. Meanwhile, the rest 3 strategies which are 'government policies to encourage sustainable development' (TIP of 60%), 'incentive to encourage sustainable development' (TIP of 57%) and 'compliance with code and regulatory tool of sustainability' (TIP of 50%) come from the sub-factors of 'regulation and code compliances'. The results revealed that all strategies indicated in 'regulation and code compliances group were considered to be very significant to be addressed in the proposed framework with the mean values ranges from 4.3 to 4.5 which represent to the answer of 'important to very important' factors. This study coincides with studies by most researchers such as Luce, 2011 and Choi, 2009 whereas; regulatory processes and code that meet sustainability goals are very significant to promote sustainability integration practices.

Summarize of the highest score of TIF (≥50%) and the MS of the strategies to integrate sustainability principles through project planning process are shown in Table 5.57 below, which is based on the TIP value of more than 50% (TIF of 94 and above). Surprisingly, the finding reveals that there is no one sub-factor has been selected as 'very important' by more than 50% respondents from the first category of strategies which are 'sustainable orientation project'. This is probably one of the main reasons why 28% of the respondents as shown in Table 5.5 (p172) perceived that 'process issues' is one of the problems in implementing sustainability in building project. Late consideration on sustainability principles, which is after planning process might leading to funding and other problems due to the changes such as plan redesign, rescheduling process and so forth. It is very critical that the specific sustainability goal and project priorities, needs and expectations to be considered and informed early to the project team during the planning process in order to minimize misunderstanding and future complication (Doyle et al, 2009 and Choi, 2009). The delay can cause sustainable project failure including cost overrun, reschedule and increase change orders during construction which also affect the quality of the building and stakeholders' dissatisfaction.

Table 5.57: The Highest Score of TIF and the Mean Value (MS)

The strategies to integrate sustainability into the project planning process	TIF of Respondents' feedback						
	5	**4**	**3**	**2**	**1**	**Total Feedback**	**Mean Score**
Integrated Project Team							
1. The team should have the core knowledge of sustainable building project	112	68	6	0	2	188	4.5
2. Team members are educated on sustainability issues including vendors	100	76	7	0	5	188	4.4
3. Team members are fully informed on sustainability goals and priorities of the project.	99	74	9	6	0	188	4.4
Integrated Design Process							
4. Design should reflect the end user community	98	69	15	4	2	188	4.4
5. Bringing the team together as early as possible during planning process	95	83	8	0	2	188	4.4
Regulations and Code Compliances							
6. Government policies to encourage sustainable development	112	52	22	0	2	188	4.5
7. Incentive to encourage sustainable development	107	57	15	7	2	188	4.4
8. Compliance with code and regulatory tool of sustainability	94	66	24	0	4	188	4.3

Note: 1= Not at all important 2= Not important 3= Neutral 4=Important 5= Very Important

Sustainable building project works best when the sustainability ideas and efforts are considered very early in the planning process. However, the result shows that (refer to Table 5.56, p207) less than 50% of the respondents valued 'specific sustainability goals and project priorities', (TIP of 43%) and 'sustainable concern during establishment of project details (TIP of 45%) as 'very important' strategies to integrate sustainability through project planning process. It shows that Malaysian building project stakeholders have placed these strategies as a second priority in during project planning process. The findings contradict with the studies by Robichaud and Anantatmula, (2011); Mochal and Krasnoff, (2010) and Wu and Low, (2010) who revealed that sustainability goals and project priorities must be set since the strategic planning of the project in order to establish the framework in which all future sustainable project decisions are made. This is the starting point of achieving sustainability to realize the goal of sustainability (Wu and Low, 2010). At this stage, project scope, contract and construction drawing and detailed project plan which focus on sustainability and stakeholders' expectation should be prepared (Mochal and Krasnoff, 2010). Without a proper planning at this stage, the sustainability in building project will carry a lot of risk and tend to fail (Doyle et al., 2009).

Though, luckily based on the results tabulated in Table 5.56 (p207), both strategies from the 'sustainable project orientation' category has achieved the mean values of more than 4.0 which are MS of 4.3, meaning that the respondents appreciated the factors to be the 'important' strategies to integrate sustainability through project planning process. For the purpose of developing the framework, it was decided that only the principles that recorded a MS of more than 4.0 and above (range 'important to very important') are considered to be the most important strategies of sustainability integration during project planning process to be addressed in the framework. Based on this parameter and the analysis output, therefore all of those 21 strategies have been determined as the most important strategies to be proceeded for further investigation.

5.5.4 Triangulation Measures of Preferences and Developing Framework of Integrating Sustainability into the Project Planning Process (Stage 1)

This section provides the summary of the empirical analysis findings of the quantitative survey by adopting triangulation of approaches. Subsequently, the findings are presented as the stage one of 'Framework of Integrating Sustainability into the Project Planning Process'. The framework is shown in Table 5.60 (p213). As mentioned previously in Chapter 4 (p160), the factor of the proposed framework that was omitted by any one of the refining methods are removed from the lists as it is not fulfill all requirements throughout the refining process The results of the empirical findings are strongly recommended as tabulated in Table 5.58 (p211) and Table 5.59 (p212). It was found that there are 22 sustainability principles of buildings and 20 strategies to integrate the principles into the project planning process have been determined as the most important to be incorporated in the proposed framework (stage 1). Seven (7) out of 29 sustainability principles of buildings have been omitted which are 'conserving heritage', 'macro social performance', 'human right performance', 'society performance', 'employment benefits', 'fairness' and 'labor/management relations'. However, this exclusion does not necessarily indicate that all of those 7 sustainability principles which most of them are within the social sustainability aspect are not at all important to be considered during project planning process but a more rational argument would be that the principles have not much very well exposed in term of efficiency. Without this exposure, the principles would only be considered to be non critical among the Malaysian project stakeholders. Another reason is the principles are perceived as not the current priority issues in Malaysia to be resolved as compared to the others.

Table 5.58: Stakeholders' Preferences of Sustainability Principles of Building (Triangulation Measures)

Sustainability Principles of Building					
Quantitative Analysis		Cronbach's Alpha	PCA	Descriptive Statistic (MS)	Inclusion in the Framework (stage 1)
Environmental Aspect					
1.	Optimise materials and resources used	Good	Significant	Very Important	Included
2.	Sustainable materials and resources	Good	Significant	Very Important	Included
3.	Energy efficient	Good	Significant	Very Important	Included
4.	Efficient water consumption	Good	Significant	Very Important	Included
5.	Noise control	Good	Significant	Important	Included
6.	Urban design, visual impact and aesthetic	Good	Significant	Important	Included
7.	Site Planning and management	Good	Significant	Very Important	Included
8.	Transport management	Good	Significant	Important	Included
9.	Concern on quality of land, river and sea	Good	Significant	Very Important	Included
10.	Air and emissions quality	Good	Significant	Very Important	Included
11.	Conserving heritage	Good	Omitted	Important	Omitted
12.	Efficient environmental management	Good	Significant	Very Important	Included
13.	Sustainable method	Good	Significant	Very Important	Included
Economic Aspect					
14.	Economic benefit to the stakeholders	Good	Significant	Important	Included
15.	Improve local market presence	Good	Significant	Important	Included
16.	Whole life cost efficiency	Good	Significant	Important	Included
17.	Indirect economic impact	Good	Significant	Important	Included
Social Aspect					
18.	Employment Benefits	Excellent	Significant	Omitted	Omitted
19.	Labor/Management Relations	Excellent	Omitted	Omitted	Omitted
20.	Occupational Health and Safety	Excellent	Significant	Important	Included
21.	Training, Education and Awareness	Excellent	Significant	Important	Included
22.	Fairness	Excellent	Omitted	Omitted	Omitted
23.	Human right performance	Excellent	Omitted	Omitted	Omitted
24.	Society Performance	Excellent	Omitted	Omitted	Omitted
25.	Product responsibility	Excellent	Significant	Important	Included
26.	Stakeholders participation	Excellent	Significant	Important	Included
27.	Macro social performance	Excellent	Omitted	Important	Omitted
Design and Innovations					
28.	Sustainable Design	Excellent	Significant	Very Important	Included
29.	Sustainable Innovation	Excellent	Significant	Very Important	Included

Meanwhile, 1 out of 21 strategies of the sustainability integration through project planning process which is 'the project team is involved and maintained throughout the planning process' has also been omitted (Table 5.59, p212). This exclusion also does not necessarily indicate that the strategy is not important to be considered for the framework but the strategy has not yet popular among the Malaysian project stakeholders as the traditional planning process are carried out linearly throughout the process. Several respondents as well claim that maintaining the project team through the whole planning process is sometimes difficult due to unforeseen circumstances. Ultimately, without this experience, the strategy would only be considered to be minor among the project stakeholders

Table 5.59: Stakeholders' Preferences of the Strategies to Integrate Sustainability Principles into the Project Planning Process (Triangulation Measures)

Sustainability Integration Strategies through Project Planning Process				
Quantitative Analysis	**Cronbach's Alpha**	**PCA**	**Descriptive Statistic (MS)**	**Inclusion in the Framework (stage 1)**
Sustainable Project Orientation				
1. Specific sustainability goals and project priorities	Excellent	Significant	Important	Included
2. Sustainable concern during establishment of project scope, project charter, drawing, contract and detailed project plan	Excellent	Significant	Important	Included
Integrated project team				
3. The project team is involved and maintained throughout the planning process	Good	Omitted	Important	Omitted
4. Local community representative is involved in support of the project	Good	Significant	Important	Included
5. An integrated design/ sustainability coordinator is appointed as one of the project's team members	Good	Significant	Important	Included
6. The team should have the core knowledge of sustainable building project	Good	Significant	Very Important	Included
7. Team members are educated on sustainability issues and process including vendors	Good	Significant	Important	Included
8. Team members' selection with sustainable development quality and capability	Good	Significant	Important	Included
9. Team members are fully informed on sustainability goals and priorities of the project.	Good	Significant	Important	Included
Integrated design process				
10. Involve diverse set of stakeholders on the team	Good	Significant	Important	Included
11. Committed and collaborative team throughout the process	Good	Significant	Important	Included
12. Bringing the team together as early as possible during planning process	Good	Significant	Important	Included
13. Sustainability and integrated design requirements and the process are included into the project documentations, strategic and comprehensive plan.	Good	Significant	Important	Included
14. Do whole building design and systems analysis	Good	Significant	Important	Included
15. Commissioning process is added during this process and described in a specific section	Good	Significant	Important	Included
16. Planning should reflect all the project stakeholders	Good	Significant	Important	Included
17. Design should reflect the end user community	Good	Significant	Important	Included
18. Effective communication and incorporation of charette process	Good	Significant	Important	Included
Regulations and code compliances				
19. Government policies to encourage sustainable development	Good	Significant	Very Important	Included
20. Compliance with code and regulatory tool of sustainability	Good	Significant	Important	Included
21. Incentive to encourage sustainable development	Good	Significant	Important	Included

Table 5.60: Framework of Integrating Sustainability into the Project Planning Process (Stage 1)

(A) SUSTAINABILITY PRINCIPLES OF BUILDING	
ENVIRONMENTAL SUSTAINABILITY	
1.	Optimise materials and resources used
2.	Sustainable materials and resources
3.	Energy efficient
4.	Efficient water consumption
5.	Noise control
6.	Urban design, visual impact and aesthetic
7.	Site Planning and management
8.	Transport management
9.	Concern on quality of land, river and sea
10.	Air and emissions quality
11.	Efficient environmental management
12.	Sustainable method
ECONOMIC SUSTAINABILITY	
13.	Economic benefit to the stakeholders
14.	Improve local market presence
15.	Whole life cost efficiency
16.	Indirect economic impact
SOCIAL SUSTAINABILITY	
17.	Occupational Health and Safety
18.	Training, Education and Awareness
19.	Product responsibility
20.	Stakeholders participation
DESIGN AND INNOVATION	
21.	Sustainable Design
22.	Sustainable Innovation
(B) STRATEGIES TO INTEGRATE THE SUSTAINABILITY PRINCIPLES INTO THE PROJECT PLANNING PROCESS	
SUSTAINABLE PROJECT ORIENTATION	
1.	Specific sustainability goals and project priorities
2.	Sustainable concern during the establishment of project scope, project charter, drawing, contract & detailed project plan
INTEGRATED PROJECT TEAM	

'Table 5.60, continued'.

3.	Local community representative is involved in support of the project
4.	An integrated design/ sustainability coordinator is appointed as one of the project's team members
5.	The team should have the core knowledge of sustainable building project
6.	Team members are educated on sustainability issues and process including vendors
7.	Team members' selection with sustainable development quality and capability
8.	Team members are fully informed on sustainability goals and priorities of the project.
INTEGRATED DESIGN PROCESS	
9.	Involve diverse set of stakeholders on the team
10.	Committed and collaborative team throughout the process
11.	Bringing the team together as early as possible during planning process
12.	Sustainability and integrated design requirements and the process are included into the project documentations, strategic and comprehensive plan.
13.	Do whole building design and systems analysis
14.	Commissioning process is added during this process and described in a specific section
15.	Planning should reflect all the project stakeholders
16.	Design should reflect the end user community
17.	Effective communication and incorporation of charette process
REGULATIONS AND CODE COMPLIANCES	
18.	Government policies to encourage sustainable development
19.	Compliance with code and regulatory tool of sustainability
20.	Incentive to encourage sustainable development

5.5.5 Relative Important Index (RII) and Developing Framework of Integrating Sustainability into the Project Planning Process (Stage 2)

In the final stage of quantitative analysis, the data was analyzed using Relative Importance Index (RII). The main purpose of this analysis is to find out the result that can be used to rank each factor that was considered as the most important to be incorporated into the proposed framework. By using mean values, the resulted RII value will be transformed into three important levels: high ($0.8 \leq RII \leq 1$), medium ($0.5 \leq RII \leq 0.8$) and low ($0 \leq RII \leq 0.5$) (Tam et al, 2007). The results of this analysis are discussed in the next section. Afterward, the findings of this analysis are presented as the stage two of 'Framework of Integrating Sustainability into the Project Planning Process'. The framework is shown in Table 5.63 (p217).

5.5.5.1 RII for Sustainability Principles of Building

The results tabulated in Table 5.61 shows the RII for each sustainability principle of building that have been selected to be incorporated in the framework. The RII values of environmental sustainability principles are within the ranges of 0.89 to 0.93, economic and social aspects are within the ranges of 0.82 to 0.85. Design and innovation aspects of sustainability scored the highest rank of RII which is within the ranges of 0.91 to 0.92. It was found that all of the selected sustainability principles of building have scored a high important level of principles to be addressed throughout the development of the proposed framework.

Table 5.61: RII of Sustainability Principles of Building

Sustainability Principles of Building	Respondents' feedback								Important Level
	5	4	3	2	1	Total feedback	MS	RII	
Environmental Aspects									
1. Efficient environmental management	128	51	9	0	0	188	4.6	0.93	High
2. Concern on quality of land, river and sea	127	53	8	0	0	188	4.6	0.93	High
3. Site planning and management	121	64	3	0	0	188	4.6	0.93	High
4. Energy efficient	111	74	3	0	0	188	4.6	0.91	High
5. Air and emissions quality	105	74	7	2	0	188	4.5	0.90	High
6. Sustainable method	101	79	8	0	0	188	4.5	0.90	High
7. Sustainable materials and resources	94	89	3	2	0	188	4.5	0.89	High
8. Optimize materials and resources used	93	89	6	0	0	188	4.5	0.89	High
9. Efficient water consumption	102	69	17	0	0	188	4.5	0.89	High
10. Transport management	85	82	16	5	0	188	4.3	0.86	High
11. Urban design, visual impact and aesthetic	85	79	19	5	0	188	4.3	0.86	High
12. Noise control	74	99	10	5	0	188	4.3	0.86	High
Economic Aspects									
13. Whole life cost efficiency	74	87	18	11	4	188	4.2	0.85	High
14. Improve local market presence	62	99	21	4	2	188	4.1	0.83	High
15. Indirect economic impact	58	89	20	3	2	188	4.1	0.82	High
16. Economic benefit to the stakeholders	68	97	28	5	0	188	4.1	0.82	High
Social Aspects									
17. Occupational health and safety	84	80	17	5	2	188	4.3	0.85	High
18. Product responsibility	71	88	27	2	0	188	4.2	0.84	High
19. Training, education and awareness	72	79	33	2	2	188	4.2	0.83	High
20. Stakeholder participation	76	70	26	12	4	188	4.1	0.82	High
Design and Innovations									
21. Sustainable Innovation	130	44	11	3	0	188	4.6	0.92	High
22. Sustainable Design	125	47	11	3	2	188	4.5	0.91	High

Note: 1= Not at all important 2= Not important 3= Neutral 4=Important 5= Very Important

5.5.5.2 RII for the Strategies to Integrate Sustainability Principles into the Project Planning Process

The results tabulated in Table 5.62 shows the RII for each strategy to integrate sustainability into the project planning process for buildings that have been selected to be incorporated in the framework. The RII values of sustainable project orientation strategies are within the ranges of 0.86 to 0.87, integrated project team are within the ranges of 0.81 to 0.91, integrated design process strategies are within the ranges of 0.82 to 0.89 and regulations and code compliances strategies are within the range of 0.86 to 0.89. The strategies of 'having the core knowledge of sustainable building among the project team' (RII of 0.91), 'government policies to encourage sustainable development' (RII of 0.89) and 'bringing the team together as early as possible during planning process', (RII of 0.89) scored the highest rank of RII among other strategies. It was found that all of the selected strategies are highly important to be included in the proposed framework.

Table 5.62: RII of Strategies to Integrate Sustainability into the Project Planning Process

Strategies to Integrate Sustainability into the Project Planning Process	Respondents' feedback								Important Level
	5	4	3	2	1	Total feed Back	MS	RII	
Sustainable Project Orientation									
1. Sustainable concern during establishment of project scope, project charter, drawing, contract and detailed project plan	85	85	14	2	2	188	4.3	0.87	High
2. Specific sustainability goals and project priorities	80	92	10	2	4	188	4.3	0.86	High
Integrated project team									
3. The team should have the core knowledge of sustainable building	112	68	6	0	2	188	4.5	0.91	High
4. Team members are educated on sustainability issues including vendors.	100	76	7	0	5	188	4.4	0.88	High
5. Team members are fully informed on sustainability goals and priorities of the project.	99	74	9	6	0	188	4.4	0.88	High
6. Team members' selection with sustainable development quality and capability	83	93	12	0	0	188	4.4	0.88	High
7. An integrated design/ sustainability coordinator is appointed as one of the project's team members	66	90	32	0	0	188	4.2	0.84	High
8. Local community representative is involved in support of the project	59	87	38	2	2	188	4.1	0.81	High
Integrated design process									
9. Bringing the team together as early as possible during planning process	95	83	8	0	2	188	4.4	0.89	High
10. Design should reflect the end user community	98	69	15	4	2	188	4.4	0.87	High

‘Table 5.62, continued’.

Strategies to Integrate Sustainability into the Project Planning Process	Respondents’ feedback								Important Level
	5	4	3	2	1	Total feed Back	MS	RII	
11. Sustainability and Integrated design requirements and the process are included into the project documentations, strategic and comprehensive plan.	89	89	3	5	2	188	4.4	0.87	High
12. Do whole building design and systems analysis	93	64	25	4	2	188	4.3	0.86	High
13. Committed and collaborative team throughout the process	82	92	8	2	4	188	4.3	0.86	High
14. Involve diverse set of stakeholders on the team	79	81	14	14		188	4.2	0.84	High
15. Effective communication and incorporation of charette process	68	81	35	4	0	188	4.1	0.83	High
16. Planning should reflect all the project stakeholders	66	90	25	7	0	188	4.1	0.83	High
17. Commissioning process is added during this process and described in a specific section.	70	70	45	3	0	188	4.1	0.82	High
Regulations and Code Compliances									
18. Government policies to encourage sustainable development	112	52	22	0	2	188	4.5	0.89	High
19. Incentive to encourage sustainable development	107	57	15	7	2	188	4.4	0.88	High
20. Compliance with code and regulatory tool of sustainability	94	66	24	0	4	188	4.3	0.86	High

Note: 1= Not at all important 2= Not important 3= Neutral 4=Important 5= Very Important

The findings of this analysis are presented as the stage two of ‘Framework of Integrating Sustainability into the Project Planning Process’. The framework is shown in Table 5.63 below.

Table 5.63: Framework of Integrating Sustainability into the Project Planning Process (Stage 2)

(A) SUSTAINABILITY PRINCIPLES OF BUILDING	RANK
ENVIRONMENTAL SUSTAINABILITY	
1. Efficient environmental management	1
2. Concern on quality of land, river and sea	2
3. Site planning and management	3
4. Energy efficient	4
5. Air and emissions quality	5
6. Sustainable method	6
7. Sustainable materials and resources	7
8. Optimize materials and resources used	8
9. Efficient water consumption	9
10. Transport management	10
11. Urban design, visual impact and aesthetic	11

'Table 5.63, continued'.

12. Noise control	12
ECONOMIC SUSTAINABILITY	
13. Whole life cost efficiency	1
14. Improve local market presence	2
15. Indirect economic impact	3
16. Economic benefit to the stakeholders	4
SOCIAL SUSTAINABILITY	
17. Occupational health and safety	1
18. Product responsibility	2
19. Training, education and awareness	3
20. Stakeholder participation	4
DESIGN AND INNOVATION	
21. Sustainable Innovation	1
22. Sustainable Design	2
(B) STRATEGIES TO INTEGRATE THE SUSTAINABILITY PRINCIPLES INTO THE PROJECT PLANNING PROCESS	**RANK**
SUSTAINABLE PROJECT ORIENTATION	
1. Sustainable concern during the establishment of project scope, project charter, drawing, contract and detailed project plan	1
2. Specific sustainability goals and project priorities	2
INTEGRATED PROJECT TEAM	
3. The team should have the core knowledge of sustainable building	1
4. Team members are educated on sustainability issues including vendors.	2
5. Team members are fully informed on sustainability goals and priorities of the project.	3
6. Team members' selection with sustainable development quality and capability	4
7. An integrated design/ sustainability coordinator is appointed as one of the project's team members	5
8. Local community representative is involved in support of the project	6
INTEGRATED DESIGN PROCESS	
9. Bringing the team together as early as possible during planning process	1
10. Design should reflect the end user community	2
11. Sustainability and integrated design requirements and the process are included into the project documentations, strategic and comprehensive plan.	3
12. Do whole building design and systems analysis	4
13. Committed and collaborative team throughout the process	5
14. Involve diverse set of stakeholders on the team	6
15. Effective communication and incorporation of charette process	7
16. Planning should reflect all the project stakeholders	8
17. Commissioning process is added during this process and described in a specific section.	9

'Table 5.63, continued'.

REGULATIONS AND CODE COMPLIANCES	
18. Government policies to encourage sustainable development	1
19. Incentive to encourage sustainable development	2
20. Compliance with code and regulatory tool of sustainability	3

5.6 SUMMARY

This chapter has presented the analysis process of identifying the most important sustainability principles of buildings and the strategies to integrate the principles into the project planning process to be incorporated into the proposed framework from the views of Malaysian project stakeholders and assigning their appropriate weighting level. It was revealed that Malaysian project stakeholders are currently appreciated sustainability in building projects skewed toward environmental aspect and the final sustainable product of the project (the building) through design and innovation. On the other hand, economic and social sustainability aspects which should be considered through the process and cycle of the building have been appreciated as a secondary aspect in delivering sustainability in building project. Sustainability in building project usually related to a high quality of product only rather than the whole success performance measures.

Sustainability principles were determined very significant to be considered for the building whole life and should be highlighted since the planning process of the project in Malaysia. At the end of the quantitative analysis process, 22 sustainability principles of building and 20 strategies to integrate the principles into the projects planning process (42 factors) have been selected to be addressed in the proposed framework. The final results are presented in a form of stage 1 and stage 2 frameworks (Table 5.60, p213 and Table 5.63, p217). The framework (stage 2) afterwards examined by the qualitative methods of the case study technique for further refining process and the external validation which is discussed in the next chapter.