

The housing development process: green homes in Malaysia

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Abstract: *Green building has been adopted and became an accepted norm in the developed countries like USA, UK, Canada and Australia. Despite the good efforts shown by the developed countries on how to build green building, the developing and less developed countries inclusive Malaysia seem lag behind in this aspect. The issue of sustainable approach in building industry in Malaysia is still new and there are a little of housing projects are meeting the criteria of green buildings. The housing developers are exposed to the risk of uncertainty demand from the house buyers if they are interested to develop green homes. This paper discuss the development of concept and design of green homes by using product development process model in the manufacturing and building industry in order to assist the housing developers to reduce the risk associated with this new product such this green homes.*

Key words: Sustainable, Green Homes, Product Development, Building Industry

1. Introduction

Green building has been adopted and became an accepted norm in the developed countries like United States of America, United Kingdom (UK), Canada and Australia. Historically, green building was established more than a decade ago and UK became a pioneer country established the green building and then followed by USA in 1990 and 1998 respectively. It is not surprising that the both countries become a benchmark for other countries in implementing this approach. Therefore, the governments from other developed countries have taken a lot of efforts in transforming the building industry from traditional approach to the green approach. As a result, the building industry in the developed countries has embarked on a new era with the increasing number of buildings which classified and certified as a green building from year to year. Despite the good efforts shown by the developed countries on how to build green building, the developing and less developed countries seem lag behind in this aspect. Malaysia also is no exception. There is no denying the fact that; Malaysia is capable in several aspects such as economic, technology advancement and the numbers of construction professionals to embark on green building. In addition, the increasing of awareness level among the public towards sustainability become an extra advantage to the Malaysian building industry to develop green building. Therefore, these aspects should be harness by the Malaysian developers and construction professional to build a building which defined as a green building. There are a little of numbers of green building were built in Malaysia and is still in exploration stage in looking the best way towards practicing the sustainable building.

According to Zainul Abidin (2010a), the green movement in Malaysia is still at its infancy and sustainable projects are mostly at the pioneer stage. This statement is supported by Abu Bakar, Abd Razak, Abdullah & Awang (2009) which stated that the issue of sustainable housing are still new and not that familiar in Malaysia and with referring back the house being built in the past decade, those houses were not meeting the essential criteria of sustainability and unfortunately, there are little to none; in depth studies for this matter. Nevertheless, there are also situations where some of the building owners or developers claimed that their development projects are qualified as a green building status. The both situations could be presumed that the green building approach is a new phenomenon and considered as a new product in Malaysia. Furthermore, nobody can tell with certainty that there would be effective demand from house buyers for this kind of homes. Because of this scenario, the marketing research needs to be carried out in order to assist the Malaysian developers to reduce the uncertainty associated with new product such as this green building. The marketing research is part of the product development process (PDP). Thus, this paper will discuss on the PDP model in order to understand the process involved in developing the new product concept such this green homes. The discussion will begin with discussion on the sustainable approach in the building industry, consequently followed by discussion about the model of PDP and lastly discussion on market segmentation. This study embarks on the following objectives:

1. To discuss the relevance of sustainable development and green homes;
2. To review the current literature in the development of green homes;

3. To purpose a model for concept and design of green homes development in Malaysia.

This study is still at infancy stage. At present, a comprehensive literature is being considered are the topics of sustainable development, and concept and design development of green homes development. At a later stage of this study, it is envisaged that a theoretical framework will be completed. Then, a survey involving property house buyers will be conducted in three locations; Kuala Lumpur, Pulau Pinang and Johor.

2. Sustainable approach in the building industry

The building industry has been recognized as one of the industries contributes to the major source of environmental problems, high energy consumption and harmful to human health (Pitt, Tucker, Riley & Longden, 2009; Spence & Mulligan, 1995; UNEP, 1992; Vadera et al., 2008). For an example, the report of "Building and Climate Change" from the United Nations Environment Programme (UNEP) indicated that the building industry contributed as much as one third (30%) of total global greenhouse gas emissions and consumes up to 40% of all energy, both in developed and developing countries (UNEP SBCI, 2009). These figures have proved that the current practice in the building industry has contributed to the negative impacts which need a new approach in order to fulfill the needs of current needs without compromising the needs of future generations. In the opinion of Addis (2001), Wines (2000), and (Cofaigh et al., 1999; Wines, 2000), the building industry is widely accepted as the best place to influence the sustainable

development because its 'end product', the built environment, is the context for the majority of human activity (Mills & Glass, 2009). Meanwhile, (Williams & Dair, 2007) stated that the building industry has the potential to shape how we live our lives and to encourage or enable us to live them in a sustainable manner; by using fewer finite resources, contributing to the development of social capital and supporting the local economy. Thus, the introduction of green concept in the building industry seems a significant approach in order to mitigate those problems.

"Green" has become the shorthand term for the concept of sustainable development as applied to the building industry which intended to be environmentally responsible, economically profitable, and healthy places to live and work (USGBC (U.S. Green Building Council), 2006). The green concept applied in the building industry also associated with energy efficiency, resources and water conservation, solid waste management, and indoor air quality improvements (ACWMA (Alameda County Waste Management Authority and Recycling Board, 2003; John, Derek, & Jeronimidis, 2005; Roper & Beard, 2006). However, this "green" term has been used interchangeably with other terms such as "sustainable building" (Deal, 2010; Klunder, 2004; Roper & Beard, 2006), "ecological building", "energy efficient building", "healthy building" (Zhu & Lin, 2004), "high-performance buildings" (USGBC (U.S. Green Building Council), 2006), and "sustainable architecture" (du Plessis, 2005). Despite the different terms exist to describe the sustainable approach in the building industry, the definition of it has been proposed during the First International Conference on Sustainable Construction in Tampa, Florida,

1994 by the conference convener, Charles Kibert as '...the creation and responsible maintenance of a healthy built environment based on resource efficient and ecological principles...' (Bakhtiar, Li & Misnan, 2008; Bourdeau, 1999; du Plessis, 2005; Sjostrom & Bakens, 1999). There are seven principles of sustainable construction as suggested by (Kibert, 1994). The principles of it are as followed (Guy & Kibert, 1998):

1. Principle 1 - Minimize resource consumption (conserve);
2. Principle 2 - Maximize resource reuse (reuse);
3. Principle 3 - Use renewable or recyclable resources (renew/recycle);
4. Principle 4 - Protect the natural environment (protect nature);
5. Principle 5 - Create a healthy, non-toxic environment (non-toxics);
6. Principle 6 - Apply life cycle cost analysis and true cost (economics); and
7. Principle 7 - Pursue quality in creating the built environment (quality).

2.1 Green Homes

New houses are being designed and constructed with sustainability issues and dimensions in mind. Apart from being known as sustainable homes, these houses are also called 'green homes' or 'green buildings'. For the purpose of clarity of terms, this paper will use the word 'green homes' to describe 'sustainable homes' or 'green buildings' in the residential sector. Green homes was defined as a whole systems approach to the design, construction and operation of buildings which begin from the early stages of development and end up with final finishes in the home. Meanwhile, the principles of it

are as follows (ACWMA (Alameda County Waste Management Authority and Recycling Board, 2003):

1. Build for the long term - build a home that is durable and long lasting;
2. Build for our children - make their environment safe; and
3. Build for the planet - make the materials from sustainable sources.

The green homes could be the best way of building industry to reduce the negative impact to the end user and environmental impacts caused by the buildings (CIB Report Publication 225, 1998). To put it into a nutshell, the concept of green home is the convergence of three fundamental objectives. These are (ACWMA (Alameda County Waste Management Authority and Recycling Board, 2003):

1. Conserve natural resources - lessening the conventional building practices that consume large quantities of wood, plastic, cardboard, paper, water and other natural resources that lead, unnecessarily, to their depletion;
2. Increase energy efficiency - this is a cornerstone of any green building project. Generation and use of energy are major contributors to air pollution and global climate change. Improving energy efficiency and using renewable energy sources are effective ways to reduce the potential of energy supply interruptions, improve air quality, and reduce the impacts of global warming. In addition, improving energy efficiency is also an economically effective choice for consumers because it can lower down their utility expenses, year after year; and
3. Improve indoor air quality - Poor indoor air quality is caused by the off gassing of chemicals found in many building materials

and polluted air in poorly designed and maintained air-conditioning and ventilation systems. The United States Environmental Protection Agency (EPA) reports that the air in new homes can be ten times more polluted than outdoor air. The building products industry has responded to these indoor pollution problems by developing alternative paint, finish, and adhesive products, and better air-conditioning and ventilating system. According to (Zainul Abidin, 2010b), these principles of sustainable construction were set out aims to produce structures that enhance the quality of life and protect the environment efficiently and profitably. However, the process of changing to the sustainable approach in the construction industry requires actions from all parties engaged in the construction industry including those providing design, consulting, and construction services. The construction industry cannot declare environmental targets without dramatically reducing the environmental impact of buildings and infrastructure construction except changing the way of design and build (Vadera et al., 2008).

3. Product development model

The traditional approach in the building industry more concern on three equilibrium of objective, namely; cost, time and quality (Vanegas, DuBose & Pearce, 1996; Vanegas & Pearce, 1997) compared to green buildings approach which add additional criteria such as minimization of resource depletion and environmental degradation, and creating a healthy built environment (Kibert, 1994) within the context of human needs and inspirations (Vanegas & Pearce, 1997). In order to achieve these targets, the buildings should be

designed and developed based on principles of green buildings. However, the design and development process involved many activities. To describe the process and activities of design and development of products, the model of product development was designed by various industries in order to describe the development process and design process.

3.1 Model of Product Development (PD) and New Product Development (NPD)

There are various product development (PD) model has been designed and used by numerous industries. But, this paper will only review PD model in manufacturing and construction industry because the both industries are similar in production process and always become discussion topic between researchers. Despite there are several numbers of PDP model exist in numerous industries, (May-Plumlee & Little, 1998) suggested that those model can be group into similar types such as sequential models, parallel and concurrent, multiple convergent and other product development models and methods. However, these models have different function. (Formoso, Tzortzopoulos, & Liedtke, 2002) cited that, several models simply try to describe the process, some of them focusing on the product development process as a whole (for instance Yazdani & Holmes, 1999; (Prasad, Fuju & Deng, 1998; Yazdani & Holmes, 1999), while others depict the design process itself (for examples(Frankenberger & Badke-Schaub, 1998; Mazijoglou & Scrivener, 1998). There are numerous definitions given to describe the term of 'product development'. In addition, the terms of product development (PD) and new product

development (NPD) have been used simultaneously in the literatures and both terms seem to represent the same definition. Despite the differences usage and ways among researchers to define the product development, but generally it is the process that covers product design, production system design and product introduction processes and start of production (Johansen, 2005). In general view, the both of PD and NPD is all about a process of converting needs into a technical and commercial solution (Whitney, 1990). Ulrich & Eppinger (2008) defined the product development as a process in which a product is conceived, designed and launched in the market and also includes the feedback from both production and product use. It begins with the perception of a market opportunity and typically involves the identification of customer requirements, concept development, product design, product validation, market launching, and collection and dissemination of feedback data (Cooper, 1998; Yazdani & Holmes, 1999). This statement is in line with (Ulrich & Eppinger, 2008) which stated that the development of any products or new products which it begins with perception on the market opportunity until launch phase. Meanwhile, the Product Development & Management Association (PDMA) defined the NPD process as a disciplined and defined set of tasks and steps that describe the normal means by which a company repetitively converts embryonic ideas into saleable products or services (Griffin & Somermeyer, 2007). On the journey from the idea to finished product, many questions will be raised and answered, relating to the market, the technologies and the commercial skills that may be required to sell the new product effectively (Hart, 2007). From this point of views, it can

be summarized that the PD and NPD process is about activities associated with marketing issues, design and concept generation and getting feedback from the marketing after the launch of the developed products. The generic PD process consists of six phases, namely; planning, concept development, system level design, detail design, testing and refinement, and production ramp-up (Ulrich & Eppinger, 2008). The authors expand the concept development phase into 'front-end process' which consist eight stages; identifying customer needs, establishing target specification, concept generation, concept selection, concept testing, setting final specification, project planning, economic analysis, benchmarking of competitive products, and modeling and prototyping. In other hand, as suggested by (Booz, Allen & Hamilton, 1982), the NPD process consist eight phases; new product strategy, idea generation, idea screening, concept development and testing, business analysis, product development and testing, test marketing, and launch (cited in (Hart, 2007; Hart & Baker, 1994). Despite different ideas was suggested by the researcher, the both model of PD and NPD process however, can be described as interdisciplinary activities that need to go through by the product developers before launching any product or new products into market place.

3.2 Product Development Model in Building Industry

In fact, much effort has been spent in devising models for the product development and design processes, most of them for the manufacturing industry (Formoso et al., 2002). The successful implementation of product development process model in the

manufacturing industry has become a reference point and benchmark for other industries such as construction (Kagioglou, Cooper, Aouad, & Sexton, 2000; Tzortzopoulos, 2004), and apparel industry (May-Plumlee & Little, 1998) in order to design and adapt in their own product development process model. Several PD models (process maps or design model) already exist in the building industry. The most known and widely used model of PD is the RIBA Plan of Work which published over 40 years ago by the Royal Institute of British Architects (Austin, Baldwin, Li, & Waskett, 2000; Austin, Steele, Macmillan, Kirby & Spence, 2001; Macmillan, Steele, Austin, Spence, & Kirby, 1999). The RIBA Plan of Work (original edition in 1969 and amendment plan in 2009) consists eleven phase of development, known as; appraisal (inception), design brief (feasibility), concept (outline proposal), design development (scheme design), technical design (detail design), production information, tender document, tender action, mobilization, construction, completion (RIBA (Royal Institute of British Architecture), 1969, 2009). This model sets out the details of work to be carried out by each profession during each stage of the design process, but differs from most other models in that it does not show 'links' of information between activities to indicate how particular tasks are related (Austin, Baldwin, Li & Waskett, 1999). However, recently the construction industry is constantly challenged to improve the design and construction process performance (Tzortzopoulos & Sexton, 2007). Thus, the advances in PD in manufacturing have prompted the construction industry to initiate a number of initiatives aiming at designing and implementing process models as means to achieve process improvement

(Tzortzopoulos, 2004). Therefore, University of Salford has conducted a research on the adoption of product development model in manufacturing industry into the construction industry. The development of new model was based upon existing model of design and construction process such as RIBA, British Property Federation (1983) and IDEF-0 (1995) (Cooper, 1998; Kagioglou et al., 2000). As a result, the research has developed a new model for construction industry which known as Process Protocol (Cooper, 1998). The 'stage-gate' approach found in the manufacturing processes has been translated in the development of phase gate, either soft or hard of the Process Protocol model. Essentially, the Process Protocol is consist ten distinct phases with soft or hard gate approach in between of each phases. The processes are demonstrating the needs, conception of needs, outline feasibility, substantive feasibility study, outline conceptual design, full conceptual design, coordinated design, production information, construction, and operation and maintenance (Cooper, 1998; Kagioglou et al., 2000). Table 3.1 show the summary PD process model for the both construction and manufacturing industry.

3.3 Product Development Process Factors

In the product development process, there are two identified crucial factors in influencing the product success. One of the factors that well acknowledge in the literatures is customer needs and requirements. From the previous studies on assessing the factor of product success and failure shown that the factor of customer needs and requirements become a key factor to the success of

product development (e.g. Hsieh & Chen, 2005; Karrkainen et al., 2001; Lagrosen, 2001; and Cooper, 1994). Meanwhile Rafinejad (2007), Cooper (1994) and Urban & Hauser (1993) stated that the design factor also have a significant role in the product development because the product design must be reflected to the customer needs and requirements. The unfilled needs and requirements will cause failure to the product producer. Despite this factor was recognized as most powerful in

influencing the product success, it also was acknowledge that this factor is a difficult activities in developing products (Wheelwright & Clark, 1994). Thus, during the development of products, the product developers need to put good efforts in dealing with this factor because it is proved that the degree of customer acceptance towards any products is depend on how good the product developers can transform the customer needs and requirements into end product.

Table 3.1: The product development process in the construction and manufacturing industry

INDUSTRY	CONSTRUCTION			MANUFACTURING		
MODEL	RIBA Plan of Work	Process Protocol		Product Development Process	New Product Development Process	
PROCESSES	Inception	PREPARATION	Demonstrate The needs	PRE PROJECT	Planning	New Product Strategy
			Conception Of need		Concept Development	Idea Generation
			Outline Feasibility			Idea Screening
			Full Feasibility			Concept Development & testing
	Outline Proposal	DESIGN	Outline Conceptual Design	PRE CONSTRUCTION	System Level Design	Business Analysis
	Scheme Design		Full Conceptual Design			Product Development & Testing
	Detail Design		Coordination Design		DETAIL DESIGN	
	Production Information	PRE CONSTRUCTION	Production Information			
	Tender Document					
	Tender Action					
	Mobilisation					
	Construction	CONSTRUCTION	CONSTRUCTION	CONSTRUCTION	Testing & Refinement	Test Marketing
	Post Completion	USE	Operation	POST	Production Ramp-Up	Launch

3.3.1 Factor of Customer in Product Development

The current competition in the market becomes more vigorous. To counter this threat, the developers must focus on searching for sustainable advantages. The survival of a company is heavily dependent on its capacity to identify new customer requirements and to develop market improved products; goods or services (Shen et al., 2000). This idea is in line with Ulrich & Eppinger (2008) which insist that the company's economic success is heavily depend on the company's capability on identifying customer's needs and requirements, and quickly design a product which meet those needs and requirements. The construction industry is adept at delivering highly complex products. It differs from much of engineering in that its products are often and respond to the specific needs of individual customers (Austin et al., 2007). Meanwhile, DTI (2002) and Egan (1998) insisted that the construction industry has been challenge to be able to deliver projects through an understanding of customer requirements (cited in Tzortzopoulos et al., 2005). This situation has increased the burden on the construction industry to provide a quality and better service to meet the customer's requirements and expectations (Dulaimi, 2005). Therefore, it is important to the developers to design products that can meet the customer needs and requirement because it will determine the customer satisfaction which led to buying preferences. According to Yang & Peng (2008), the product success is depend on the quality of product which factors of meet the customer needs and requirements and customer satisfaction are taken into account in determine the quality of products. In terms of terminology, customer's satisfaction can be

reviewed as an expectancy disconfirmation process which the satisfaction is highly depend on the company's capability to meet the customer's expectation or needs and requirements (Maloney & ASCE, 2002). In essence, Drucker (1989) and Levitt (1975) suggested that the value of a product can be determined only in reference to the customer, and the goal of production is satisfying customer needs. Therefore, it can be summarized that customer needs and requirements is compulsory to be identify by the developers because the next phase of product development, the concept and design development phase is highly depend on this factor. As indicated by Karlsson et al. (1998), the needs of a customer are condensed into a specification of the product, and Koskela (2000) insisted that the specification controls the design function.

3.3.2 Summary

The sustainable construction projects are still new and at pioneer stage in Malaysia. Despite the developed countries have long ago shown good examples in implementing sustainable construction, Malaysia are relatively behind so far in this aspect. Thus, the construction players such as architects, engineers, developers and contractors was urged to take a holistic approach (Hussein et al., 2009/2010) and proactive actions to promote the sustainability concept in delivering the construction projects (Zainul Abidin, 2009). There is no denying the fact that, the technology to build sustainable houses is there for the Malaysian developers and construction professionals to harness. Nevertheless, nobody can tell with certainty that there would be effective demand from house buyers for this kind of homes because it is still a

relatively new product concept and will need more time to succeed. Because of this scenario, a marketing research focusing on reducing the uncertainty associated with any new product such as these green homes, need to be carried out before any property developer will want to build these houses, and consequently, for these houses to be accepted by the house buyers

4. Proposed model

Although the development of Process Protocol model taken similar approach from manufacturing process, this review found that, the both model of RIBA and Process Protocol are more emphasis on client factor. This is totally different with manufacturing approach which more concern on the customer factor. Despite several literatures used the term of customer in their literatures, it can be assumed that it refers to the client (for examples, (Kagioglou et al., 2000; Lee, Song, Cooper, & Aouad, 2000; Tzortzopoulos & Sexton, 2007). This is slightly different with manufacturing process which taken the customer (consumer) factor into consideration during the development of products. Thus, in the case of development for the concept and design for green homes in Malaysia, the RIBA Plan of Work and Process Protocol are still can be used but the both models need to put the consumer needs factors into account while proposing the concept and design of green homes. The consumer needs is acknowledge as a significant factor in determine the success of organizations. As indicated by (Shen, Tan, & Xie, 2000), the survival of a company is heavily dependent on its capacity to identify new customer requirements and to develop market improved products;

goods or services. This idea is in line with (Ulrich & Eppinger, 2008) which insisted that the company's economic success is heavily depend on the company's capability on identifying customer's needs and requirements, and quickly design a product which meet those needs and requirements. Furthermore, (Yang & Peng, 2008) indicated that the product success is depend on the quality of product which factors of meet the customer needs and requirements and customer satisfaction are taken into account in determine the quality of products. In terms of terminology, customer's satisfaction can be reviewed as an expectancy disconfirmation process which the satisfaction is highly depend on the company's capability to meet the customer's expectation or needs and requirements (Maloney & William, 2002). The construction industry is adept at delivering highly complex products. It differs from much of engineering in that its products are often and respond to the specific needs of customers (Austin & Thorpe, 2007). Thus, the construction industry has been challenge to be able to deliver projects through an understanding of customer requirements (Tzortzopoulos, Sexton, & Cooper, 2005). This situation has increased the burden on the construction industry to provide a quality and better service to meet the customer's requirements and expectations (Dulaimi, 2005).

4.1 Justification of RIBA Plan of Work and Plan of Work and Process Protocol in the Green Home Development in Malaysia

The RIBA Plan of Work has been partially or fully used in the management and administration of all conventional property

development projects in Malaysia. Despite its tried and tested reputation, there is no guarantee that the RIBA Plan of Work can be seamlessly applied in the development of green homes. A number of salient factors unique to the green homes development must be considered first. These are the green homes - specific characteristics, namely, house buyers needs and requirements, and the requirements of green homes concept and objectives.

5. Conclusion

Therefore, in the case of the development for the concept and design for the green homes in Malaysia, the housing developers should be noted that the green homes that are going to be developed in the future should consider the needs of house buyers. By taking the needs of house buyers into account, it will reduce the uncertainty associated with any new product such as these green homes.

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