GREEN CERTIFICATION: ANALYSIS OF RISK FACED BY DEVELOPER

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ABSTRACT

Motivated by environment, economic and social benefits, green developers opt to be accredited with Green Building Index (GBI) Certificate for building green in Malaysia. In the need of preserving the accreditation of GBI certificate, this paper aims to equip the developers with the knowledge of risks compounded in green construction projects, which are perceived in association to impeding such accreditation, which the current theories are lacking of. A list of factors contributing to economic risks, legal risks, technical risks, risks of communication breakdown and risks of unfulfilled expectation; impacts on cost overrun, time overrun and quality deficiency; and risks mitigation strategies are identified from literature review. They are consolidated into a close-ended questionnaire to be dispatched among the developers, architects and green consultants who are involved in green construction projects in the states of Selangor and Wilayah Persekutuan Kuala Lumpur in Malaysia. Data collected are analyzed with Relative Agreement Index and Relative Impact Index method. Findings revealed that every factor in the risks would occur and impose a certain impact on cost overrun, time overrun and quality deficiency in green construction industry. The most suitable risk mitigation strategies to the respective risks are: 1) Economic risks: present preliminary evaluation of alternative approaches on project design and construction, 2) Legal risks: include additional contract provisions and warranties regarding the energy efficiency of green buildings, 3) Technical risks: design team to acquire in-depth knowledge of sustainable projects, 4) Risks of communication breakdown: open communication, and 5) Risks of unfulfilled expectation: outline a clear-cut performance specification in contract.

Key words: Green Building Index Certificate; Risk's Impacts; Risk's Mitigation Strategies.

INTRODUCTION

The revolution of green construction industry in Malaysia has brought to the launch of Green Building Index (GBI) in the year 2009 (Greenbuildingindex, 2013c). GBI is an established green rating tool, with intent to delineate the criteria in meeting the expectations

of a qualified Green Building with specified GBI rating ranging from Certified, Silver and Gold to Platinum level (Greenbuildingindex, 2013b).

Project awarded with GBI certificate merited plenty of benefits. Not only has GBI certificate served as a stipulation to secure the pledge of energy saving for a sustainable ecology and environment development, it functioned as a modus operandi to tax incentives in Malaysia (Greenbuildingindex, 2013b). Adding to the economic benefits, Green Building Alliance (2013) pointed out that green building certificate would give assurance of intangible benefits to the developer firm in the long run such as higher rental or resale value, higher occupant satisfaction, higher demand and a relatively lower operating cost. GBI is locally and internationally acknowledged (Greenbuildingindex, 2013a). Such globally proven credibility further prompts green developers to be more devoted towards the acquisition of GBI certificate, to yield a higher status and value of his green project.

The efforts to obtain the green certificate were unavailing when the construction encountered risks that could restrain the realization of developer in becoming sustainable. Akintoye and MacLeod (1997) defined risk as an occurrence of an unexpected event, which involved a variety of unpredictable factors that exerted dire effects in a period of time. It happened despite a scrupulous preparation in the project (Hildebrand, 2014). Risk was uninviting due to their damaging capabilities towards the construction projects (Mills, 2001). Such unwelcoming conditions brought in the importance of risk analysis.

Quoted from Edward and Bowen (2007), risk analysis was defined as "a systematic assessment of decision variables, which are subjected to risk and uncertainty". On the contrary, Investopedia (2015) proposed risk analysis as a tandem study on the fundamental uncertainty of a given course of action that allowed the professions to identify and mitigate risks for a more favorable result. Risk analysis is formulated in serial stages, commencing from: 1) identifying pitfalls, 2) determining the impact of pitfalls, 3) evaluation of impact, and lastly, 4) techniques to reduce the impact or pitfalls (BusinessDictionary.com, 2015).

Risk is inevitable in any context. The efforts in getting green certificate is not without risk threat. Hence, a risk analysis is necessary if the green developer desires a pleasurable repercussion while investing his assets to obtain the GBI certificate in Malaysia.

PROBLEM STATEMENT

According to Buckley (2009), failure to achieve green certification can be detrimental, for instance onerous code violations, significant loss from tax credits and overall financial crisis. This shows that the accreditation of green certification is economically and financially of paramount importance. It is a reason to become a crucial goal to most of the green developers if he is not merely only having a pure green intent.

As green construction continues to evolve, the issue on risk faced by green developer became more eminent as insinuated by several past researchers. For instance, Mills (2001) has alerted that the industry's lack of poor risk management has contributed to delay, financial and legality issues. It was indicated that the project would perform unfavorably in an event of the non-systematic risk management practices by developers and contractors (Serpella et al., 2014). Additionally, Zimmer and Rohleder (2009) opined that it was critical to manage the risk of attaining green certification through an understanding of risks compounded in green construction project.

Perry and Hayes (1986) on one hand suggested client to be responsible on the identification of risks as they were the party who opted for a quality-completed project within the time and budget required (as cited by Potts and Ankrah, 2014, p. 119). Hence, this called for an explicit need for risk analysis in GBI certification since it was a new construction industry segment in Malaysia. This research intends to fill the gap by: 1) identifying the risks faced by developer in obtaining green certificate and 2) identifying the level of impact of each risk on the green construction process.

TYPES OF RISK IN GREEN CONSTRUCTION PROJECT

Preliminary studies have suggested that risks compounded in green construction process are in relation to the risks in obtaining green certificate and have categorized the risks in green construction project into five broad risks which are shown in Figure 1.

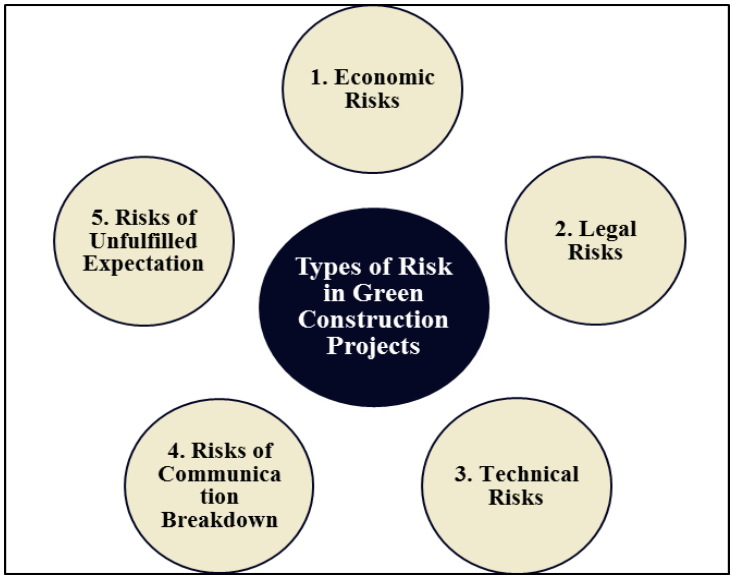

Figure 1: Types of Risk in Construction

Economic Risks

Green developer encountered an affliction of economic risks with the induction of convoluted design and technology. According to Ballobin (2008), the higher the green rating, the higher the design efforts and construction costs incurred owing to the implications of sophisticated design to meet the requirements at pre-selected certification level. The unfamiliarity of contractors, subcontractors, and designers towards the sophisticated innovation induced a risk of inconsistency between design and as-built (Alexander, 2011). As suggested by Ballobin (2008), the developer might be expected to incur more cost even when the anticipated benefit was not achieved.

Adding to the economic risks, York (2009) pointed out that a deficiency of reliable performance data on 'untested' green products prompted the developer to incur a higher cost when they failed to meet the intended performance level (as cited by U.S. Green Building Council [USGBC], 2009, p. 4).

Legal Risks

Legal risk was not new but a prevalent issue centring in green construction industry (USGBC, 2009). As stated by USGBC (2009), all persons in building development, design and construction have confronted green building litigation. The risks bounded to legality are as such; fraud, negligence, breach of contract, and violations of federal, state and local regulations. With reference to Ballobin (2008), deceptive marketing from design firms to secure contract of commission with an overstatement of their capabilities and qualifications in energy and costs savings was regarded as fraud and misrepresentation. This led to failure to meet obligations intended by the developer. On the other hand, Alexander (2011) pointed out that the owner encountered losses on dispute of liability towards the non-realization of project goal. Followed by the launching of green product, risk of liability allocation was triggered (Ballobin, 2008). Conflict sprang up when the invention did not attain the required cost and energy saving efficiency.

Technical Risks

Alexander (2011) introduced technical risk as one of the risks encountered in green construction, which included the following factors: (i) high risk LEED credits in certain climates; (ii) new & untested green products; (iii) innovative technical approaches; (iv) emerging green building requirements and (v) maintaining "green" standards. Eizzatul et al. (2012) and Lam (2007) considered design problem as one of the technical issues when the aesthetic factor outweighed the maintenance aspects in sustainable built (as cited by Zainol, 2014, p. 72). As outlined by Zainol (2014), the perception of incorporating a more high- ended green technology to achieving a higher green rating level led to a higher construction defect risk or other unknown potential risks. This accorded with the observation of Blake (2009) noting that green product could disrupt the construction program in the event of insufficient supply to meet the growing market demand (as cited by USGBC, 2009). Additionally, Blake (n.d.) suggested that green projects involved process, which entailed long lead times for example, two-weeks of flushing-out of the HVAC system prior to occupancy incurred additional time (as cited by USGBC, 2009). Blake (2009) further elaborated that contractors would face a risk of project delay if he neglected this issue and other green activities during construction process (as cited by USGBC, 2009, p. 4).

Risks of Communication Breakdown

The emergence of risk in communication breakdown came with the setting in of inconsistent expectations between the developer and the construction team. Ballobin (2008) commented that the client might make wrongful assumptions towards the intrinsic sustainability features in green projects, of which the matter would surface on the dispute table. An inefficient communication might draw the developer into a conviction that the expertise and competency of design team should be equipped with experience and knowledge of the underlying design principles in sustainable system.

Risks of Unfulfilled Expectation

Unsatisfactory standard of care created unfulfilled expectations (Ballobin, 2008). Development of standard of care was affected by statements of professional groups, language of industry contracts and constraint of codes of ethics. As the design professionals were contracting to third party certification, Ballobin (2008) claimed that the design team would bound to recommend based on trade-off in time, money and quality. Such act was spurred by the absence of obligatory contract conditions and uncovered professional liability insurance (Ballobin, 2008). In reference to statement made by Blake (2009), the risks of unfulfilled expectation increased when the contractor was green about his obligations at time of tendering, leading to a conflicting stage which might invite legal consequences on time, money and quality matter (as cited by USGBC, 2009, p. 5). Halicioglu et al. (2014) highlighted a few scenarios which could lead to unfulfilled expectations; 1) Late sustainability-related decisions; 2) Conflict in the selection of indoor environmental quality and energy performance technologies and sustainable materials; and 3) Lessons learned from previous experiences not practised in decision making.

IMPACT OF RISK FACED BY DEVELOPER TO THE ACCREDITATION OF GREEN CERTIFICATE

Cost Overrun

The issue of cost overrun stemmed from economic risks such as the application of higher intricacy in design and/or technologies to the green construction (Ballobin, 2008), impracticable sophisticated design features demand (Alexander, 2011) and failure of green material performance (USGBC, 2009). Technical risks and legal risks were considered as contributing sources to overrunning cost where high maintenance fees incurred to compensate for whole life cycle costing (Zainol, 2014) and high legal fees for dispute resolution. As reported by Zurich (n.d.) in their survey concerning risks in green construction, financial risks were identified as a major concern from the construction industry.

The consumption of enormous additional costs for green buildings might lead to a severe budgetary constraint, hence pushing the construction process to a sudden halt, resulting in construction delay. In the event of seeking a substitute over the highly priced technology which resulted in lower energy saving, such effort would distant the developer from achieving the desired GBI credit points.

Time Overrun

Researchers attributed time overrun to technical risks for instance; design problem (Nawakorawit, 1999) (as cited by Zainol, 2014, p. 71)., convoluted sustainable technologies (Blake, 2009) (as cited by USGBC, 2009), material shortages (Hwang, Zhao, & Tan, 2015) and (Blake, 2009) (as cited by USGBC, 2009, p. 4), and under performance of green products and technologies (Alexander, 2011). Communication breakdown was a cause of construction delay due to wrongful or inconsistent expectations made between the construction parties. Zurich (2008) added that lacking of professional experiences and improper material specifications in green construction could prolong the construction progress. Alexander (2011) too suggested that the unfamiliarity of green products and innovative approaches employed to the accreditation of green certificate could also lead to time overrun.

Quality Deficiency

The tendency of receiving a substandard green asset increased in an event of unrealistic expectation from client's conflicting demand (Ballobin, 2008). Communication risk further administered negative impact on the quality assurance of the predetermined standard specification with the inconsistent expectations and convictions of roles and responsibilities that came into play (Ballobin, 2008). Sustainable built emphasized high performance building. The owner and construction professionals were expected to input their value-added knowledge and capabilities in order to achieve efficiency and cost effectiveness (Horman et. al., 2006). In the need to seek a compromise between owner and construction professionals might lead to the risk of lower performing product to satisfy GBI criteria.

RESEARCH METHODOLOGY

In relation to the nature of this study, descriptive survey design was employed to quantify a list of specific risks faced by developer in green construction process and solutions to mitigate the risks, as advised by Creswell (2009).

Pilot interviews were conducted with two experts from a targeted population in the hope of exploring new variables to build in a more relevant question in the instruments and to test the variables discussed in literature review. In this study, both of the interviewees were of the opinion that green developer's reducing interest to be green was one of the fundamental attributes to communication breakdown between the consultant and developer as expectation and intention to be green were no longer met. Recurring themes on the key variables underlying risks in construction process and risk mitigation strategies were analyzed and incorporated into a questionnaire, which was then distributed through e-mailing route to a deliberately selected sample comprising of 219 developers, 147 architects and 72 green consultants in Selangor and Wilayah Persekutuan in the sampling frame excluding those who had taken part in the pilot interview.

The questionnaire was adopted in close-ended format to allow a relatively easier answer processing and completion and a better comparability between the variables. The form of questionnaire consisted of two sections; the first section focused on the demographic background of the respondent to test the validity and reliability of the respondent's answer. The second section looked into the respondent's perception on sustainable project where the respondents were required to rate on (1) their agreement towards the occurrence of risks; (2) the impact of risks in green construction projects; and (3) the risk mitigation strategies on risk faced by

developer. The 5-points Ordinal Likert scale was used to measure the agreement and impact in (1) and (2) whereas, a nominal scale was employed for identifying and categorizing the proposed risk mitigations against the types of risk faced by the developer respectively.

In the light of multiple variables on risks faced in green construction process and proposed risk mitigation strategies, the data collected from the questionnaire survey were tabulated and analyzed via Multi-Attribute Utility Approach (MAUA); namely Mean Rating (MR), Relative Agreement Index (RAI), and Relative Impact Index (RII) in reference to Chang and Ive (2002). The outcomes of the analysis display the agreement of risks and relative significance of the risks on each impact and lastly identifying the most suitable strategy to mitigate the risks encountered.

FINDINGS & DISCUSSION

The following findings were analysed based on the responded close-ended semi-structured questionnaire surveys.

Findings on Types Of Risk In Green Construction Project

The agreement on the occurance of factors contributing to respective risks were presented and analysed accordingly from Table 1- 5.

Table 1 presented the two identified factors contributing to the economic risks. Construction key players' unfamiliarity towards highly developed and complex design innovation had been identified as the most significant factor contributing to economic risks at a narrow margin of Relative Agreement Index of 0.5215 and 0.4785 respectively. This was in line with Alexander's (2011) and Ballobin's (2008) opinion that the unfamiliarity towards sophisticated innovation would render the developer to incur more cost when the construction was inconsistent from the specification.

Table 1: Economic Risks

	Types Of Risk Faced By Developer In Green Construction Project	RAI	RANK
1	Construction key players' unfamiliarity towards highly developed and complex design/ innovation	0.5215	1
2	Lacking of reliable performance data on 'untested' green products	0.4785	2

Table 2 revealed two identified factors contributing to legal risks in green construction projects. Results showed that dispute on liability towards the non-realization of cost and energy saving was the most important factor in contributing to legal risks, with a Relative Agreement Index of 0.5385. This factor was in agreement with Alexander's (2011) point of view that the dispute liability towards the non-realization of owner's project aspirations was one of the matters, which was tantamount to legal dispute.

Table 2: Legal Risks

	Types Of Risk Faced By Developer In Green Construction Project	RAI	RANK
1	Overstated design qualifications or capabilities in energy and cost saving from design team	0.4615	2
2	Dispute on liability towards the non-realization of cost and energy saving	0.5385	1

In Table 3, two identified factors contributed to technical risks in green construction projects. Results revealed that underlying unknown defects from high-ended green technology was the most crucial factor contributing to technical risks. This was in accordance to Zainol's (2014) finding in which not only the incorporation of a higher ended green technology induced a higher chance of construction defect risks, but it too invited unknown potential risks. One respondent revealed the process of identifying raw materials required in GBI as a new risk to be noted on due to the non readiness to go green. It imposed a tendency of creating more wastages, complicated procedures and increased construction cost and time.

Table 3: Technical Risks

	Types Of Risk Faced By Developer In Green Construction Project	RAI	RANK
1	Underlying unknown defects from high- ended green technology	0.58	1
2	Construction delay from long green construction process	0.42	2

Table 4 exhibited four identified factors that contributed towards the risks of communication breakdown. From the results, it could be seen that these four factors were almost equally important with Relative Agreement Index at close interval of 0.01 between the factors. However, developer's wrongful assumption towards the fundamental sustainability features in green projects was the most significant factor, which could cause communication breakdown between the construction team.

Table 4: Risks of Communication Breakdown

	Types Of Risk Faced By Developer In Green Construction Project	RAI	RANK
1	Inconsistent expectations between the developer and the construction team	0.2599	2
2	Developer's wrongful assumption towards the fundamental sustainability features in green projects	0.2605	1
3	Developer's belief towards the sustainable design expertise and competency of design team	0.2427	3
4	Developer's reducing green interest	0.237	4

The factors contributing to the risks of unfulfilled expectation were as shown in Table 5. There were a total of five identified factors and the factor 'recommendations made based on compromises in time, money and quality by design team' topped all the other factors at a narrow margin, with a Relative Agreement Index of 0.2175. This conformed to Ballobin's (2008) finding where such compromises would arise in an event of third party certification, absence of obligatory contract conditions and uncovered professional liability insurance.

Table 5: Risks of Unfulfilled Expectation

	Types Of Risk Faced By Developer In Green Construction Project	RAI	RANK
1	Recommendations made based on compromises in time, money and quality by design team	0.2175	1
2	Contractors are ignorant towards his obligations at time of tendering	0.2015	3

3	Late sustainability-related decisions	0.2068	2
4	Conflict in the selection of indoor environmental quality and energy performance technologies, and sustainable materials	0.1858	5
5	Lessons learned from previous experiences not practised in decision making	0.1884	4

Findings on Risk's Level Of Impact Of The Accreditation Of Green Certification

The level of impact of each factor in risk was presented and analysed accordingly from Figure 2-4 using of the following legend.

Legend:

Types of Risk	Code Factor	Factors Contributing to the Risk
A.Economic Risks	ER1	Construction key players' unfamiliarity towards highly developed and complex design/ innovation
	ER2	Lacking of reliable performance data on 'untested' green products
B. Legal Risks	LR1	Overstated design qualifications or capabilities in energy and cost saving from design team
	LR2	Dispute on liability towards the non-realization of cost and energy saving
C.Technical Risks	TR1	Underlying unknown defects from high- ended green technology
	TR2	Construction delay from long green construction process
D.Risks of Communication Breakdown	RCB1	Inconsistent expectations between the developer and the construction team
	RCB2	Developer's wrongful assumption towards the fundamental sustainability features in green projects
	RCB3	Developer's belief towards the sustainable design expertise and competency of design team
	RCB4	Developer's reducing green interest
E.Risks of Unfulfilled Expectation	RUE1	Recommendations made based on compromises in time, money and quality by design team
	RUE2	Contractors are ignorant towards his obligations at time of tendering
	RUE3	Late sustainability-related decisions
	RUE4	Conflict in the selection of indoor environmental quality and energy performance technologies, and sustainable materials
	RUE5	Lessons learned from previous experiences not practiced in decision making

Risk's impact on cost overrun

Figure 2 presented the above identified risks in relation to their relative levels of impact in cost overrun. From the results, it can be seen that the relative impact index of each factor in all of the risks categories falls at a very close range among each other. This indicates that all of the factors in each category have almost equal impact towards cost overrun in green construction projects. Construction key players' unfamiliarity towards highly developed and complex design/ innovation was the most influencing

'economic risks' consequence of cost overrun. This was evident with its Relative Impact Index of 0.5086. This was consistent with Ballobin's (2008) finding where convoluted design would increase cost burden during non-compliance of performance. Dispute on liability towards the non-realization of cost and energy saving was the most impacting 'legal risks' to cost overrun, with a Relative Impact Index of 0.5060. This accorded with the finding of Zainol (2014) due to the high expense in legal fees for dispute resolution.

On the side of 'technical risks', underlying unknown defects from high- ended green technology has the highest Relative Impact Index of 0.5174 to contributing to cost overrun of the project. This lent credence to USGBC's (2009) finding suggesting the failure of green materials performance led to cost overrun. The factor on 'risks of communication breakdown' that contributed most to cost overrun was developer's wrongful assumption towards the fundamental sustainability features in green projects, with a Relative Impact Index of 0.2670. This was not in line with past studies as this risk was only revealed as a contributive factor to time overrun in the view of Ballobin (2008). Lastly, the factor on late sustainability-related decisions hit the highest Relative Impact Index of 0.2187 under the 'risks of unfulfilled expectation' category in affecting cost overrun. Such condition leads to construction delay, which accumulates to the cost of delay.

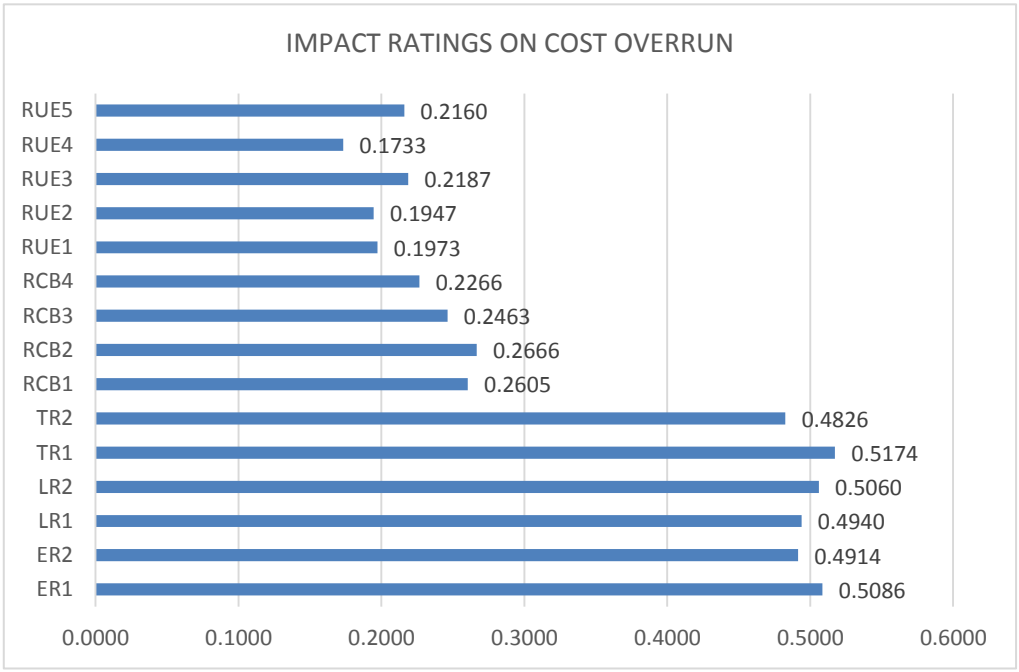

Figure 2: *Impact ratings on Cost Overrun*

Risk's impact on time overrun

Figure 3 presented the above-identified risks in relation to their relative level of impact in time overrun. From the results, it can be seen that the relative impact index of each factor in all of the risks categories falls at a very close range among each other. This indicated that all of the factors have almost equal impact towards time overrun in green construction projects.

The abovementioned risks in relation to their relative levels of impact on time overrun were as summarized in Figure 3. In 'economic risks', results revealed that the factor 'construction key players' unfamiliarity towards highly developed and complex design/ innovation' was the most significant in causing time overrun, with its Relative Impact Index of 0.5198. This lent credence to the observation of Alexander (2011) that unfamiliarity of green products and design innovation lengthened the construction duration.

Dispute on liability towards the non-realization of cost and energy saving was identified as the most influential factor in 'legal risks' contributing to time overrun due to its highest Relative Impact rating of 0.5672. Dispute is time consuming when the parties'

expectation does not intersect with each other. Construction delay from long green construction process deviated largely from the other factor of technical risks, with an evidently highest Relative Impact Index of 0.6099. This indicates the second factor of technical risks, underlying unknown defects from high- ended green technology has minor impact on time overrun. This harmonizes with the finding of Eizzatul et al. (2012); & Lam (2007) and Blake (2009) that prolonged construction process is the principal factor contributing to time overrun.

The factors in 'risks of communication breakdown' shared almost a similar level of impact towards time overrun, as they ranged closely to each other at around 0.2. The factor that has the highest relative impact index in this category is the inconsistent expectations between the developer and the construction team. This result was consistent with the previous study from Ballobin (2008) who recognized inconsistent expectations between the construction parties as one of the factor towards time overrun. As for the 'risks of unfulfilled expectation', late sustainability-related decisions is the most influential factor contributing to time overrun, with a relative impact index of 0.2310. This conformed to the suggestions of Hwang, Zhao, & Tan (2015) indicating the late client's decision-making has significant impact on project schedule performance.

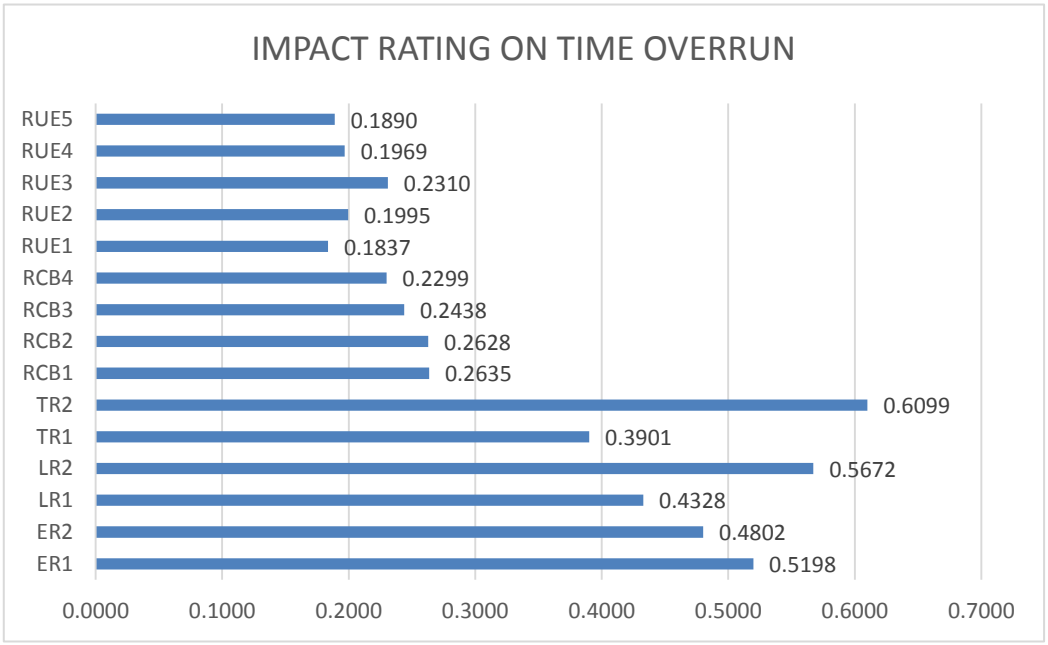

Figure 3: Impact Ratings on time Overrun

Risks impact on quality deficiency

Figure 4 summarized the level of impact of each identified factor in quality deficiency. Lacking of reliable performance data on 'untested' green products ranked first in 'economic risks' with its Relative Impact Index of 0.5194. This was identified as a new factor constituting to quality deficiency in green construction process.

The overstated design qualifications or capabilities in energy and cost saving from design team for 'legal risks' was identified as the most impacting factor to 'quality deficiency', with its Relative Impact Index at 0.5313. This was in compliance with the finding of Ballobin (2008) and Horman et al. (2005) stating that such overstatement would result in inconsistent performance, leading to a substandard green building. Underlying unknown defects from high- ended green technology topped the second factor at great range for 'technical risks', with an evidently Relative Impact rating of 0.6073. This was in line with the view of Alexander (2011) that the new and unknown defects of green products induced a lower quality of product or performance of green building.

Results also revealed that every factor under 'risks of communication breakdown' has nearly equal impact in quality deficiency. The highest Relative Impact Index was carried by inconsistent expectations between the developer and the construction team, with a Relative Impact Index of 0.2832. This result accorded with Ballobin (2008) and York (n.d.) indicating that conflict arising from client's unrealistic demand and expectation prompted a lower quality of the building due to compromises made (as cited by USGBC). Arriving to 'risks of unfulfilled expectation', the five factors exhibited a rather close range of relative impact index. This implied that all of them have impacted onto the quality deficiency of the green building. Unpracticed lessons learned from previous experiences for decision making triumphed over the other factors, with the highest relative impact rating of 0.2130. Meanwhile, recommendations made based on compromises in time, money and quality by design team ranked the second with a relative impact index of 0.2041. These two results were new discoveries of factors contributed to quality deficiency which should be looked into.

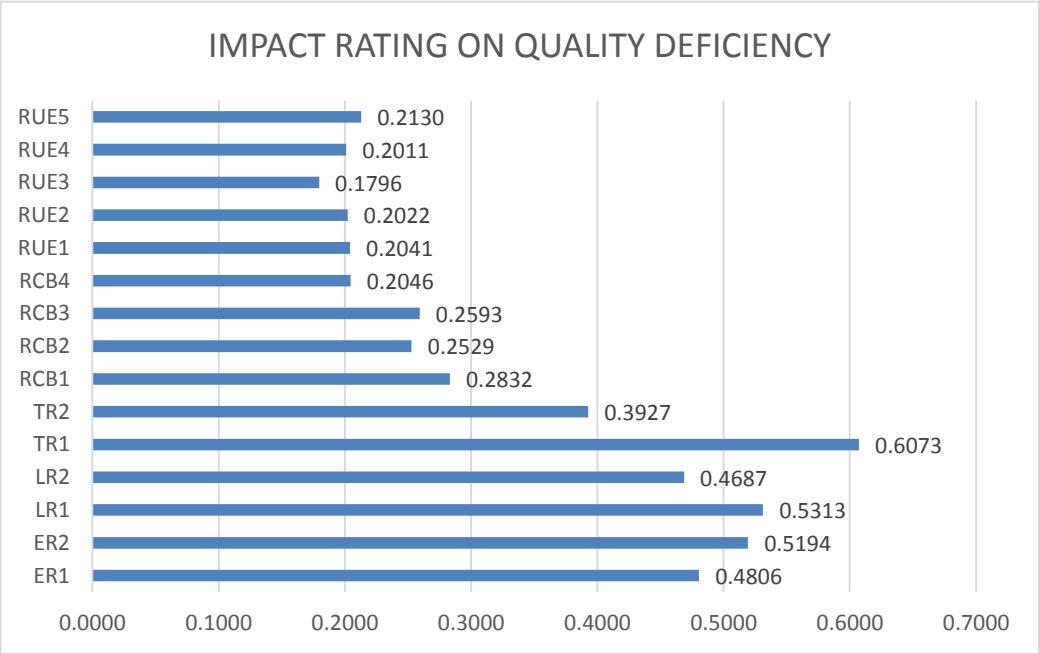

Figure 4: Impact Ratings on Quality deficiency

Findings on Risk Mitigation Strategies to the Risk Faced by Developer

The relevancy of risk mitigation strategies to the types of risk faced by developer are presented and analysed accordingly from Table 6 – 10.

Risk Mitigation Strategies on Economic Risks

In reference to Table 6, risks mitigation strategies that ranked at top three were presenting preliminary evaluation of alternatives approaches on project design and construction (14%) imposing liquidated damages to Contractor (13%), and insuring against changes in environmental standards, repairs using green materials, additional debris-removal expenses, and loss of tax profits (13%). The top ranked factor was in compliance with the findings of Ballobin (2008) where the presentation of design alternatives is viewed as a preventive measure against the extra claim from the design team on underperforming products. The strategy of imposing liquidated damages to Contractor was a new discovered strategy to address economic risks. This might be a reason of construction delay that consequent to cost overrun indirectly in an event of undesirable market price fluctuation. Lastly, the strategy to insure the developer against changes in environmental standards, repairs using green materials, additional debris-removal expenses, and loss of

tax profits was the second important measure is in agreement with Slone (n.d.) for it lessened the financial burden of the developer (as cited by USGBC, 2009).

Table 6: Risk Mitigation Strategies on Economic Risks

	Risk Mitigation Strategies on Economic Risks	**Respondents**	
		%	**Rank**
1	Open Communication	7	8
2	Fully disclose risks of using an untested product with the developer	9	5
3	Risk sharing on green product liability	10	4
4	Acquire informed consent from client before implementing/ adopting experimental products	9	5
5	Present preliminary evaluation of alternatives approaches on project design and construction	14	1
6	Outline a clear-cut performance specification in contract	9	5
7	Include additional contract provisions and warranties regarding the energy efficiency of green buildings	2	11
8	Impose liquidated damages to Contractor	13	2
9	Delete a clause imposing blanket liability on the contractor for achieving certification	6	10
10	Insured against changes in environmental standards, repairs using green materials, additional debris-removal expenses, and loss of tax profits	13	2
11	Design teams to acquire in-depth knowledge of sustainable projects	7	8
	Total	100	

Risk Mitigation Strategies on Legal Risks.

From Table 7, it is evident that strategies namely, to include additional contract provisions and warranties regarding the energy efficiency of green buildings (15%) and; impose liquidated damages to Contractor (14%) yield top two ranking in mitigating legal risks. The highest ranked strategy is in consistent with reference of Ballobin (2008) in which the inclusion of additional provisions warrant the developer to claim against the design professionals when the green performance is not achieved or when they overstated their capabilities and qualifications in energy and costs savings.

Followed with the secondly ranked strategy, the strategy to impose of liquidated damages to contractor agreed with the insights of Slone (2009) indicating this is a solution to limit legal risk. Shifting the risk of liability on timely completion in green construction projects to contractor prevent long lead time in resolving disputes which has an impact on green certification

Table 7: Risk Mitigation Strategies on Legal Risks

	Risk Mitigation Strategies on Legal Risks	Respondents	
		%	Rank
1	Open Communication	5	10
2	Fully disclose risks of using an untested product with the developer	9	6
3	Risk sharing on green product liability	10	4
4	Acquire informed consent from client before implementing/ adopting experimental products	10	4
5	Present preliminary evaluation of alternatives approaches on project design and construction	6	9
6	Outline a clear-cut performance specification in contract	9	6
7	Include additional contract provisions and warranties regarding the energy efficiency of green buildings	15	1
8	Impose liquidated damages to Contractor	14	2
9	Delete a clause imposing blanket liability on the contractor for achieving certification	12	3
10	Insured against changes in environmental standards, repairs using green materials, additional debris-removal expenses, and loss of tax profits	7	8
11	Design teams to acquire in-depth knowledge of sustainable projects	2	11
	Total	100	

Risk Mitigation Strategies on Technical Risks

From the Table 8, results revealed that design teams to acquire in-depth knowledge of sustainable projects yielded the highest ranking of 16%; risk sharing on green product liability ranked second with 14% of agreement from the respondents. The acquisition of in depth knowledge of sustainable projects from the design teams is perceived to be the most crucial strategy to mitigate technical risk and this is in line with findings of Ballobin (2008) due to their comprehensive and quality services rendered that could reduce the construction delay encountered in green construction process.

Table 8: Risk Mitigation Strategies on Technical Risks

	Risk Mitigation Strategies on Technical Risks	Respondents	
		%	Rank
1	Open Communication	9	6
2	Fully disclose risks of using an untested product with the developer	11	3
3	Risk sharing on green product liability	14	2
4	Acquire informed consent from client before implementing/ adopting experimental products	8	7
5	Present preliminary evaluation of alternatives approaches on project design and construction	10	5
6	Outline a clear-cut performance specification in contract	11	3
7	Include additional contract provisions and warranties regarding the energy efficiency of green buildings	8	7
8	Impose liquidated damages to Contractor	4	10
9	Delete a clause imposing blanket liability on the contractor for achieving certification	6	9
10	Insured against changes in environmental standards, repairs using green materials, additional debris-removal expenses, and loss of tax profits	4	10
11	Design teams to acquire in-depth knowledge of sustainable projects	16	1
	Total	100	

Risk Mitigation Strategies on Risks of Communication Breakdown

In reference to Table 9, strategy open communication outran other risk mitigations with a percentage of 19. The second ranked relevant strategy is to acquire informed consent from client before implementing or adopting experimental products, at 13% of relevancy. Strategy open communication lend credence to York (2009) and Nigel, Tony and Paul (2009) implying this as an effective approach to align the expectations between the parties through the trust and mutual understanding formed between each other. The acquisition of informed consent from client aligned with observation of Ballobin (2008) implying the importance of well-documented profile of every decision made in limiting risk of communication breakdown.

Table 9: Risk Mitigation Strategies on Risks of Communication Breakdown

	Risk Mitigation Strategies on Risks of Communication Breakdown	Respondents	
		%	Rank
1	Open Communication	19	1
2	Fully disclose risks of using an untested product with the developer	9	3
3	Risk sharing on green product liability	5	11
4	Acquire informed consent from client before implementing/ adopting experimental products	13	2
5	Present preliminary evaluation of alternatives approaches on project design and construction	8	6
6	Outline a clear-cut performance specification in contract	9	3
7	Include additional contract provisions and warranties regarding the energy efficiency of green buildings	8	6
8	Impose liquidated damages to Contractor	7	9
9	Delete a clause imposing blanket liability on the contractor for achieving certification	8	6
10	Insured against changes in environmental standards, repairs using green materials, additional debris-removal expenses, and loss of tax profits	6	10

11	Design teams to acquire in-depth knowledge of sustainable projects	9	3
	Total	100	

Risk Mitigation Strategies on Risks of Unfulfilled Expectation

From Table 10, it could be seen that strategy outlining a clear-cut performance specification in contract was ranked first with the highest percentage of 13%. Strategies such as open communication, fully disclose risks of using an untested product with the developer. Present preliminary evaluation of alternatives approaches on project design and construction, include addition contract provisions and warranties regarding the energy efficiency of green buildings and design teams to acquire in-depth knowledge of sustainable projects shared the similar rating of 12% and this indicating they were suitable in mitigating the risk of unfulfilled expectations. Referring to the top ranked strategy, outlining a clear-cut performance specification was deemed to be most effective strategies in this case elaborated Blake's (2009) viewpoint that it could be a legal risks mitigation strategies. It found to be suitable in tackling risk of unfulfilled expectations as it set forth the objective to be green certified.

Table 10: Risk Mitigation Strategies on Risks of Unfulfilled Expectation

	Risk Mitigation Strategies on Risks of Communication Breakdown	**Respondents**	
		%	**Rank**
1	Open Communication	11	2
2	Fully disclose risks of using an untested product with the developer	11	2
3	Risk sharing on green product liability	2	11
4	Acquire informed consent from client before implementing/ adopting experimental products	10	7
5	Present preliminary evaluation of alternatives approaches on project design and construction	11	2
6	Outline a clear-cut performance specification in contract	13	1
7	Include additional contract provisions and warranties regarding the energy efficiency of green buildings	11	2
8	Impose liquidated damages to Contractor	4	10
9	Delete a clause imposing blanket liability on the contractor for achieving certification	7	8
10	Insured against changes in environmental standards, repairs using green materials, additional debris-removal expenses, and loss of tax profits	6	9
11	Design teams to acquire in-depth knowledge of sustainable projects	11	2
	Total	100	

CONCLUSION

The ultimate purpose of this full paper is to bathe the green developers in an overview of underpinning risks that can happen during the construction process which can challenge their accreditation of GBI certificate. Specifically, this paper aimed to identify the risks faced by developer in obtaining green certificate and to determine the risk level of the identified risks based on their relative levels of impact on GBI certificate accreditation, which have been categorized into cost overrun, time overrun and quality deficiency that might arisen in green construction project. Results demonstrated that economic risks, legal risks, technical risks, risks of communication breakdown and risks of unfulfilled expectation were agreed to be risks encountered in green construction project. These risks were considered to have three major impacts, that was cost overrun, time overrun, and quality deficiency which were opined to have an indirect impact on the GBI certificate accreditation. Risk faced by developers in obtaining GBI certificate is analogous to risks encountered in green construction process. In view of the inauspicious events such as cost overrun, time overrun and quality deficiency borne by the predetermined important risk contributing factors, the developer is urged to seek and adopt the risk mitigation strategies as a preventive measure to shield the developer against the foreseen risks. The effort to achieve accreditation of GBI certificate would not be enough under a sole initiative from the developer, the design professionals, consultant team and contractors are hence encouraged to join forces with the developer to ameliorate a green construction process that is prickled with risks, in marching towards the ultimate goal of green accreditation.

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