SUSTAINABLE CONSTRUCTION AND RESIDENTIAL BUILDING DEVELOPERS IN MALAYSIA: FACTORS AFFECTING THE ADOPTION

Noorsaidi Mahat[1], Joseph H M Tah and Christos Vidalakis

School of the Built Environment, Faculty of Technology, Design and Environment, Oxford Brookes University, Oxford, OX3 0GB, UK

The adoption and implementation of Sustainable Construction has been one of the main challenges facing the construction industry for the last three decades. The issue has attracted global attention with many governments and organizations developing codes and frameworks to encourage and enforce the adoption of Sustainable Construction. However, current evidence suggests that companies and individuals are struggling to commit to Sustainable Construction and implement the suggested policies. This paper explores from the Malaysian residential building developer's perspective, the barriers and external drivers influencing the adoption of sustainable construction in Malaysia. A comprehensive literature survey is carried out to develop a theoretical link between sustainable construction and identified factors. This was followed by a structured questionnaire survey among 365 Developer company registered with the REHDA (Real Estate and Residential Building Developers 'Association Malaysia). 103 responses were received, 101 considered valid for analysis. Findings from the study revealed financial support (Incentives/tax rebates/subsidies, high profit margin), legislative and building regulation and availability of rating system. E.g. Green Building Index (GBI) are the key external drivers. Besides, high initial cost and investment, insufficient initiatives and support by government in term of tax rebates/subsidies/incentives and lack of improvement of legislation, building code and byelaws are the crucial barrier to the sustainable construction adoption. The study suggests government support in term of financial incentives, change in legislation and creation of awareness can promote the adoption and at the same time can provide barriers mitigation.

Keywords: sustainable construction, barriers, external drivers, adoption

INTRODUCTION

Residential buildings are one of the largest consumers of energy and water as well as producers of emissions and waste. During operation they consumes 32% of the world's renewable and non-renewable resources, 12% of available water and 40% of produced energy, while generating 40% of global CO2 emissions (GBCA, 2013). Apart from the potential to improve the environmental performance of buildings, Sustainable Construction (SC) has been associated with numerous benefits including increased property value, improved occupant productivity and better corporate image (Hyland *et al.,* 2013). However, even though SC seems to be an attractive business proposition for housing developers, adoption has been slow. Indeed, as pointed out by Thomson, (2001) delivering sustainability remains a challenge partly due to a range of

[1] 15110098@brookes.ac.uk

Mahat, N, Tah, J H M and Vidalakis, C (2019) Sustainable Construction and Residential Building Developers in Malaysia: Factors Affecting the Adoption *In:* Gorse, C and Neilson, C J (Eds) *Proceedings of the 35th Annual ARCOM Conference,* 2-4 September 2019, Leeds, UK, Association of Researchers in Construction Management, 455-463.

traditional, cultural and structural barriers such as the lack of integration between the different project stages, poor collaboration between the various professions in the project team and lowest-cost focused procurement (Sodagar, (2008), Häkkinen, (2011), Razali, (2015). The latter i.e. cost concerns have been cited by many researchers as the most important barrier to sustainable construction.

To encourage and enforce the adoption of SC many governments and organizations across the globe have proposed and implemented a series of measures and strategies. Malaysia has one of the best sets of environmental legislations, comparable even with those of developed countries Sani, (2007), indeed, a number of sustainable development frameworks and policies are in place, deployed to reduce and overcome sustainability issues. However, current evidence suggests that companies and individuals are struggling to commit to SC. As shown by Haron, (2005) the level of knowledge and awareness of environment issues and sustainability aspects among Malaysian residential developers has been particularly low. This indicates that the concerted efforts for promoting SC have not had the anticipated impact.

Sustainable construction is an important way to realize the sustainable development of construction industry. At present, many scholars have studied sustainable development and sustainable construction in the built environment, several definitions on sustainable construction has been introduced. Therefore, the final definition of Sustainable Construction in this paper is: In the residential building industry, it is the general term of the application, practices, innovation, technologies, products, approach, measures, initiatives, processes and technical means to be employed to accomplish the aim of "energy saving, water saving, material saving, land saving, and environmental protection" during the whole life cycle of the construction.

The majority of the studies looking at SC adoption have focused on design for sustainability Nilashi (2015), sustainability performance (Sim, 2015) and sustainability related technological challenges (Diyana, 2013). It is evident that further research is required into the factors affecting the decision of residential developers to embrace SC in the context of Malaysia. Therefore, this study explores residential building developer's perspective by looking at the barriers and external drivers influencing the adoption of sustainable construction in Malaysia.

LITERATURE REVIEW

Residential Building Developers and Sustainable Construction

Residential buildings are one of the largest consumers of energy and water as well as producers of emissions and waste. In Malaysia, the demand for houses is expected to be over 30 million in the year 2020, highlighting serious housing issues (Ajzen, 1991). The industry has been using conventional methods for many years, where environmental issues were not a major concern. With greater urbanisation and more projects on hillside and coastal areas, Malaysia is facing multiple environmental problems such as an increase in construction waste material generation (Ajzen, 2006), soil erosion, deforestation and landslides (Kraft *et al.,* 2005), water pollution and ecosystem disruption (Armitage, 2001) and many more. There are some buildings which claimed to be sustainable but were not classified as a sustainable building because they do not meet certain requirements. Houses being built in the past decades did not meet the essential criteria of sustainability and contributing to energy inefficiency.

Also, In Malaysia, residential buildings consume 15 per cent of total energy and are a key contributor to greenhouse gas emissions Tornatzky, 1982). Furthermore, up to date in 2015, there is total of 8,028 local building projects, 121 from it is Green Building Index (GBI) registered, but less than two per cent of eligible projects are assessed with building rating systems such as the GBI, and even among those assessed, less than 50 percent have been rated. Furthermore, this study will be a focus on developers' view because of their crucial role in the green application. Equivalent to project client, the developer dictates the course of the projects and are regarded as key decision makers and play an important role to determine the extent of sustainable approach for a particular project. Besides, they were projected initiators are having prevailing influence over the overall project direction. Also, their positions are strategic to ensure green practices are effectively applied.

Barriers Towards Sustainable Construction

Despite the numerous benefits claimed to be associated with sustainable construction, adopting such practices has its barriers. Thomson and El-Haram (2011) explained that delivering sustainability in practice remains a challenge partly due to a range of traditional cultural and structural barriers such as the lack of integration between the different project stages and professions in the project team. Zhou and Lowe (2003) argue that the promotion of sustainable construction faces several economic challenges due to poor understanding of economic benefits that can be achieved. Even though there are high investment costs for sustainable construction projects compared with traditional building practices (Häkkinen and Belloni, 2011), however, this can be addressed by utilizing the whole life cycle costing technique, moving from cost to value and from short-term to long-term cost perspectives (Al-Yami and Price, 2006). Additional construction cost has been cited by many researchers as the most current barrier to the implementation of sustainable construction (Sodagar and Fieldson, 2008; Hakkinen and Belloni, 2011). This common perception that sustainable construction is more expensive regarding capital costs compared to efficient mainstream buildings is a significant challenge to the adoption of sustainable construction (Zhou and Lowe, 2003). Moreover, the focus on price in procuring construction products and services is also hindering the journey towards sustainable construction (Adetunji *et al.,* 2003; Sodagar and Fieldson, 2008; Häkkinen and Belloni, 2011).

In a qualitative study by Williams and Dair (2007) involving five case studies of completed developments in England, it was identified that there were a number of barriers to sustainable construction practices, including; lack of consideration of sustainability measures by stakeholders, not required by clients, real and perceived costs and inadequate expertise and powers. The complex and fragmented nature of the construction industry is suspected to be another reason there is a tendency to resist changes leading towards sustainability. Sustainable construction projects require close working interaction with all the project team from design to completion stage (Riley *et al.,* 2003; Häkkinen and Belloni, 2011). Most construction organizations concerned with the implementation of sustainable practices have the perception that it will result in increased risks, difficulties in obtaining financial support and the lack of awareness of market value (Zhou and Lowe, 2003). The construction industry is client driven and, therefore, plays a significant role in the adoption of sustainable construction. The challenge is that lack of client awareness and demand for sustainable building (Pitt *et al.,* 2009) will affect the agenda towards sustainability.

Construction organizations should, therefore, be proactive in offering sustainable services and products to prospective clients (Berry and McCarthy, 2011).

Drivers of Sustainable Construction

In considering the effectiveness of the drivers that have been implemented to achieve sustainable construction practices in developing countries, it would perhaps be wise to people's moral views towards the environment and also the process of change. The following have been identified as key drivers, Ethics and behavioural change and Legislation and regulation.

Ethics is the branch of philosophy that investigates morality and the ways of thinking that guide human behaviour. The philosophy of ethics requires that people take a step back from experience and reflect critically on it. Steg and Vlek (2009) suggested that when the environmental behaviour has been selected and its casual factors identified, intervention strategies can be targeted on those factors. Also, Steg and Vlek (2009) note that economic analysis in ethics rests on a serious misunderstanding between 'wants' or 'preferences' and 'beliefs' or 'values.' However, sustainable economics offer a different way to view about economics and the environment as sustainable economics is concerned with the resources rate flowing through the economy (Dyllick and Hockerts 2002). Therefore, it makes sense to develop a sustainable economic system that uses the resources at the rate the earth can sustain if human realizes natural resource originate from the earth.

Cocklin and Blunden (1998) suggested that regulatory analysis and regulation theory provide appropriate foundations for the analysis of the environmental problem and encourage firms to invest in green technologies. Tam *et al.,* (2006) and Fraj-Andres (2009) indicated that fines and penalties for non-compliance with regulations will lead to more cautious attitude to environmental compliance. Recent evidence (Jardin, 2009) provide a different view that environmental regulations go too far and mentioning that governments fail to consider economics or whether the social overall benefit provided may be worth the 'cost' to the environment. Stricter environment policies are needed as drivers. From the above review, it can be observed that sustainable construction in developing countries will be based on best practices which emphasize long-term affordability, quality, and efficiency.

RESEARCH METHODOLOGY

The study sought to explore from the Malaysian developer's perspective, the barriers and drivers influencing the adoption of sustainable construction in Malaysia. To attain these objectives, structured questionnaires involving closed-ended queries were distributed to developers belonging to the REHDA (Real Estate and Residential Building Developers 'Association Malaysia) within 365 registered developers' company. The 365 questionnaires were distributed via emails to the registered developers. A total of 103 responses were received of which 101 were deemed valid for analysis after data screening, thus representing 28% response rate. Data from the survey was analysed by percentages and mean score rankings.

Table 1: Ranking of perceived barriers of sustainable construction adoption

No.	Perceived Barriers of Sustainable Construction Adoption	Mean	Standard Deviation	Ranking
1	High initial cost and investment	4.25	0.684	1
2	Insufficient initiatives & support by government in term of tax rebates/subsidies/incentives	4.22	0.743	2
3	Lack of improvement of legislation, Building code and byelaws	4.16	0.689	3
4	Lack of skilled tradesman for sustainable construction	4.14	0.749	4
5	Overlapping of roles among the government agencies	4.14	0.749	5
6	Lack of project team commitment	4.08	0.796	6
7	Insufficient skills about sustainability	4.08	0.794	7
8	Lack of consideration of supplier and manufacturer	4.07	0.778	8
9	Lack of buyer demand and understanding of sustainability	4.03	0.806	9
10	Lack of understanding of cost vs benefits in term of sustainable implementation	4.02	0.836	10
11	Slow government programs about sustainability	3.99	0.854	11
12	Lack of research and innovation about sustainability	3.99	0.853	12
13	Lack of research about existing success sustainable building projects	3.99	0.852	13
14	Lack of training of benefits and incentives on sustainable buildings	3.98	0.824	14
15	Limited of local sustainable technology	3.97	0.830	15
16	Limited of local sustainable materials	3.96	0.848	16
17	Lack of consideration of client	3.96	0.677	17
18	Increase in project cost and low profit margin	3.95	0.853	18
19	Sustainable construction technology requires special technical maintenance due to the complexity of the technology	3.93	0.852	19
20	Sustainable construction complexity (complicated technology and not easy to adopt)	3.93	0.851	20
21	Sustainable methods compromise ease of traditional methods	3.92	0.924	21
22	Limited company policies	3.91	0.694	22
23	Lack of public interest	3.91	0.981	23
24	Lack of awareness and knowledge among project team and contractors on sustainability	3.89	0.904	24
25	Lack of education of benefits and incentives on sustainable buildings	3.88	0,909	25
26	Lack of financial resources to address sustainability	3.87	1.083	26
27	Lack of public awareness understanding sustainability	3.84	0.924	27
28	High cost of green materials and technology	3.79	1.052	28
29	Difficult to understand the use of green Contract requirement/procurement practices	3.78	0.996	29
30	Lack of success sustainable projects using sustainable technology to give an example	3.75	1.126	30
31	Risk of unforeseen cost	3.61	1.095	31
32	Inability of sustainable construction imported technology advance testing	3.53	1.162	32

The second part presented the identified barriers and drivers to sustainable construction and respondents were asked to rate the extent to which each of the barriers and drivers affects sustainable construction using a 5-point Likert scale. Here respondents were asked to indicate their degree of agreement with the barriers on the Likert scale of 5 = strongly agree, 4 = agree, 3 = fairly agree (average), 2 = disagree, 1 = strongly disagree. A factor with a mean score of 2.5 and above was considered significant for the purposes of this study.

FINDINGS AND DISCUSSION

Factors Affecting Sustainable Construction Adoption

At the beginning of research objectives of this study, the main issues stated is to identify the factors (barriers and drivers) that affect the adoption of sustainable construction practices in Malaysia. As such, the various responses regarding the drivers and barriers reported by respondents were ranked in terms of their percentages and mean score rankings.

The significant barriers of SC adoption that were identified in literature were listed on the questionnaire and respondents were asked to rank them on a scale of 1 to 5. The findings of the responds are presented in Table 1. It was observed that the most ranked barriers by developers is 'high initial cost and investment'. This recorded a mean of 4.25. This is in line with research conducted by (Abidin 2010), (Lim 2011) and (Samari, *et al.,* 2009) in which they claimed that to adopt the SC normally requires higher initial cost and investment.

Table 2: Ranking of external drivers of sustainable construction adoption

No.	Perceived External Drivers of Sustainable Construction Adoption	Mean	Standard Deviation	Ranking
1	Financial support (Incentives/tax rebates/subsidies, high profit margin)	4.28	0.665	1
2	Legislative and building regulation	4.18	0.669	2
3	Availability of rating system. E.g. Green Building Index (GBI)	4.03	0.793	3
4	Awareness and knowledge by top management	4.09	0.763	4
5	Availability of new and integrated technology and material	4.02	0.812	5
6	Availability and access to green products, materials and technology	3.99	0.818	6
7	Cost efficiency and risk	3.98	0.824	7
8	Availability of sustainable construction research funding	3.97	0.830	8
9	Client/buyer awareness and demand	3.96	0.734	9
10	Availability and supports of local suppliers and manufacturers	3.93	0.863	10
11	Stakeholder influence	3.90	0.866	11
12	Responding to competitor rivalry	3.88	0.972	12
13	Obtain more projects to maintain business	3.84	1.065	13
14	Availability of comprehensive Information and database	3.84	0.903	14
15	Company's Reputation and brand image	3.83	0.895	15
16	Portray moral obligation to protect the environment	3.75	1.014	16

The significant drivers of sustainable construction adoption that were identified in literature were listed on the questionnaire and respondents were asked to rank them on a scale of 1 to 5. The findings of the responds are presented in Table 2. It was observed that the most ranked driver by developers is 'financial support (Incentives/tax rebates/subsidies, high profit margin)'. This recorded a mean of 4.28. This is in line with research conducted by (Pitt *et al.,* 2009), in which they claimed that financial incentives are the leading significant driver for sustainable construction.

CONCLUSION AND FURTHER RESEARCH

The findings in this study provide information on the most ranked barriers and drivers in Malaysia. As observed from the study and mentioned earlier, most of the issues refers to financial incentives. This therefore suggest that the Government of Malaysia needs to focus on issues that promotes reduction of taxes and levies, on sustainable products (i.e. recyclable materials, etc.). In addition, it was also observed that construction professionals do not consider protection of the environment as a key issue in sustainable construction. However, protection of the environment is one of the main pillars of all professional of the built environment in Malaysia. This therefore suggests that there is a need for the government and stakeholders to focus on methods that ensures that construction professional value the environment. There is a need for further investigation on how various factors are related. In other words, inferential statistical methods must be used in the future to determine whether there is a correlation and correlation relationship between the various constructs and the identified variables. Such information will provide information on how to promote sustainable construction practices in Malaysia. This means that with information about the most appropriate variables any information about the relationship between the variables will provide information about the variables that need to be promoted at another to trigger other variables that will lead to the expedition of adoption and implementation of sustainable practice in Malaysia.

ACKNOWLEDGEMENT

This research is part of an ongoing PhD Project and was supported by Universiti Teknologi MARA. The authors are grateful to people who helped undertake the research and improve this article. The Authors would also like to thank the editors and reviewers for their insightful comments on this research

REFERENCES

Abidin, N Z (2010) Investigating the awareness and application of sustainable construction concept by Malaysian developers, *Habitat International*, 34(**4**), 421-426.

Abidin, N Z and Afandi, N D (2015) Exploring developers' expectations on green construction, *Advances in Environmental Biology*, 75-79.

Adetunji, I, Price, A, Fleming, P and Kemp, P (2003) Sustainability and the UK construction industry: A review, *Engineering Sustainability*, 156(**4**),185-199.

Ajzen, I (1991) The theory of planned behaviour, *Organizational Behaviour and Human Decision Processes*, 50(**2**), 179-211.

Ajzen, I (2006) The theory of planned behaviour, *Organizational Behaviour and Human Decision Processes*, 50(**2**), 179-211.

Ajzen, I and Fishbein, M (1980) *Understanding Attitudes and Predicting Social Behaviour*. London: Pearson.

Armitage, C J and Conner, M (2001) Efficacy of the theory of planned behaviour: A meta-analytic review, *British Journal of Social Psychology*,40(**4**), 471-499.

CIDB (2007) *Construction Industry Master Plan Malaysia 2006-2015*. Kuala Lumpur Construction Industry Development Board Malaysia.

Cocklin, C and Blunden, G (1998) Sustainability, water resources and regulation, *Geoforum*, 29, 51-68.

Diyana, A N and Abidin, N Z (2013) Motivation and expectation of developers on green construction: A conceptual view, *Proceedings of World Academy of Science, Engineering and Technology, 2013: World Academy of Science, Engineering and Technology* (WASET), 247.

Dyllick, T, and Hockerts, K (2002) Beyond the business case for corporate sustainability, *Business Strategy and the Environment*, 11(**2**), 130-141.

Elias, E M and Lin, C K (2015) The empirical study of green buildings (residential) implementation: Perspective of house developers, *Procedia Environmental Sciences*, 28, 708-716.

Fraj-Andres, E, Martinez-Salinas, E, Matute-Vallejo, J (2008) Factors affecting corporate environmental strategy in Spanish industrial firms, *Business Strategy and the Environment*, 18(**8**), 500-514

Froese, T and Rankin, J (2011) *Strategic Roadmaps for Construction Innovation: Assessing the State of Research*. Doctoral Thesis, University of British Columbia, Canada

GBCA (2013) *Green Star Project Directory*, Green Building Council, Australia. Available from https://www.gbca.org.au/project-directory.asp Accessed 12/07/2019].

Häkkinen, T and Belloni, K (2011) Barriers and drivers for sustainable building, *Building Research and Information*, 39(**3**), 239-255.

Hall, B H and Khan, B (2003) *Adoption of New Technology*. Paper No. w9730. National Bureau of Economic Research

Haron, S A, Paim, L and Yahaya, N (2005) Towards sustainable consumption: An examination of environmental knowledge among Malaysians, *International Journal of Consumer Studies*, 29(**5**), 426-436.

Hyland, M, Lyons, R C and Lyons, S (2013) The value of domestic building energy efficiency - evidence from Ireland, *Energy Economics*, 40, 943-952.

Idris, N H, Ismail, Z and Hashim, H (2015) Towards a framework for promoting sustainable construction in Malaysia, *Jurnal Teknologi*, 76(**1**).

Joachim, O I, Kamarudin, N, Aliagha, G U and Ufere, K J (2015) Theoretical explanations of environmental motivations and expectations of clients on green building demand and investment, IOP Conference Series: Earth and Environmental Science, 23(**1**), 012010.

Kraft, P, Rise, J, Sutton, S and Røysamb, E (2005) Perceived difficulty in the theory of planned behaviour: Perceived behavioural control or affective attitude? *British Journal of Social Psychology*, 44(**3**), 479-496.

Nemoto, M C M O, Vasconcellos, E P G d and Nelson, R (2010) The adoption of new technology: Conceptual model and application, *Journal of Technology Management and Innovation*, 5(**4**), 95-107.

Nilashi, M, Zakaria, R, Ibrahim, O, Majid, M Z A, Zin, R M, Chugtai, M W, Abidin, N I Z, Sahamir, S R and Yakubu, D A (2015) A knowledge-based expert system for assessing the performance level of green buildings, *Knowledge-Based Systems*, 86, 194-209.

Razali, M N and Mohd Adnan, Y (2015) Sustainable property development by Malaysian property companies, *Property Management*, 33(**5**), 451-477.

Sahin, I (2006) Detailed review of Rogers diffusion of innovations theory and educational technology-related studies based on Rogers theory, *The Turkish Online Journal of Educational Technology*, 5(**2**).

Samari, M, Godrati, N, Esmaeilifar, R, Olfat, P and Mohd Shafiei, M. (2013) The investigation of the barriers in developing green building in Malaysia, *Modern Applied Science*, 7 (2).

Sani, S and Mohd Sham, A (2007) *Environmental Management in Malaysia: Changing Concerns and Approaches*. IMPAK, 3, 4-6.

Sieber, S and Valor, J (2008) *Criteria for Adopting Information and Communication Technologies*, PwC/IESE/ Business and Information Project (Ed. Pellicer, M).

Sieffert, Y, Huygen, J and Daudon, D (2014) Sustainable construction with repurposed materials in the context of a civil engineering-architecture collaboration, *Journal of Cleaner Production*, 67, 125-138.

Sim, Y L and Putuhena, F J (2015) Green building technology initiatives to achieve construction quality and environmental sustainability in the construction industry in Malaysia, *Management of Environmental Quality: An International Journal*, 26(**2**), 233-249.

Sodagar, B and Fieldson, R (2008) Towards a low carbon construction practice, *Construction Information Quarterly*, 10(**3**), 101-108.

Steg, L and Vlek, C (2009) Encouraging pro-environmental behavior: An integrative review and research agenda, *Journal of Environmental Psychology*, 29, 307-317.

Thomson, C S, El-Haram, M, Egbu, C and Lou, E Exploring the potential of sustainability action plans within construction projects, *In*: *Proceedings of the 27th Annual ARCOM Conference*, Association of Researchers in Construction Management, Bristol, 5-7.

Tornatzky, L G and Klein, K J (1982) Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings, *IEEE Transactions on Engineering Management*, (**1**), 28-45.