

CHAPTER SIX

RESEARCH FINDINGS: CASE STUDIES: CROSS CASE ANALYSIS

6.1 INTRODUCTION

This chapter sets out to refine the framework (stage 2) proposed in Chapter Five by the means of case studies interviews. It aims to get inputs from the relevant stakeholders who have been directly involved in the planning process of the three selected case studies - LEO, GEO and Diamond buildings. It presents findings gathered from the cross case analysis of the three case studies with the purpose of seeking understanding on research question three, four and five of this study – ‘Do project stakeholders integrate the sustainability principles into the project planning process of Malaysian sustainable building? What? How?, ‘How the sustainability integration practices into the planning process influence the project performance?’ and ‘What are the most significant sustainability principles of buildings and how the principles should be integrated into the planning process of Malaysian building project? It explores and examines the sustainability principles that are integrated into the case building projects and how the principles are integrated into the project planning process. The influences of sustainability integration towards the project performances are also discussed. It then explores the perceptions of the stakeholders on the sustainability principles of buildings and the strategies to integrate the principles into the project planning process suitable to Malaysian context. Discussion and analysis of findings are specifically arranged to show replication logic

The results are categorized into six main aspects; 1) stakeholders’ involvement, 2) sustainability practices 3) the projects performances. 4) barriers to the project 5) stakeholders’ preferences of sustainability principles of building and the strategies to integrate the principles into the project planning process and 6) the framework development. The cross case of basic information of the buildings is shown in Table 6.1 and the following texts will discuss each of these projects and aspects in detail. The Framework of Integrating Sustainability into the Project Planning Process (Final Stage) is proposed at the end of this chapter.

Table 6.1: The Case Building Projects' Information

Name of Building	LEO	GEO	DIAMOND
Location	Parcel E, Precinct 1 Putrajaya	Section 9, Bandar Baru Bangi, Bangi, Selangor	Precinct 2, Putrajaya
Category	Office Building	Office Building	Office Building
Gross Floor Area	22,976m ²	4,152m ²	14,230m ²
Energy Index	100 kWh/m ² /year	65 kWh/m ² /year (excl. PV) 30 kWh/m ² /year (incl. PV)	65 kWh/m ² /year (excl. PV) 55 kWh/m ² /year (incl. PV)
Initial Cost	RM55 million	RM16 million	RM87 million
Actual Cost	RM57 million	RM20 million	RM87 million
Extra Cost for Sustainable Features	RM5 million (10%)	RM7 million (33%)	RM3.6 million (4%)
Cost Saving	RM900k/year	RM160k-RM170k/year	RM1 million/year
ROI	8-10 years	34 years	3-5 years
Commencement	2001	2004	2005
Construction started	2002	2006	2007
Completion	2004	2007	2010
Occupancy	September 2004	November 2007	June 2010
Client/Owner	Ministry of Energy, Green Technology and Water (KeTTHA)	Malaysia Energy Centre (PTM)	Malaysia Energy Commission (ST)
Developer	Putrajaya Holdings Sdn. Bhd.	Malaysia Energy Centre	Senandung Budiman Sdn. Bhd.
Project Manager	KLCC Project	KLCC Project	Putra Perdana Construction Sdn Bhd
Architect	SNO Architects Sdn. Bhd	Ruslan Khalid Associates	Professor Soontorn, Bangkok NR Architect
Engineer	Syed Mansur and Associates Sdn Bhd (C&S engineer) VY Consult Sdn Bhd (M&E engineer)	Arup Jururunding Sdn Bhd (C&S engineer) Five-H Associates Sdn Bhd (M&E engineer)	Perunding SM Cekap (C&S engineer) Primetech Engineers Sdn. Bhd (M&E engineer)
Energy Consultants	DANIDA	IEN Consultants	IEN Consultants
Main Contractor	Putra Perdana Construction Sdn. Bhd.	Putra Perdana Construction Sdn Bhd	Putra Perdana Construction Sdn Bhd
Local Authority	Putrajaya Corporation	Kajang Municipal Council	Putrajaya Corporation
End User	Ministry of Energy, Green Technology and Water (KeTTHA)	Malaysia Energy Centre (PTM)	Malaysia Energy Commission (ST)

6.2 STAKEHOLDERS INVOLVEMENT

Generally, the stakeholders' involvement in the planning process of the three projects was imbalance, with a very low operation and maintenance stakeholders' (energy/facility manager) involvement in decision making during planning process. However whether they were appointed late or not, they were informed by the owners

about decisions being taken during the planning process. The owners' involvement throughout the planning process of the projects was very high (refer Table 6.2 and Table 6.3, p224). They represented clients, operators and users of the buildings. Local authorities' involvement throughout the planning process of the projects was at a medium level, which is only for approval reason. Energy consultant involvement was very low during early planning process of LEO building project but became very high during the detail design stage. While, energy consultants' involvement was very high throughout the planning process of GEO and Diamond buildings as they said:

‘We involved from the very beginning of GEO building project..we introduced them to the integrated idea and came with some design principles for example the north south orientation of the building and the principles of making the building to be a highly daylit building’. (E2)

‘...Differences ideas had came out.. it was nothing intention for the building to looks like a diamond. But, during conceptual and detail design planning and charrettes process towards achieving an energy efficient and Islamic design building, it was finally looks like a diamond. Then.. we agreed to design the building in a diamond shape. It was nothing intention at the beginning!’ (E3)

Table 6.2: Stakeholders' Involvement in the Project Planning Process

Stakeholders	Projects	Involvement	Planning Process			
			Conceptual Planning	Preliminary Design	Detail Design and Development	
OWNER	LEO BUILDING (O1)	Extents of Involvement	Full	Full	Full	
		Degree of Involvement	(A)	(A)	(A)	
	GEO BUILDING (O2)	Extents of Involvement	Full	Full	Full	
		Degree of Involvement	(A)	(A)	(A)	
	DIAMOND BUILDING (O3)	Extents of Involvement	Full	Full	Full	
		Degree of Involvement	(A)	(A)	(A)	
	ENERGY/ FACILITY MANAGER	LEO BUILDING (M1)	Extents of Involvement	None	None	None
			Degree of Involvement	(D)	(D)	(D)
		GEO BUILDING	Extents of Involvement	None	None	None

‘Table 6.2, continued’.

Stakeholders	Projects	Involvement	Planning Process		
			Conceptual Planning	Preliminary Design	Detail Design and Development
ENERGY/ SUSTAINABILITY CONSULTANT	(M2)	Degree of Involvement	Ⓓ Being Informed	Ⓓ Being Informed	Ⓓ Being Informed
	DIAMOND BUILDING (M3)	Extents of Involvement	None	None	None
		Degree of Involvement	Ⓓ Being Informed	Ⓓ Being Informed	Ⓓ Being Informed
	LEO BUILDING (E1)	Extents of Involvement	None	None	Full
		Degree of Involvement	Ⓔ Not Being Involved	Ⓔ Not Being Involved	Ⓐ Most Occupying
	GEO BUILDING (E2)	Extents of Involvement	Full	Full	Full
Degree of Involvement		Ⓐ Most Occupying	Ⓐ Most Occupying	Ⓐ Most Occupying	
DIAMOND BUILDING (E3)	Extents of Involvement	Full	Full	Full	
	Degree of Involvement	Ⓐ Most Occupying	Ⓐ Most Occupying	Ⓐ Most Occupying	
MAIN CONTRACTOR	LEO BUILDING (C1)	Extents of Involvement	None	None	Substantial
		Degree of Involvement	Ⓔ Not Being Involved	Ⓔ Not Being Involved	Ⓑ Being Involved
	GEO BUILDING (C2)	Extents of Involvement	None	None	None
		Degree of Involvement	Ⓔ Not Being Involved	Ⓔ Not Being Involved	Ⓔ Not Being Involved
	DIAMOND BUILDING (C3)	Extents of Involvement	Substantial	Substantial	Full
		Degree of Involvement	Ⓐ Most Occupying	Ⓐ Most Occupying	Ⓐ Most Occupying
LOCAL AUTHORITY	LEO BUILDING (L1)	Extents of Involvement	Little	Little	Little
		Degree of Involvement	Ⓐ Most Occupying	Ⓐ Most Occupying	Ⓐ Most Occupying
	GEO BUILDING (L2)	Extents of Involvement	Little	Little	Little
		Degree of Involvement	Ⓐ Most Occupying	Ⓐ Most Occupying	Ⓐ Most Occupying

pre-construction stage of the project as the owner (O2) said: ‘We had never had a contractor in place during the project planning process because this was a conventional tender project. But, we used to get inputs and feedback from them throughout the construction stage’.

Diamond building project was quite special, although the main contractor was officially appointed during detail design stage of the project but their involvement in the project was actually beforehand. Their involvement was high during the project planning process at the conceptual and preliminary design. After appointment, their involvement became very high in making decisions for the building as the main contractor (E3) highlighted: ‘A truly integrated design process will have to include the contractor to help designers to down the design path’.

6.3 SUSTAINABILITY PRACTICES

This part aims to explore the extent of sustainability practices in the three building projects in order to define the gaps that should be bridged towards achieving sustainability. This part comprises of four issues; 1) the projects goals 2) sustainability principles consideration in the projects and 3) the projects’ strategy to achieve the projects goal of sustainability 4) the strategies to integrate sustainability into the projects planning process. Each of the issues is described in the followings.

6.3.1 The Projects Goals

As shown in Table 6.4 (p226), all interviewees of LEO, GEO and Diamond projects agreed that all three projects have the environmental sustainability goals. The fact reveals that environmental aspects were considered and it is likely that this reflected the sustainability appraisal and integration in every stage of the projects. It was varied and diverse perception of the goals of economic, social, design and innovation aspects of the projects among the interviewees.

Table 6.4: Stakeholders’ Responses on the Sustainability Goals of the Projects

Stakeholders’ Perceptions		LEO	GEO	DIAMOND	Positive Answers
Sustainability Goal Considerations	Environmental Aspect	Yes: O1, E1, C1, M1, L1 Overall: Yes (all 5)	Yes: O2, E2, C2, M2, L2 Overall: Yes (all 5)	Yes: O3, E3, C3, M3, L3 Overall: Yes (all 5)	All 15
	Economic Aspect	Yes: O1, E1, C1, M1 No: L1 Overall: Yes (4 out of 5)	Yes: O2, E2, M2 No: C2, L2 Overall: Yes (3 out of 5)	Yes: O3, E3, C3, M3 No: L3 Overall: Yes (4 out of 5)	11 out of 15
	Social Aspect	Yes: O1, E1, C1, M1 No: L1 Overall: Yes (4 out of 5)	Yes: O2, E2, M2 No: C2, L2 Overall: Yes (3 out of 5)	Yes: O3, E3, C3, M3 No: L3 Overall: Yes (4 out of 5)	11 out of 15
	Design and Innovation Aspect	Yes: O1, E1, C1, M1, L1 Overall: Yes (all 5)	Yes: O2, E2, M2, C2 No: L2 Overall: Yes (4 out of 5)	Yes: O3, E3, C3, M3, L3 Overall: Yes (all 5)	14 out of 15
Positive Answers		18	15	18	51
Total Answers		20	20	20	60

Four out of five LEO’s and Diamond’s project stakeholders agreed that the projects (LEO and Diamond) have the economic and social sustainability goals, while only 3 out of 4 of the GEO’s stakeholders mentioned that GEO project had both of the sustainability goals. The local authorities of LEO and Diamond projects did not aware that the projects have up to some extent of the economic and social sustainability goals. One of the reasons, is the local authorities had only been involved at the approval part of the projects. The documents submitted to the local authorities did not clearly mentioned about the economic and social goals of the projects.

Of the five GEO project’s stakeholders, local authorities and main contractor of this project also did not aware that the projects have up to some extent of economic and social sustainability goals. As the same as LEO and Diamond projects, the local authorities had only been involved for the approval stage of the projects. In the meantime the main contractor had not been involved during the planning process and was not exposed to the economic and social sustainability aspects of the project. As a result, it reflected the project performance during construction stage of the project (refer Appendix M, p360) as the contractor perceived that GEO project was delivered at a poor level of cost efficiency during this stage. They were also not very familiar with the performances of the building relating to the TBL concept of sustainability.

The situations support Perkins et al. (2011) findings that when teams are fully engaged they are more likely to facilitate proactive comprehensive planning and will increase their ability of sustaining sustainability efforts. All stakeholders of LEO's and Diamond's projects agreed that the two projects (LEO and Diamond) have the sustainable design and innovations goals, while only 4 out of 5 GEO's project stakeholders considered that the project has the same sustainability goals. Of the five GEO's stakeholders, local authorities of the project did not exposed to the project's sustainable design and innovations goals. It was clearly shown that the goals of sustainability have been well informed and reached to the project stakeholders of LEO and Diamond's projects with exceptional of the local authorities. The sustainability goals of GEO project had not reached to the local authority and the main contractor of the project. This situation supposes to be avoided to prevent errors in sustainable construction projects (Hwang and Ng, 2013).

Of the four sustainability goals, environmental aspects was given more priority followed by design and innovations aspect as compared to the economic and social sustainability aspects. One of the reasons is as mentioned previously that the projects' main concentration was towards realizing the greens and energy efficient target of buildings.

Three groups of stakeholders (owner, energy consultant and energy manager) have awareness on all of the sustainability goals of the projects. It was varied and diverse awareness of the sustainability goals in the local authorities and the main contractor groups. Of the three local authorities interviewed, all three stakeholders have awareness on environmental and have no awareness on the economic and social aspects. Two out of three local authorities (LEO and Diamond projects) have awareness on design and innovations sustainability goals. Meanwhile, of the three main contractors interviewed, all three stakeholders have awareness on environmental, design and innovations sustainability goals. Two of the main contractors (LEO and Diamond projects) have also awareness on the economic and social aspects and one of them (GEO project) has no awareness on those both sustainability goals.

6.3.2 Integration of Sustainability Principles into the Projects Planning Process

Table 6.5 (p229) shows that four sustainability principles were mentioned clearly in the project documents of all the three projects and considered among the owners, energy consultants and local authorities of the projects during planning process. The principles are:

1. Efficient environmental management
2. Site planning
3. Air and emissions quality
4. Occupational health and safety

Two sustainability principles were mentioned clearly in the project documents of LEO and Diamond projects and considered among the owners, energy consultants and local authorities of the projects during planning process. The principles were also considered among the planning stakeholders of GEO project exceptional of the local authority. The principles are:

1. Sustainable innovation
2. Sustainable design

Two sustainability principles have not been mentioned in any project document of all the three projects, even though the principles were considered by some of the stakeholders.

1. Sustainable method
2. Improve local market presence

Overall sustainability practices of the projects are simplified in Table 6.6 (p230). Generally, sustainability principles that had been mentioned in the project documents of the three projects were at a medium level and the consideration of the principles during the projects planning process were at a high level.

Table 6.5: Sustainability Principles Documented and Considered during the Planning Process of the Case Building Projects

Sustainability Principles	Individual Project						Overall Sustainability Practiced	
	LEO		GEO		Diamond		Documented	Considered
	Documented	Considered	Documented	Considered	Documented	Considered		
Environmental Sustainability								
1. Efficient environmental management	●●●	●●●	●●●	●●●	●●●	●●●	9	9
2. Concern on quality of land, river and sea	●	●●●	●	●●●	●●●	●●●	5	9
3. Site planning and management	●●●	●●●	●●●	●●●	●●●	●●●	9	9
4. Energy efficient	●●●	●●●	●●●	●●	●●●	●●●	9	8
5. Air and emissions quality	●●●	●●●	●●●	●●●	●●●	●●●	9	9
6. Sustainable method		●●		●●		●●	0	6
7. Sustainable materials and resources		●●		●●	●●	●●	2	6
8. Optimize materials and resources used		●●		●●	●●	●●	2	6
9. Efficient water consumption			●●	●●	●●	●●●	4	5
10. Transport management	●	●			●●●	●●●	4	4
11. Urban design, visual impact and aesthetic	●●●	●●●		●●	●●●	●●●	6	8
12. Noise control	●●	●●●	●●●	●●●	●●●	●●●	8	9
Economic Sustainability								
13. Whole life cost efficiency	●●	●●	●●	●●	●●	●●	5	6
14. Improve local market presence				●●		●●	0	4
15. Indirect economic impact			●●	●●		●●	2	4
16. Economic benefit to the stakeholders	●●	●●●	●●	●●	●●	●●●	5	8
Social Sustainability								
17. Occupational health and safety	●●●	●●●	●●●	●●●	●●●	●●●	9	9
18. Product responsibility	●●	●●	●●	●●	●●	●●	6	6
19. Training, education and awareness	●●	●●	●●	●●	●●	●●	6	6
20. Stakeholder participation	●●	●●	●●	●●	●●	●●	6	6
Design and Innovation								
21. Sustainable Innovation	●●●	●●●	●●	●●	●●●	●●●	8	8
22. Sustainable Design	●●●	●●●	●●	●●	●●●	●●●	8	8
TOTAL	38 Av: 13	48 Av:16	37 Av: 12	48 Av:16	49 Av:16	57 Av:19	122 Av: 14	153 Av:17
	Medium	High	Medium	High	High	High	Medium	High
Total respondents	3		3		3		9	
<i>Note: ● the number of stakeholder with a positive feedback</i> <i>Level of Sustainability Practices: 22-20 Very High 19- 16 High 15-11 Medium 10-7 Low 6-0 Very Low</i>								

Table 6.6: Overall Sustainability Principles Mentioned and Considered during the Planning Process of the Case Projects

Sustainability Practices	Stakeholders' Responses						
	9 out of 9	8 out of 9	6 out of 9	5 out of 9	4 out of 9	2 out of 9	None
Mentioned in Project Documents	Efficient environmental management	Noise control	Urban design, visual impact and aesthetic	Concern on quality of land, river and sea	Efficient water consumption	Sustainable materials and resources	Sustainable method
	Site Planning	Sustainable Design	Economic benefit to the stakeholders	Whole life cost efficiency	Transport management	Optimized materials and resources used	Improve local market presence
	Energy efficient	Sustainable Innovation	Product responsibility			Indirect economic impact	
	Air and emissions quality		Training and education				
	Occupational health and safety		Stakeholders participation				
Consideration	Efficient environmental management	Energy efficient	Sustainable method	Efficient water consumption	Transport management		
	Concern on quality of land, river and sea	Urban design, visual impact and aesthetic	Sustainable materials and resources		Improve local market presence		
	Site Planning	Economic benefit to the stakeholders	Optimized materials and resources used		Indirect economic impact		
	Air and emissions quality	Sustainable Design	Whole life cost efficiency				
	Noise control	Sustainable Innovation	Product responsibility				
Occupational health and safety		Training and education					
			Stakeholders participation				

It was varied and diverse sustainability principles mentioned in the project documents that had been prepared, considered and communicated among the owners, energy consultants and local authorities groups during the projects planning process (refer Table 6.7) The sustainability principles mentioned in the project documents that had been prepared for the three local authorities groups are at a low level and the consideration was at a very low level in GEO project and at a medium level in the LEO and Diamond projects.

Table 6.7: Finding Summary of the Stakeholders’ Responses on the Integration of Sustainability Principles into the Case Projects Planning Process

Projects	Stakeholders	Mentioned/Considered Sustainability Principles?				Level of Practiced
		Mentioned and Considered	Not Mentioned but Considered	Mentioned but Not Considered	Not Mentioned and Not Considered	
LEO	Owner	14 Medium	4 Very Low	0 Very Low	4 Very Low	Mentioned: 14 (Medium) Considered: 18 (High)
	Energy Consultant	14 Medium	4 Very Low	0 Very Low	4 Very Low	Mentioned: 14 (Medium) Considered: 18 (High)
	Local Authority	10 Low	2 Very Low	0 Very Low	10 Very Low	Mentioned: 10 (Low) Considered: 12 (Medium)
GEO	Owner	15 Medium	6 Very Low	0 Very Low	1 Very Low	Mentioned: 15 (Medium) Considered: 21 (Very High)
	Energy Consultant	15 Medium	6 Very Low	0 Very Low	1 Very Low	Mentioned: 15 (Medium) Considered: 21 (Very High)
	Local Authority	6 Very Low	0 Very Low	1 Very Low	15 Medium	Mentioned: 7 (Low) Considered: 6 (Very Low)
Diamond	Owner	19 High	3 Very Low	0 Very Low	0 Very Low	Mentioned:19 (High) Considered:22 (Very High)
	Energy Consultant	19 High	3 Very Low	0 Very Low	0 Very Low	Mentioned: 19 (High) Considered: 22 (Very High)
	Local Authority	11 Medium	2 Very Low	0 Very Low	9 Low	Mentioned: 11 (Low) Considered: 13 (Medium)

Note:
Level of Practices: 22-20 Very High 19- 16 High 15-11 Medium 10-7 Low 6-0 Very Low

The sustainability principles mentioned in the project documents that had been prepared on behalf of the owner groups of LEO and GEO projects were are at a medium level and at a high level for the owner of the Diamond project. The consideration on the sustainability principles was at a high level by the owner of LEO project and a very

high level by the owners of GEO and Diamond project. Meanwhile, the sustainability principles mentioned in the project documents that had been prepared among the energy consultant of LEO and GEO projects were at a medium level and at a high level among the energy consultant of the Diamond project. The consideration on the sustainability principles was at a high level by the energy consultant of LEO project and a very high level by the energy consultant of GEO and Diamond project.

Clearly, Diamond building project was perceived as the best project among the three in term of the documentation and consideration of sustainability principles during the project planning process as they achieved a high level of the principles' documented and a high level of the principles consideration.

6.3.3 The Projects Strategies to achieve the Goals for Sustainability

A total of 15 strategies were pointed out by the stakeholders of LEO, GEO and Diamond building projects to achieve the projects goals of sustainability (refer Table 6.8, p233 and Table 6.9, p234). Findings reveal that 2 strategies have been practiced by majority (12 out of 15) of the stakeholders (3 owners, 3 energy consultants, 3 main contractors and 3 energy managers) throughout the conceptual, design, construction and operation and maintenance stage of the projects. The strategies are:

1. Regular awareness, brief and campaign on energy efficiency to the project team, and to the occupant to save energy and to operate the building in sustainable manners since the early planning process and over the course of the project
2. Fulfil the requirements of MS1525

Other 2 strategies have been practiced by 10 out of 15 stakeholders, namely:

1. To get GBI certification
2. To have incentives

Six strategies have been practiced by 9 stakeholders of the projects. The strategies are:

1. Workshop among the stakeholders
2. Visiting other countries energy efficient building with the project team members

3. Attending sustainability related conferences
4. Attending a lot of seminars including presenting the progress and project performance among stakeholders in every stage of the project
5. Monitoring and controlling the building energy and operate the building in sustainable manners
6. Monitor indoor environmental performance and occupant satisfaction

Seven stakeholders (3 owners, 3 energy consultants and 1 contractor) have practiced ‘multidisciplinary collaboration and integrated design throughout the project planning process’ up to some extent to be among the strategies to reach the sustainability goals of the project. Six stakeholders (2 owners, 2 energy consultants, 1 contractor and 1 local authority) have ‘considered energy efficient and some sustainability principles since the early projects planning processes’.

The strategy of ‘exchanged existing equipments with the latest energy efficient equipments’ has only actively practiced by the LEO project stakeholders (O1, E1, M1) as the concentration to achieve GBI requirements was only took place after the building was completed. The strategy of ‘mentioning the goal of sustainability in Structure Plan, Local Plan and Strategic Plan’ was practiced by all 3 local authorities of the projects. The stakeholders of Diamond project (O3, E3, C3) were also practiced the strategy of ‘bringing the team together as early as possible since early planning stage’ to be the strategy to achieve the sustainability goals of the project.

Table 6.8: The Practiced Strategies to Achieve the Projects Sustainability Goals

No.	Practiced Strategies	Projects			No. of times recorded
		LEO	GEO	Diamond	
1.	Workshop among stakeholders to reveal the energy efficient and sustainability knowledge and worldwide experiences in order to enhance their awareness and capability.	3	3	3	9
2.	Multidisciplinary collaboration and integrated design	2	2	3	7
3.	Visiting other countries energy efficient building with the project team members	3	3	3	9
4.	Attending sustainability related conferences with the project team members	3	3	3	9
5.	A lot of seminars among stakeholders have been arranged in every single stage of development and also presenting the progress and project performance	3	3	3	9

‘Table 6.8, continued.’

No.	Practiced Strategies	Projects			No. of times recorded
		LEO	GEO	Diamond	
6.	Regular awareness, brief and campaign on energy efficiency to the project team, and to the occupant to save energy and to operate the building in sustainable manners since the early planning process and over the course of the project.	4	4	4	12
7.	Monitor and control the building energy and operate the building in sustainable manners	3	3	3	9
8.	Exchanged existing equipment with the latest energy efficient equipments	3	0	0	3
9.	Monitor indoor environmental performance and occupant satisfaction	3	3	3	9
10.	Fulfil the requirements of MS1525	4	4	4	12
11.	To get GBI certification	3	3	4	10
12.	Mentioned the goal of sustainability in Structure plan, Local plan and Strategic plan.	1	1	1	3
13.	Consider energy efficient and some sustainability principles since the early project planning process	0	2	4	6
14.	Bringing the team together as early as possible since early planning stage	0	0	3	3
15.	Incentives	0	5	5	10
Total number of strategies practiced		12	13	14	15
No. of times recorded		35	39	46	120
Total respondents		5	5	5	15

Table 6.9: Stakeholders’ Responses on the Projects Strategies to Achieve the Sustainability Goals

	Strategies Practiced	Projects	Stakeholders					No. of times recorded	
			O	E	C	L	M	Total	Overall
1.	Workshop among stakeholders to reveal the EE and sustainability knowledge and exposed them to the worldwide experiences	LEO	•	•	•			3	9
		GEO	•	•	•			3	
		Diamond	•	•	•			3	
2.	Multidisciplinary collaboration and integrated design	LEO	•	•				2	7
		GEO	•	•				2	
		Diamond	•	•	•			3	
3.	Visiting other countries energy efficient building with the project team members	LEO	•	•	•			3	9
		GEO	•	•	•			3	
		Diamond	•	•	•			3	
4.	Attending sustainability related conferences with the project team members	LEO	•	•	•			3	9
		GEO	•	•	•			3	
		Diamond	•	•	•			3	
5.	A lot of seminars among stakeholders have been arranged in every single stage of development and also presenting the progress and project performance	LEO	•	•	•			3	9
		GEO	•	•	•			3	
		Diamond	•	•	•			3	
6.	Regular awareness, brief and campaign on EE to the project team, and to the occupant to save energy and to operate the building in	LEO	•	•	•		•	4	12
		GEO	•	•	•		•	4	
		Diamond	•	•	•		•	4	

‘Table 6.9, continued.’

Strategies Practiced	Projects	Stakeholders					No. of times recorded	
		O	E	C	L	M	Total	Overall
sustainable manners since the early planning process and over the course of the project.								
7. Monitor and control the building energy and operate the building in sustainable manners	LEO	•	•			•	3	9
	GEO	•	•			•	3	
	Diamond	•	•			•	3	
8. Exchange existing equipment with the latest energy efficient equipments	LEO	•	•			•	3	3
	GEO						0	
	Diamond						0	
9. Monitor indoor environmental performance and occupant satisfaction	LEO	•	•			•	3	9
	GEO	•	•			•	3	
	Diamond	•	•			•	3	
10. Fulfil the requirements of MS1525	LEO	•	•	•		•	4	12
	GEO	•	•	•		•	4	
	Diamond	•	•	•		•	4	
11. To get GBI certification	LEO	•	•			•	3	10
	GEO	•	•			•	3	
	Diamond	•	•	•		•	4	
12. Mention the goal of sustainability in Structure plan, Local plan and Strategic plan.	LEO					•	1	3
	GEO					•	1	
	Diamond					•	1	
13. Consider energy efficient and some sustainability principles since the early project planning process	LEO						0	6
	GEO	•	•				2	
	Diamond	•	•	•	•		4	
14. Bringing the team together as early as possible since early planning stage	LEO						0	3
	GEO						0	
	Diamond	•	•	•			3	
15. Incentives	LEO						0	10
	GEO	•	•	•	•	•	5	
	Diamond	•	•	•	•	•	5	
No. of times recorded		36	36	24	6	18	120	
Total respondents							15	

Note: • the strategies practiced by the interviewees

Five strategies to integrate sustainability into the building project as listed in the proposed framework - stage 2 (Table 5.63, p217) are not related to any strategy that have been mentioned by the stakeholders to reach the sustainability targets of the sustainable projects as follows:

1. Team members’ selection with sustainable development quality and capability
2. Commissioning process is added during this process and described in a specific section
3. An integrated design/ sustainability coordinator is appointed as one of the project’s team members

4. Local community representative is involved in support of the project
5. Sustainability and integrated design requirements and the process are included into the project documentations, strategic and comprehensive plan.

Diamond project had the highest numbers of efforts to achieve the goals of sustainability of the project (14 out of 15 cited strategies), followed by GEO (13 strategies) and LEO project (12 strategies). The owners and energy consultants groups have practiced the highest numbers of strategies to achieve the goals of sustainability of the project which is 36 out of 120 times of the strategies recorded. It was followed by the contractors and energy managers groups with 24 and 18 times of the recorded strategies respectively. The local authority had the lowest involvement in the cited strategies (6 out of 120).

Generally, the strategies practiced by the stakeholders are relatively related to the sustainability integration strategies as tabulated in the proposed framework – stage 2 (Table 5.63, p217). The fact shows that the projects have the specific sustainability goals and project priorities. Even though, the approaches were slightly different among the three projects, however, the most priority target was given to the environmental aspects especially towards reaching the energy efficient aspects. Knowledge transfers were actively practiced throughout the projects in order the team members to have the core knowledge within the area of sustainable development and sustainable building. Team members were educated on sustainability issues and fully informed on sustainability goals and priorities of the projects. The projects were a part of the government efforts to encourage sustainable development in the country.

The code and practice of MS1525 was decided as the main tool to be complied towards achieving the goal of sustainability in the building projects. The GBI Malaysia requirements have also been considered even though the certification systems came a bit late in the industry. Findings show that the knowledge of sustainability and the sustainability directions of the project are very important to be educated and informed among the project stakeholders. The government incentives are also significant to support the sustainability goals of buildings projects successfully. To conclude, it is crucial for the building projects to have a clear and well documented framework of sustainability and the integration process to be a guide throughout the projects.

6.3.4 The Practiced Strategies of Sustainability Integration into the Projects Planning Process

Most strategies (16 out of 20 strategies) were practiced among the owner and designer groups of the three projects during the planning process of the projects (refer Table 6.10). Other 2 strategies have also been practiced throughout the planning process of the projects exceptional of the LEO building project. The strategies are:

1. Team members' selection with sustainable development quality and capability
2. Bringing the team together as early as possible during planning process

Table 6.10: Interviewees' Comments on Sustainability Integration Strategies into the Planning Process of the Building Projects

Sustainability Integration Strategies	Projects			Overall Practiced
	LEO	GEO	Diamond	
Sustainable Project Orientation				
1. Sustainable concern during establishment of project scope, project charter, drawing, contract and detailed project plan	●●	●●	●●	6
2. Specific sustainability goals and project priorities	●●	●●	●●	6
Integrated project team				
3. The team should have the core knowledge of sustainable building	●●	●●	●●	6
4. Team members are educated on sustainability issues including vendors.	●●	●●	●●	6
5. Team members are fully informed on sustainability goals and priorities of the project.	●●	●●	●●	6
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	●●	●●	●●	6
8. Local community representative is involved in support of the project				0
Integrated design process				
9. Bringing the team together as early as possible during planning process		●●	●●	4
10. Design should reflect the end user community	●●	●●	●●	6
11. Sustainability and integrated design requirements and the process are included into the project documentations, strategic and comprehensive plan.				0
12. Do whole building design and systems analysis	●●	●●	●●	6
13. Committed and collaborative team throughout the process	●●	●●	●●	6
14. Involve diverse set of stakeholders on the team	●●	●●	●●	6
15. Effective communication and incorporation of charette process	●●	●●	●●	6
16. Planning should reflect all the project stakeholders	●●	●●	●●	6

Sustainability Integration Strategies	Projects			Overall Practiced
	LEO	GEO	Diamond	
17. Commissioning process is added during this process and described in a specific section.	●●	●●	●●	6
Regulations and code compliances				
18. Government policies to encourage sustainable development	●●	●●	●●	6
19. Incentive to encourage sustainable development	●●	●●	●●	6
20. Compliance with code and regulatory tool of sustainability	●●	●●	●●	6
TOTAL	32 Av: 16 High	36 Av: 18 Very High	36 Av: 18 Very High	104 Av: 17.3 Very High
Total respondents	2	2	2	6
<i>Note: ● the number of stakeholder with a positive feedback</i>				
<i>Level of Practices: 20-18 Very High 17- 14 High 13-10 Medium 9-6 Low 5-0 Very Low</i>				

Two strategies were not practiced throughout the planning process of all the three projects.

1. Local community representative is involved in support of the project.
2. Sustainability and integrated design requirements and the process are included into the project documentations, strategic and comprehensive plan.

Of the 18 practiced strategies, 3 strategies were not highlighted by any of the stakeholders earlier in the previous question. The strategies are;

1. Team members' selection with sustainable development quality and capability
2. Commissioning process is added during this process and described in a specific section
3. An integrated design/ sustainability coordinator is appointed as one of the project's team members

The strategy of 'team member's selection with sustainable development quality and capability' has been practiced in the GEO and Diamond project. The selection priority of the team members was given based on their past experiences in sustainable projects. Commissioning process was added during the three projects planning process and described in a specific section as it is a usual procedure which is also affected conventional projects. Thus, this strategy was not seen earlier to be one of the crucial strategies to achieve sustainability in the building projects. A sustainability coordinator or energy consultant was appointed during the projects planning process even though the time of appointment was quite imbalanced.

The GEO and Diamond building projects were perceived as the best projects among the three on practising the strategies as the projects took place 18 out of 20 strategies listed in the proposed framework. The sustainability practices of the projects are simplified in Table 6.11. Overall, the sustainability integration strategies that have been practiced in the sustainable projects were at a very high level.

Table 6.11: Overall Practiced Sustainability Integration Strategies into the Planning Process of the Case Building Projects

	Stakeholders' Responses		
	6 out of 6 (All projects)	4 out of 6 (2 projects)	None
Practiced Strategies	Sustainable concern during establishment of project scope, project charter, drawing, contract and detailed project plan	Team members' selection with sustainable development quality and capability	Sustainability and integrated design requirements and the process are included into the project documentations, strategic and comprehensive plan.
	Specific sustainability goals and project priorities		
	The team should have the core knowledge of sustainable building	Bringing the team together as early as possible during planning process	Local community representative is involved in support of the project
	Team members are educated on sustainability issues including vendors.		
	Team members are fully informed on sustainability goals and priorities of the project.		
	An integrated design/ sustainability coordinator is appointed as one of the project's team members		
	Design should reflect the end user community		
	Do whole building design and systems analysis		
	Committed and collaborative team throughout the process		
	Involve diverse set of stakeholders on the team		
	Effective communication and incorporation of charette process		
	Planning should reflect all the project stakeholders		

‘Table 6.11, continued.’

Practiced Strategies	Stakeholders’ Responses		
	6 out of 6 (All projects)	4 out of 6 (2 projects)	None
	Commissioning process is added during this process and described in a specific section.		
	Government policies to encourage sustainable development		
	Incentive to encourage sustainable development		
	Compliance with code and regulatory tool of sustainability		

Table 6.12 reveals that the strategies that have been practiced by the owners and energy consultants of the three projects were almost similar. Basically, their efforts were considered to be at a high to a very high level based to the strategies that listed in the proposed framework. However, the way how they practiced each strategy was still limited to some extent as these projects were the earliest trials of sustainable building projects in the country.

Table 6.12: Finding Summary of Stakeholders’ Responses on the Practiced Sustainability Integration Strategies into the Planning Process of the Case Building Projects

Projects	Stakeholders	Practiced Strategies	Level of Practiced
LEO	Owner	16	High
	Energy Consultant	16	High
GEO	Owner	18	Very High
	Energy Consultant	18	Very High
Diamond	Owner	18	Very High
	Energy Consultant	18	Very High

Note:
Level of Practices: 20-18 Very High 17- 14 High 13-10 Medium 9-6 Low 5-0 Very Low

The knowledge and experiences of the stakeholders in dealing with such project was inadequate. It was also no clear framework on the sustainability principles and the integration strategies existed to be referred by the stakeholders. The limitations of the practiced strategies have been revealed such as; the team members’ selection was based to the available limited quality and capability in the country. The stakeholders that have been involved the projects planning process were also imbalanced, such as the

contractors were not fully involved throughout the process. Even though the contractor was involved in the Diamond project, but their involvement were substantial throughout the very early stage of the process. Local authorities' involvement was also very limited throughout the process. The phenomenon strengthens the reason for the industry to have a framework on sustainability and the integration strategies to help the stakeholders in realizing the sustainability targets.

6.4 THE PROJECTS PERFORMANCES

The cross case data of the overall performances of the projects sustainability principles practiced are provided in Table 6.13 (p242). LEO and GEO projects managed to reach up to the good level of sustainability principles' performance during the conceptual and design stages and construction stages. LEO project managed to achieve at the good level of sustainability principles' performance during the operation and maintenance stage. Meanwhile, GEO project managed to accomplish up to an excellent level of sustainability principles' performance during this stage. The sustainability performance of the Diamond building was measured to be the best among others. The project was able to reach up to an excellent level at all stages of the project.

Overall, the stakeholders assessed the performances of practiced sustainability principles are at the good level for the LEO and GEO projects and excellent for the Diamond building project. The most regularly cited 'excellent performances' given by the stakeholders of the three Malaysian sustainable building projects are:

1. Energy efficient
2. Sustainable design

The fact shows that, these two factors are the most important concentration among others, given by the Malaysian sustainable building projects stakeholders throughout the project development process.

The cross case data of the overall performances of the projects in term of the cost, time, quality and stakeholders' satisfaction are provided in Table 6.14. It is clear that Diamond building project achieved the best performances among others in every aspect. The performance of the building has also been recognized by multiple awards and recognition of by many prestigious awards at the local and international level.

Table 6.14: Stakeholders' Responses on the Performances of Cost, Time, Quality and Stakeholders' Satisfaction of the Projects

Performances	Sustainable Building Projects		
	LEO	GEO	Diamond
Cost	Cost exceeded about 4% of the initial cost Other extra cost was spent for retrofitting	Cost exceeded about 25% of the initial cost	No cost overrun
Time	No delay	1 year delayed during construction	No delay
Quality	2 excellent 16 good 4 fair	6 excellent 13 good 2 fair 1 poor	12 excellent 10 good
Stakeholders Satisfaction	Minor complaint	Minor complaint	Minor complaint
Changes	Variation order on M&E aspects during construction stage Retrofitting to fulfil green aspects for GBI certification and renovations to cope with the increment number of occupants	Variation order on EE and RE aspects during construction stage	Minor changes
Awards and Recognitions	ASEAN Energy Award 2006 (Winner) GBI Certification 2011 (Silver)	ASEAN Energy Award 2009 (Winner) GBI Certification 2009 (Certified)	ASEAN Energy Award 2012 (Winner) GBI Certification 2011 (Platinum) Singapore BCA Green Mark Award 2011 (Platinum) Emerson Cup 2012 (Champion) ASHRAE Technology Award 2013 (Second Place)

As indicated in Table 6.15 (p244), the planning stakeholders of all three projects perceived that the sustainability principles and the integration strategies practiced during the projects planning process exercised either a very positive or positive impact

on the overall performances of the projects. Diamond building project planning process was perceived as the best among others.

Table 6.15: Interviewees’ Responses on the Overall Impact of the Projects Sustainability Principles Practices and the Integration Strategies into the Planning Process on Influencing the Projects Performances

Representing the Stakeholders of Planning Process	Owner	Energy Consultant	Overall Impact on the Projects Performances
LEO Building	+2	+2	Both Stakeholders: Positive
GEO Building	+2	+3	Very Positive and Positive
Diamond Building	+3	+3	Both Stakeholders: Very Positive

To conclude, it was clear that the sustainability principles and the integration strategies practiced will not only enhances the quality and sustainability performances of building as believed by majority of the interviewees during quantitative study but it is also significant to improve the cost, time and stakeholders’ satisfaction performance of the project. The strategies have longer the duration during the conceptual and design stages; however it was proved that they have shortened the overall duration of the projects. The planning strategies that have been implemented in the projects were confirmed not to increase the project cost, but they have enhanced the performance of the projects. The higher level of sustainability principles documented and practiced during project planning process and the higher level of integration strategies implemented have enhanced the level of project performance throughout the life cycle. Contractors’ involvement during project planning process will enhance the quality and stakeholders’ satisfaction of the project as well as to ensure the project to be delivered within the budget and timeframe.

The higher involvement of local authority in sustainability considerations of the projects has improved the project performance. Most received complaints of the projects were regarding the technical issues such as lighting, ventilation, and temperature of the building. The fact shows that the projects were adopted foreign sustainable technologies which sometimes were not suit to the local climate and conditions. Thus, the stakeholders in the industry should be exposed to the sustainability knowledge and technologies. The country needs to enhance the availability of local materials and technologies that suit to the local building needs. Local experts who are understand the

country's conditions are also crucially needed in order to deliver sustainable project successfully.

6.5 BARRIERS TO THE PROJECTS

This part identifies stakeholders' views on the major barriers or obstructions during the LEO, GEO and Diamond projects delivery. The cross case data are provided in Table 6.16. The most common barriers cited in all of three projects (all replies) were 'there was no clear aspect concerning sustainability and the integration strategies in building and the project planning standards and guidelines', 'lack of sustainable development awareness among construction players' and 'lack of sustainable development knowledge among construction players'. They were followed by the 'lack of local sustainable materials, technology and experts and adoption of foreign technologies and guidelines that not suit to local climate and conditions' which cited by 4 to 5 stakeholders from each project. The rest two barriers which are the 'lack of sustainability integration process and technical understanding' and 'funding issues' were only replied by 3 and 2 LEO project's stakeholders respectively. The barriers were slightly decreased in the Diamond project as the stakeholders learnt the lesson of sustainable project from the LEO and GEO projects.

Table 6.16: Perceptions of Stakeholders on the Problems in LEO, GEO and Diamond Buildings Projects

Barriers	Quantitative Survey	Case Studies		
		LEO	GEO	Diamond
No clear aspect concerning sustainability and the integration strategies in building and the project planning standards and guidelines	42% replies (79 out of 188)	5 replies (O1,E1,L1,C1,M1)	5 replies (O2,E2,L2,C2,M2)	5 replies (O3,E3,L3,C3,M3)
Lack of sustainable development awareness among construction players	24% replies (46 out of 188)	5 replies (O1,E1,L1,C1,M1)	5 replies (O2,E2,L2,C2,M2)	5 replies (O3,E3,L3,C3,M3)
Lack of sustainable development knowledge among construction players	20% replies (38 out of 188)	5 replies (O1,E1,L1,C1,M1)	5 replies (O2,E2,L2,C2,M2)	5 replies (O3,E3,L3,C3,M3)
Lack of local sustainable materials, technology and experts and adoption of foreign technologies and guidelines that not suit to the local needs	Not cited	4 replies (O1,E1,C1,M1)	5 replies (O2,E2,L2,C2,M2)	4 replies (O3,E3,C3,M3)

‘Table 6.16, continued.’

Barriers	Quantitative Survey	Case Studies		
		LEO	GEO	Diamond
Lack of sustainability integration process and technical understanding	28% replies (52 out of 188)	3 replies (O1,E1,C1)	Not cited	Not cited
Funding issues	25% replies (47 out of 188)	2 replies (L1,M1)	Not cited	Not cited
Lack of collaboration and integration among stakeholders	31% replies (58 out of 188)	Not cited	Not cited	Not cited

It was clear that the most crucial barriers cited in quantitative survey and the case studies was the barrier of ‘there was no clear aspect concerning sustainability and the integration strategies in building and the project planning standards and guidelines’, which 42% of the quantitative survey’s respondents and all case studies’ interviewees have highlighted the issue. The findings strengthen the need for developing the sustainability integration framework as proposed in the study. It should be noted; however the practiced experiences of the three projects are also considered in formulation of the framework.

6.6 PREFERENCES ON SUSTAINABILITY PRINCIPLES OF BUILDING AND THE STRATEGIES TO INTEGRATE THE PRINCIPLES INTO THE PROJECT PLANNING PROCESS

Table 6.17 shows that the LEO’s stakeholders have rated a total of 102.8 points (4.7) for the sustainability principles’ importance level. GEO’s stakeholders rated 103.2 points (4.7) and Diamond’s stakeholders rated 103.4 points (4.7). This resulted in average total score of importance level of 4.7 (103.1 points) which is very important. It was clearly proved that the stakeholders of all three projects have a very high preference on sustainability principles that proposed in the framework - stage 2 (refer Table 5.63, p217).

LEO’s stakeholders rated 15 out of 22 principles as ‘very important’ and 7 principles as ‘important’ principles for a sustainable building. GEO’s stakeholders rated 18 principles as ‘very important’ and 4 principles as ‘important’, while Diamond’s stakeholders perceived 19 principles as ‘very important’ and 3 principles as ‘important’ principles that should be integrated for a sustainable building project. ‘Sustainable design’ was

considered as the most important principle among all of those 22 sustainability principles.

Table 6.17: Stakeholders' Preferences on the Sustainability Principle of Building

Sustainability Principles	Average Rating				Level of Importance
	LEO	GEO	Diamond	MS	
Environmental Sustainability					
1. Efficient environmental management	4.8	5.0	4.8	4.9	Very Important
2. Concern on quality of land, river and sea	4.6	4.8	4.8	4.7	Very Important
3. Site planning and management	4.6	4.8	4.6	4.7	Very Important
4. Energy efficient	5.0	4.6	5.0	4.9	Very Important
5. Air and emissions quality	4.8	4.6	4.8	4.7	Very Important
6. Sustainable method	4.4	4.6	4.2	4.4	Important
7. Sustainable materials and resources	4.8	4.8	5.0	4.9	Very Important
8. Optimize materials and resources used	4.8	4.6	4.8	4.7	Very Important
9. Efficient water consumption	4.8	4.8	4.8	4.8	Very Important
10. Transport management	4.8	4.4	4.6	4.6	Very Important
11. Urban design, visual impact and aesthetic	4.4	4.4	4.6	4.5	Very Important
12. Noise control	4.4	4.8	4.6	4.6	Very Important
Economic Sustainability					
13. Whole life cost efficiency	5.0	4.8	5.0	4.9	Very Important
14. Improve local market presence	4.4	4.4	4.4	4.4	Important
15. Indirect economic impact	4.2	4.0	4.0	4.1	Important
16. Economic benefit to the stakeholders	4.4	4.6	4.6	4.5	Very Important
Social Sustainability					
17. Occupational health and safety	4.8	4.8	4.8	4.8	Very Important
18. Product responsibility	5.0	4.8	4.8	4.9	Very Important
19. Training, education and awareness	4.4	4.8	4.6	4.6	Very Important
20. Stakeholder participation	4.6	5.0	4.6	4.7	Very Important
Design and Innovation					
21. Sustainable Innovation	4.8	4.8	5.0	4.9	Very Important
22. Sustainable Design	5.0	5.0	5.0	5.0	Very Important
TOTAL	102.8	103.2	103.4	103.1	
Average Rating	4.7	4.7	4.7	4.7	Very Important
Level of Importance	Very Important	Very Important	Very Important	Very Important	
Average Rating: 5.0-4.5= Very Important 4.4-3.5=Important 3.4-2.5= Neutral 2.4-1.5= Not important 1.4-0= Not at all important					
Shaded rows = the most important principles (5.0 points)					

Table 6.18 (p248) shows that, the LEO's stakeholders have rated 93.4 points (4.7), GEO's stakeholders rated 92.8 points (4.6) and Diamond's stakeholders rated 93.8

points (4.7) for the overall strategies to integrate the sustainability principles into the project planning process. This resulted in a very high average total score of 4.7 points (93.7) which is at a ‘very important’ level. Clearly, the stakeholders of three projects have a very high preference on the sustainability integration strategies that proposed in the framework (stage 2).

Table 6.18: Stakeholders’ Preferences on the Strategies to Integrate Sustainability Principles into the Project Planning Process

Strategies of Sustainability Integration	Average Rating				Level of Importance
	LEO	GEO	Diamond	MS	
Sustainable Project Orientation					
1. Sustainable concern during establishment of project scope, project charter, drawing, contract and detailed project plan	5.0	4.4	4.8	4.7	Very Important
2. Specific sustainability goals and project priorities	5.0	4.6	4.6	4.7	Very Important
Integrated Project Team					
3. The team should have the core knowledge of sustainable building	4.8	4.2	5.0	4.7	Very Important
4. Team members are educated on sustainability issues including vendors.	4.8	4.6	4.8	4.7	Very Important
5. Team members are fully informed on sustainability goals and priorities of the project.	4.8	4.6	5.0	4.8	Very Important
6. Team members’ selection with sustainable development quality and capability	4.6	4.2	4.6	4.5	Very Important
7. An integrated design/ sustainability coordinator is appointed as one of the project’s team members	4.2	4.6	4.0	4.3	Important
8. Local community representative is involved in support of the project	4.8	4.0	4.2	4.3	Important
Integrated design process					
9. Bringing the team together as early as possible during planning process.	5.0	4.8	5.0	4.9	Very Important
10. Sustainability and integrated design requirements and the process are included into the project documentations, strategic and comprehensive plan.	5.0	4.4	5.0	4.8	Very Important
11. Design should reflect the user community	4.6	5	4.6	4.7	Very Important
12. Committed and collaborative team throughout the process	4.8	5	4.8	4.9	Very Important
13. Do whole building design and systems analysis	4.4	4.8	4.6	4.6	Very Important
14. Involve diverse set of stakeholders on the team	4.2	4.6	4.4	4.4	Important
15. Planning should reflect all the project stakeholders	4.6	4.6	4.6	4.6	Very Important
16. Incorporation of charette process	4.4	4.6	4.6	4.5	Very Important
17. Commissioning process is added during this process and described in a specific section.	4.4	4.8	4.6	4.6	Very Important
Regulations and code compliances					
18. Government policies to encourage sustainable development	5.0	5.0	4.8	4.9	Very Important
19. Incentive to encourage sustainable development	5.0	5.0	4.8	4.9	Very Important
20. Compliance with code and regulatory tool of sustainability	5.0	5.0	5.0	5.0	Very Important

‘Table 6.18, continued.’

Strategies of Sustainability Integration	Average Rating				Level of Importance
	LEO	GEO	Diamond	MS	
TOTAL	93.4	92.8	93.8	93.7	Very Important
Average Rating	4.7	4.6	4.7	4.7	
Level of Importance	Very Important	Very Important	Very Important	Very Important	
<i>Average Rating: 5.0-4.5= Very Important 4.4-3.5=Important 3.4-2.5= Neutral 2.4-1.5= Not important 1.4-0= Not at all important Shaded rows = the most important principles (5.0 points)</i>					

LEO’s and GEO’s stakeholders rated 15 out of 20 strategies as ‘very important’ and 5 strategies as ‘important’ principles for a sustainable building. Diamond’s stakeholders preferred 17 strategies as ‘very important’ and 3 strategies as ‘important’ to be implemented during the planning process of a project. ‘Compliance with code and regulatory tool to encourage sustainable development’ was considered as the most important strategy among all of those 20 strategies. Overall, all stakeholders agreed that the strategies are very crucial to be practiced for the purpose of sustainability integration into a sustainable building project.

As shown in Table 6.19, generally, the three groups of stakeholders (owners group, energy consultants group and energy managers group) have rated the proposed sustainability principles to be at a ‘very important’ level to be included in the final stage of the proposed framework. Meanwhile, it was varied and diverse preferences have been given for the sustainability principles among the local authority and main contractor groups. Of the three local authorities interviewed, two have rated the principles at a ‘very important’ level (LEO and Diamond projects) and one has rated at an ‘important’ level (GEO). Of the three main contractors interviewed, one has rated the principles at a ‘very important’ level (Diamond project) and two have rated the principles at an ‘important’ level to be addressed in the final stage of proposed framework.

Table 6.19: Summary of the Findings of the Level of Importance of Sustainability Principle of Building and the Strategies to Integrate the Principles into the Project Planning Process

		LEO	GEO	DIAMOND	Overall Findings
Sustainability Principles	Stakeholders’ Preferences	Very Important: O1, E1, M1,L1 Important: C1 Overall: Very Important	Very Important: O2, E2, M2 Important: C2, L2 Overall: Very Important	Very Important: O3, E3, C3, M3, L3 Overall: Very Important	Very Important
	Rating Given	Very Important: 15	Very Important: 18	Very Important: 19	Very Important

‘Table 6.19, continued.’

		Important: 7 Overall: Very Important	Important: 4 Overall: Very Important	Important: 3 Overall: Very Important	
Sustainability Integration Strategies during Planning Process	Stakeholders’ Preferences	Very Important: O1, E1, M1 Important: C1, L1 Overall: Very Important	Very Important: O2, E2, M2 Important: C2, L2 Overall: Very Important	Very Important: O3, E3, C3, M3 Important: L3 Overall: Very Important	Very Important
	Rating Given	Very Important: 15 Important: 5 Overall: Very Important	Very Important: 15 Important: 5 Overall: Very Important	Very Important: 17 Important: 3 Overall: Very Important	Very Important

Table 6.19 (p249) shows that, three groups of stakeholders (owners, energy consultants and energy managers groups) have rated the proposed strategies to be at a ‘very important’ level, meanwhile the local authority group has rated the overall strategies at an important level to be included in the final stage of the proposed framework. It was varied and diverse important levels given to the strategies among the main contractor groups (refer Appendix M for the details). Of the three main contractors interviewed, one has rated the strategies at a ‘very important’ level (Diamond projects) and two have rated them at an ‘important’ level (LEO and GEO projects) to be addressed in the final stage of proposed framework.

To conclude, the 22 sustainability principles of building and the 20 strategies to integrate the principles into the project planning process that have been proposed in the framework (stage 2) were confirmed by the cross case interview analysis to be very significant to be included in the final stage of the proposed framework. The results show that, the findings of quantitative analysis through the triangulation measures of cronbach alpha, PCA and descriptive statistic (shown in Table 5.58, p211 and Table 5.59, p212) are consistent with the findings given by the qualitative analysis (illustrated in Table 6.17, p246 and Table 6.18, p248). Due to the consistency, the results show that the suggested factors for inclusion into the development of the final proposed framework are significant.

6.7 THE FRAMEWORK DEVELOPMENT

A clear framework of sustainability principles and the integration strategies are very important to be innovated so that the stakeholders are guided towards sustainability. The policy maker, the politician and the construction stakeholders should have the knowledge and exposed on the issues. The goals of sustainability which has been developed during planning process should be considered throughout the life cycle of the

project and product. It is very crucial to get the right consultants who able to plan and design well and get the right contractor who able to build and comply the sustainability requirements to achieve the goals. The government should pay more attention to promote sustainability in building projects through incentives, subsidies and policies so that the product will survive in the market. Local sustainability materials and resources should be enhanced where the government should ensure sustainable materials and equipments are going into mass production to become common products. Through the competitions, quantity and quality of the local sustainable materials and equipments will be enhanced and the costs are reduced.

The findings and discussions in Chapter 6 have implications for the formulation of the final stage of ‘Framework of Integrating Sustainability into the Project Planning Process’. All the 22 sustainability principles of building and 20 strategies to integrate the principles into the project planning process as listed in the second stage of the proposed framework (refer Table 5.63, p217) were validated by the case study interview analysis as significant to be considered as the factors in the final proposed framework. Subsequently, the ‘Framework of Integrating Sustainability into the Project Planning Process (Final Stage)’ was formed as presented in Table 6.20 below.

Table 6.20: Framework of Integrating Sustainability into the Project Planning Process for Buildings (Final Stage)

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

‘Table 6.20, continued.’

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

‘Table 6.20, continued.’

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

The framework has considerable potential to provide understanding on sustainability integration into the project planning process. It is realistic and significant. It is not an assessment systems but it is intended to provide a base guideline for sustainability integration into building projects during the project planning process in order to improve decision making and facilitate the process towards delivering successful project performances whether for project management, product or the marketability success as illustrated in Figure 6.1 below.

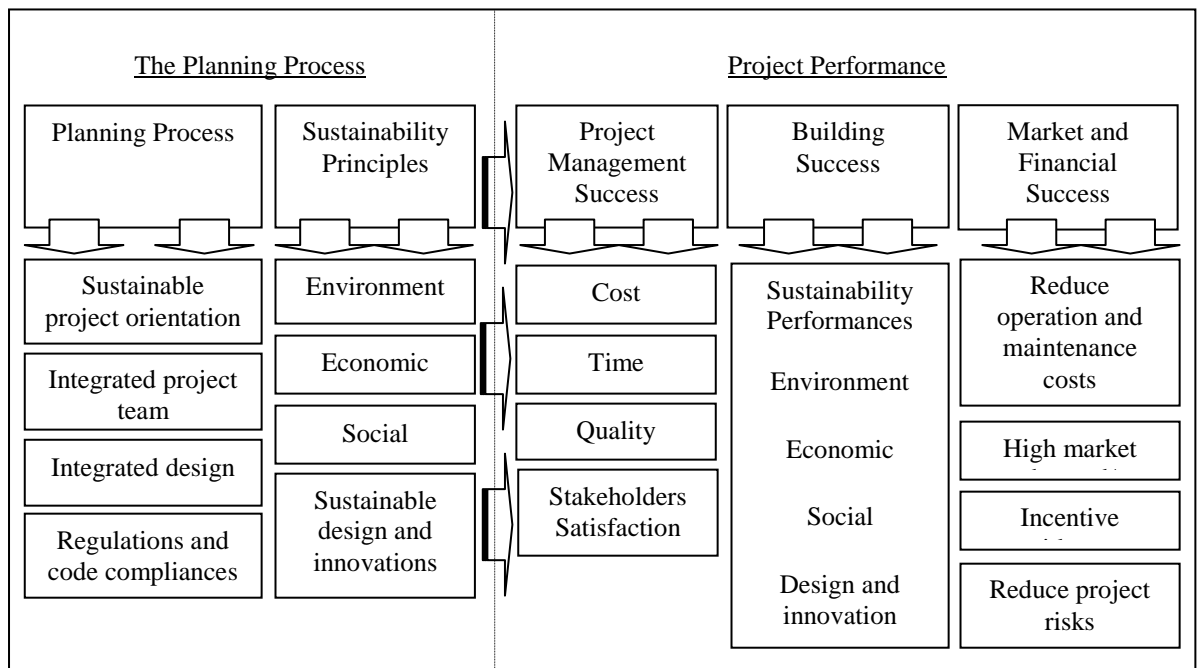


Figure 6.1: Sustainability Integration and the Project Performances

6.8 SUMMARY

This chapter has presented the results of cross case analysis from three case studies and 15 semi structured interviews. Looking across the case studies, the most striking findings are;

- The stakeholders’ involvement in the planning process of the projects was imbalanced, with a very low operation and maintenance stakeholders’

(energy/facility manager) involvement, a very high owners' involvement and a medium level of local authorities' involvement in decision making and planning process. Diamond project was the only project who involved the main contractor since the early planning process.

- Of the four sustainability goals, 'environmental' aspect was given more priority by the stakeholders followed by the 'design and innovation' as compared to the economic and social sustainability aspects.
- The owners, energy consultants and energy managers have awareness on all of the sustainability goals of the projects. There is varied and diverse awareness of the sustainability goals among the local authorities and the main contractor groups. The economic and social aspects were regularly overlooked by these two groups of stakeholders especially the local authorities.
- The level of documented sustainability principles requirements are at a medium in the LEO and GEO projects but at a high level in the Diamond project. The principles however, were practiced at a high level in all the three projects.
- The level of practiced of the strategies to integrate sustainability principles into the project planning process was at a high level in the LEO project and at a very high level in the GEO and Diamond project.
- Life cycle costing was considered in all the three projects but the calculation was focuses on ROI and limited to the operation and maintenance stage. It was cost overrun about 4% to 25% of the initial cost of the LEO and GEO projects respectively and it was no exceeded cost in the Diamond building project.
- The LEO and Diamond building projects were completed in time but it was about one year delay during the construction stage of GEO building project.
- The practiced strategies into the projects planning process exercised either a very positive or positive impact on the overall performances of the projects. Diamond building project planning process was measured as the best among others.
- Diamond building project achieved the best performance level among others in every aspect. The performance of the building has also been recognized by multiple awards and recognition of by many prestigious awards locally and internationally.
- Two strategies have never been practiced throughout the planning process of the projects but were thought as important and very important for the reason of sustainability integration. The strategies are: 'local community representative is

involved in support of the project’ and ‘sustainability and integrated design requirements and the process are included into the project documentations, strategic and comprehensive plan’.

- All of 22 sustainability principles of building and 20 strategies to integrate the principles into the project planning process as listed in the proposed framework (stage 2) were confirmed by the interview analysis as an important to a very important to be included in the formulation of the final stage of the framework.

Taken together, these findings suggest significant connections exist between the level of project performances and the practices of the sustainability integration as proposed in this study. It is remarkable that excellent performance of sustainable building, project management and marketing performance are achieved when the sustainability principles are integrated efficiently into the project through its planning process. The project should employ an integrated project team who interact closely throughout the planning process. The project team should have the core knowledge of sustainable building in order to integrate the principles into the project. They are informed and fully understand the sustainability goals and priority of the project. The project needs to be fully supported by the government policy or otherwise they are unable to deliver the project smoothly.

This study concur with studies such as by Choi (2009) which sustainable building project works best when the expanded group of stakeholders work together to concentrate the majority of their creative efforts very early in the planning process. This approach can organize priorities to align with a project’s budget and timeframe in order to avoid cost overruns, minimize delays, and decrease change orders during construction. It will streamline operations and maintenance of the building in the post-occupancy phase and provide lower utility and maintenance costs. A successful sustainable building benefits from full recognition of its features and a smooth approval process from the local authorities and the related technical department. The finding has thoughtful implications for sustainability integration and the planning process of the new Malaysian building projects in the future.