

## An Overview of the Challenges in Malaysian Green Construction

Asniza Hamimi Abdul Tharim<sup>1</sup>, Aifa Syazwani Zainudin<sup>1</sup>, Noraidawati Jaffar<sup>1</sup>,  
The Zahariah Nasaruddin<sup>1</sup>, Muna Hanim Abdul Samad<sup>2</sup>

<sup>1</sup>Department of Quantity Surveying, Faculty of Architecture, Planning and Surveying,  
Universiti Teknologi MARA, Perak, Malaysia,  
Email: <sup>1</sup>mimiasniza@gmail.com

<sup>2</sup>Architecture Programmed, Universiti Sains Malaysia, Penang, Malaysia.

---

### Abstract

Green building means to refine and improve the design, construction and management practices so that building will last longer, cost less and contribute to healthy living. It also brings significant effects in protecting natural resources and improving the built environment. However, the green development approach often faces challenges and obstacles in terms of the implementation of the new procedures and technologies. The main objective of this paper is to explore the challenges encountered by the project manager in managing green building in Malaysia. Thus, this paper will also provide an overview on the Malaysian green assessment context that is known as the Green Building Index (GBI). The Green Building Index (GBI) is an index on environmentally friendly building with the ability to save utility costs and preserve the quality of the external and internal environment. Therefore, it is crucial to identify the challenges in implementing the green building construction and management for the benefits of the building assessment. To achieve the main purpose of this paper, questionnaire surveys were conducted among project managers in the Klang Valley, Malaysia. Data obtained was then analyzed by using the SPSS software and the outcome from the survey indicates eight main challenges in green building management in Malaysia faced by the project managers. Most of the respondent agreed that the most substantial challenge faced by the project manager in managing a green construction is the time factor. This result is similar to the findings from previous research which indicates that longer time is needed in pre-construction of the green construction projects.

*Keywords:* Green Construction, Project Manager, Challenges, Green Building Index (GBI)

---

### 1.0 Introduction

The construction industry is an important element in Malaysian economy. According to Department of Statistics Malaysia (2013) the construction sector in Malaysia registered a solid growth of 10.9% in 2013 and 18.1% in 2012 compared to 4.7% in 2011. Compared to other sectors, the construction industry recorded a commendable growth due to building works and major civil engineering projects, particularly in public infrastructure works. The output of construction is about RM50 billion a year. Public building, commercial buildings, residential or infrastructure such as roads, airports, railway tracks are part of the construction industry. All these outputs have a major impact on Malaysia's ability to maintain a sustainable economy and environment. Ding (2005) mentioned that compared to other sectors, the construction industry consumes huge portions of raw materials. The construction sector is not only to deliver buildings and infrastructures but it must look beyond on opportunities to reduce pollution thus minimize the use of resources and energy. Osman (2012) believed that much energy is used in the production of materials such as cement, steel, wood as well as plant and machinery operations on site. The construction process results in waste and contamination of natural resources and the environment. Regarding these issues, the construction sector must improve the quality of life and adopt environment-friendly solutions and products. The concept of green building is now widespread in the construction industry due to rising awareness on sustainability (Peng, 2010).

Riley (2003) states that green building can be a project in which efforts are made to minimize the environmental impact of construction, and to maximize energy efficiency and the productivity of occupants. While Hoffman and Henn (2008) define "Green building" as a term covering strategies, techniques, and construction products that are less pollution producing than regular construction. Green building is also a way of enhancing the environment, which benefits human well-being, community, environmental health, and life-cycle costs (Adler, 2006). According to Glavinich (2008) the term green building is defined as a building that provides the specified building performance requirements while minimizing disturbance to and improving the function of local, regional, and global ecosystems both during and after its construction. Based on the various definitions given, green building

can be described as a solution to minimize the environmental impact of construction to improve human well-being, community and also environmental health. Green building is the most commonly defined as techniques or efforts made to minimize the impact of construction and improving ecosystems as well as productivity of the occupants. The construction of a green building can be part of an overall plan for sustainable development. Therefore, it is a way of enhancing the environment, which provides benefit to our environment, human well-being and the health of the community. Kubba (2010) stated some of the primary benefits of green building includes; reducing energy consumption, protection of ecosystems, improved health of occupants, and increased productivity

Green building enhances the ecosystem and environmental wellbeing. Also, it enhances productivity in terms of performance and value. The United Nations Environment Programme (UNEP) (2007) stated that the construction industry has the greatest opportunity to affect environmental issues due to the built environment's major energy consumption and contribution to global warming. Many studies showed that sustainable or green building can considerably reduce bad impacts towards the environment. It may help to improve the environmental quality and protect the ecosystem. Moreover, the following benefits encourage the adoption of green building concepts in the industry (Hakkinen and Belloni, 2011):

- i. Costs of green operational building are more beneficial than conventional buildings.
- ii. The improved performance sustainable buildings can enhance the productivity of their users.
- iii. The reduced emission and use of natural resources by sustainable buildings may give benefit to the national economy.

## 2.0 Green Building Index (GBI) Malaysia

Consequently, as an acceleration of the Malaysian sustainable construction industry and as a manifesto of the government's seriousness in implementing "green" initiatives for the country, The National Green Technology Policy was launched by the Former Prime Minister of Malaysia Tun Dr Mahathir Mohamed in July 2009 with the aims to be a driver to support the national economy and promote sustainable development in Malaysia. The intention to drive the national sustainable construction and development through green technology was clearly mentioned and stated in Objective number 4 of the National Green Technology Policy : ***"to ensure sustainable development and conserve environment for future generation"***. Later, the four pillars of green development were introduced by the Ministry of Energy, Green Technology and Water of Malaysia which consist of 4 main pillars; energy, the environment, social and economy. The main target of the environment pillar is to conserve and minimize the impact on the environment by adopting Green Technology in construction and development of Malaysia. In order to expand the use of green technology in Malaysia, Green Building Index (GBI) was launched by the government on 21 May 2009 and it is one of the incentives announced in Budget 2010 under the heading of ***"Promoting Construction of Green Building"***. The Green Building Index (GBI) is a green rating index on environmentally friendly building with the ability to save utility costs and preserve the quality of the external and internal environment.

Green Building Index (GBI) is Malaysia's green rating tool for buildings and towns developed to promote sustainability in the built environment. The green building rating tool was introduced to provide fundamental direction for the building industry to move towards environmental protection and the achievement of sustainability (Ding, 2008). The GBI rating tool provides an opportunity for developers or owners to design and construct sustainable buildings that can provide energy savings, water savings, and promote a healthier environment. Green Building Index is needed because it allows public evaluation of green building. Thus, it serves as key design principles for Architects and Engineers to design green buildings and also acts as principles of better total building performance (Green Building Index, 2012). In order to achieve the standards of quality for green building index (GBI), there are six criteria that need to be considered namely energy efficiency, indoor environmental quality, sustainable site planning water efficiency and innovation. All these criteria have their points score to achieve green building index rating. These rating index is given based on the overall score points of the six criteria namely; Platinum (86+ points), Gold (76 to 85 points), Silver (66 to 75 points), and Certified (50 to 65 points).

## 3.0 Challenges in Implementing Green Building

According to Pedler (2002), challenges are critical tasks, problem and issues requiring action. Based on the Reverso Dictionary (2008) and Princeton University Dictionary (2000), challenges can be defined as any condition that makes it difficult and prevent people or groups from agreeing, communicating or achieving an objective. Challenges can be precise as issues, problem or barriers that prevent people to implement the work. Green construction is still relatively new in Malaysia especially with the lack of experienced workers. This situation gives challenges to the project manager in managing green building projects. There are many challenges in sustainable

construction, especially in terms of cost, technologies, construction process, quality, and lack of communication, lack of time, materials and equipment or governmental barriers.

### **1. Higher Costs for Green Construction Practices and Materials**

Green projects impose higher costs to construct than conventional projects. According to Zhang et al. (2011), the higher costs of the green project are due to design complexity and also modeling costs needed to integrate the green practices. Higher costs of the project are also associated with green materials and using green construction technologies (Hwang and Tan, 2010). Ling (2003) stated that the higher costs of green construction are affecting project managers because they handle managing and planning the budget. In fact, in the green building process, as stated by Hakkinen et al. (2011), there are many challenges in adopting new processes and operation methods for applying new technologies in green construction. Risks and unpredictable costs due to new technologies should also be taken into consideration. As a good project manager, they should have technical expertise, knowledgeable in materials and systems as well as being familiar with the green technologies. The most common challenges are the cost premiums of green buildings. Cost premium include raising costs of the supplier, wages of skills and productivity of material (Muir, 2005). Hills et al. (2008) as cited in Delnavaz (2012) believed that in order to avoid additional costs, the project manager could have significant influence by their careful choice of building methods that can save manpower as well as reducing environmental damage.

### **2. Technologies**

According to Tagaza and Wilson (2004) green building concept is usually more complicated than conventional methods, especially with technologies, material and construction. If the project manager is unfamiliar with green technologies, it may affect management and performance of the work. Therefore, it becomes a challenge to the project manager. The project manager must be clearly knowledgeable about green technological operations. This is supported by Shi et al. (2013) who stated that the lack of mature green technologies on requirements of implementation and operation in green construction presents a barrier to projects. According to Griffith (2002), implementing new innovative ways to design, construct, maintain and use are identified as challenges for green building construction. Besides that, the project manager must understand the objectives of their client, especially when the client wants to achieve a Green certification (Hwang and Nga, 2012). This situation gives challenges to the project manager. The client should specify the type of technology to be used for the project manager to fulfill the client's requirements. For example, the use of energy efficient glass façade, which is a special request from a client, makes the project manager aware about the benefits of green roofs or green façades.

### **3. More Time is required to Implement Green Construction Practices on Site**

Choi (2009) cited that delays frequently lead to greater risks and higher costs. More time is required during planning the design and structuring of green building. During the design stage, the impact of the elements on each structure in a green project must be considered as a whole. For example, plan to reduce energy consumption in buildings and optimize energy savings. Therefore, the project manager must ensure that the plan is detailed and comprehensive, subsequently leading to a lengthier process. The pre-construction period of green construction requires more time compared to conventional projects. A longer duration is required to implement green construction on site. For example, random checks and on-site visits by project managers are usually required to ensure sustainable practices are implemented on-site (Tagaza and Wilson, 2004). Also, green construction demands a combination of sustainable technologies and interaction with other recycled and reused components (Hoffman and Henn, 2008). Therefore, the planning and period of approval for material becomes lengthy. Hwang and Ng (2012) argued that delays will occur if the delivery of material does not comply with the standards for green construction. This may become an issue and challenge to the project manager. Delays in construction may occur and increased costs.

### **4. Communication**

Lack of communication may become a challenge to the project manager. As a project manager, they must be able to handle or manage a large number of stakeholders such as contractors, suppliers or team members. Therefore, communication skills are needed. Hwang (2010) stated that communication is important especially in critical situations in a green project to convey the sustainable practices expected from the team members. The conflict between stakeholders may occur if there is a lack of communication among them. This may affect the performance of projects. The use of green construction techniques can sometimes bring trouble to the architectural design of a building (Shi et al., 2013). For example, the issue on how to integrate solar panel system with other materials such as using it as a façade for a building. This may become a challenge for the project manager to control and solve the problem. The project manager must be able to use the knowledge area of conflict and dispute. To avoid misunderstanding and conflict between the project manager and the stakeholder, frequent meetings with the green specialist is needed. Frequent meetings with the green specialist is one of the most common challenges faced by the project manager in a green building project (Hwang, 2012). This is because many issues and ideas should be

discussed together to ensure that the objective is achieved.

### **5. Material and Equipment**

Availability of green materials and equipment is recognized as a barrier in green building construction. Reused and recycled construction material during the construction phase is one of the important aspects in green construction (Pitt, Tucker, Riley, & Longden, 2009). When there is a high demand for green material, the cost of green materials will increase. For example, Tam (2011) as cited in Delnavaz (2012) stated that reusing timber and recycling steel material can generate income for the supplier. Even though the availability of green material is good, it has become one of the challenges because of the cost. The project manager must ensure that materials used comply with the standards of green construction. Imported green material and equipment may become an issue for the project manager. Unlike conventional construction materials, many green materials are not usually available locally (Hwang, 2012). Hwang (2012) also mentioned that to ensure an imported material will be well-suited for local use, extensive testing may be required. Uncertainty with green material and equipment often leads to barriers in green construction. According to Griffin (2002) the project manager becomes uncertain with the choice of green structural material during the construction phase. When there is a limitation of scope and applicability of new material or technologies, it becomes a challenge for the project manager involved in green building construction. It may affect the performance of the project manager and forces them to move back to traditional construction methods.

### **6. Quality**

Lack of quality in terms of knowledge area in green concept may give challenges in management. Lack of adequate knowledge for developing a project brief with clear target and objective are difficult in constructing a sustainable building (Häkkinen and Belloni, 2011). Shi et al. (2013) also supported this by stating that the lack of knowledge in green technology and green materials prevents the construction industry from implementing the strategies of green construction. Lack of technical skills or training regarding green technologies may contribute to barriers or challenges faced by the project manager. According to Hwang (2012), if the workers lack technical skills or are unaware about the correct procedures, it may give negative impacts on the project. For example, the lack of understanding of treatment for construction waste is a main problem that leads to inefficient and ineffective practices of reuse and recycling of construction waste (Delnavaz, 2012). Although project manager may not directly deal with the construction workers, as project managers they must play a role to project success.

The project manager must encourage and improve the skills and knowledge of workers through training and education session on site (Hills et al., 2008 as cited in Delnavaz, 2012). Besides, the design criteria of green buildings may also become a barrier for the project manager while managing green construction. Design criteria of green buildings include Energy Efficiency, Indoor Environmental Quality, Sustainable Site & Management, Material & Resources, Water Efficiency (WE), and Innovation. Crawley and Aho (1999), stated that specifications and green design are critical for construction projects, especially those subjected to environmental assessment. It has become a challenge for the project manager because they have to be responsible and knowledgeable in all the design criteria of green buildings.

### **7. Technical Difficulty during the Construction Process**

Green projects require high-level technologies with complicated techniques and construction processes. If complexities are not addressed well, it may affect the project manager's performance (Hwang, 2012). Tagaza and Wilson (2004) mentioned that one of the main challenges in green building is technical difficulties experienced during the construction process. The complicated design in green construction, difficulty and risks are faced by the project manager. According to Hwang (2012), more alteration and variation with the design during the construction process is one of the challenges faced by the project manager. Hakkinen et al. (2011) considered client understanding and willingness as main factor in the development of green construction. The interest and willingness of clients is a challenge for green building practice acceptance (Delnavaz, 2012). Besides, unforeseen circumstances in the green construction process may lead to barriers encountered by the project manager. Unforeseen circumstances such as impacts on the environment or pollution from construction activities present one of the key challenges in green construction (Griffith, 2002). The potential pollution from construction activities such as noise, air pollution or vibration should be minimized. According to Hwang and Tan (2010) project managers should ensure that pollution from construction activities is minimized by controlling soil erosion, waterway sedimentation, and airborne dust generation. Malaysia is still new in green construction projects, hence the team, and construction workers have little experience in green knowledge. Therefore, when project manager are confronted with unforeseen circumstances, they are not equipped with any prior knowledge or skills to manage the situation. These issues give challenges to project manager.

### **8. Government Support**

Increasing government regulation can also give challenges to the project manager managing green building

construction. According to Muir (2005), with increasing environmental and safety laws, the industry is coming under greater regulation and requirements. As a project manager, they must ensure that all the requirements regarding the environment or safety compliance are according to the standard regulations. For example, the project manager must ensure that the pollution from the construction activities is minimized by controlling soil erosion or waterway sedimentation (Hwang and Tan, 2010). In Malaysia, the government launched the National Green Technology Policy in August 2009 (Malaysia Green Technology & Renewable Energy Industry, 2011). It is aimed at reducing 40% of carbon emission by 2020. This policy provides direction toward implementation of green buildings. Therefore, the role of project manager in green building construction is important. Lack of government support and incentives give challenges to the increase of green building activity (McGraw-Hill Construction, 2013). In Singapore especially, the government has policies that help to drive the adoption of green building practices. In Malaysia, the green building concept is also slowly implemented with the incorporation of Green Building Index (GBI) features for government buildings. Green Technology & Renewable Energy Industry (2011) reported that the government has established a fund and provides loans to companies that supply and operate green technology. As the government is supporting sustainability in development, the project managers should act as responsible actors for the construction of green buildings.

#### 4.0 Research Outcome

Table 1.0: Project Manager’s Challenges

Item	Challenges	Mean Value	Item	Challenges	Mean Value
<b>1.</b>	<b>COST</b>		<b>5.</b>	<b>MATERIAL</b>	
a.	Higher cost in green material and equipment	4.13	a.	Availability of green material and equipment	4.00
b.	Raising costs by wages, supplies, productivity and time delay	3.81	b.	Imported green material and equipment	4.09
c.	Higher cost in green construction process and technique	3.98	c.	Uncertainty with green material and equipment	3.85
	Average Mean Cost:	3.97 (Agree)		Average Mean Material:	3.98 (Agree)
<b>2.</b>	<b>TECHNOLOGY</b>		<b>6.</b>	<b>QUALITY</b>	
a.	Misunderstanding of green technological operations	3.62	a.	Lack of knowledge on green technology and material	4.02
b.	Unfamiliarity with green technologies and techniques	3.55	b.	Lack of the technical skill/ trained regarding green technologies and techniques	4.02
c.	Special request from client about specified green technologies to be used	3.64	c.	Design criteria of green building	3.94
	Average Mean Technology:	3.60 (Agree)		Average Mean Quality:	3.99 (Agree)
<b>3.</b>	<b>TIME</b>		<b>7.</b>	<b>CONSTRUCTION STAGE</b>	
a.	More time needed during planning in design and structure of green building	4.17	a.	Technical difficulty during construction process	3.98
b.	More time required to implement green construction practices on site	4.13	b.	More alteration and variation with the design during the construction process	3.85
c.	Delivery of materials, suppliers and equipment	4.02	c.	Unforeseen circumstances in green project	4.19
	Average Mean Time:	4.10 (Agree)		Average Mean Construction Stage:	4.06 (Agree)
<b>4.</b>	<b>COMMUNICATION</b>		<b>8.</b>	<b>GOVERNMENT SUPPORT</b>	
a.	Lack of communication among project team members	3.77	a.	Lack of government support and incentives	2.38
b.	Frequent meetings with green specialist	4.11	b.	Government policy	3.62
c.	Conflict between stakeholder/construction team	3.83			
	Average Mean Communication:	3.90 (Agree)		Average Mean Government Support:	3.00 (Moderate)

Table 1.0 presents the summary of challenges encountered by the project manager. The top three barriers ranked by respondents include time, construction stage, and quality. Most challenges faced by the project manager are in terms of time with the average mean of (4.10). Project managers must ensure that the design and structure plans are prepared in detail and these results in a lengthy process. When the process of planning involves a long duration of time, it forces the project manager to ensure all the planning is done according to the timeline. This is followed by construction stage (4.06), which was ranked second.

In the construction stage, unforeseen circumstances were ranked as the most significant barrier faced by the project manager. As a project manager, they should be able to manage all risks in the project. This unforeseen situation creates challenges to the project manager because they must reschedule the construction process

according new circumstances, design or requirement. The capability, skills and knowledge of the project manager needed to overcome the barrier.

The third-ranked challenge is quality (3.99). Lack of knowledge and technical skills among the workers influences the quality and work performance. Since Malaysia is still new in green projects, many stakeholders and workers need to gather experience and learn more especially in terms of green knowledge. The bottom three ranked challenges faced by the project manager include communication, technology, and governmental support. It was found that communication was the lowest ranked with the average mean value of (3.90). Even though respondents have to manage a large number of stakeholders and have frequent meetings with green specialists but it was found that communication is not the main challenge faced by the respondents. They have the ability to control the condition or situation in meetings and on-site. Challenges in technology with the average mean value of (3.60) was placed in the seventh rank. The lowest ranking is governmental support with an average mean of (3.00).

Most of the respondents agreed that lack of government support does not present barriers to the project manager in managing green building construction. This is because the Malaysian government gives incentives not only to help increase green building projects but to give support in green building construction in terms of cost. These incentives help promote green building development in Malaysia. This was reported by the Malaysia Green Technology & Renewable Energy Industry (2011) which stated that the government has established a fund and provided soft loans to companies that supply and use green technology. Therefore, respondents can control challenges and risks to prevent the increase related to cost. From the summary of challenges encountered by the project manager, most of the respondents agreed that most of the factors stated posed challenges to the project manager. All the respondents agreed with the seven main challenges, but one main challenge was deemed as a “moderate” challenge by respondents that is the government support.

## 5.0 Conclusion

The analysis was carried out based on the data gathered from the questionnaires. It was found that there are eight factors that are considered as major challenges encountered by project managers while managing green building construction. This objective was also tackled using questions involving the Likert's Scale. The average mean of each main challenge was listed within 3.00 to 4.10 which show that most of the respondents firmly agreed with all the statements stated in the questionnaire. This situation leads to challenges to the project manager. According to the average mean, the level of agreement starts from 3.00 which represent moderate agreement or uncertainty of the respondents. The respondents only show moderate agreement in terms of “governmental support” as a barrier faced by project managers in green building projects while other barriers scored more than 3.60 which shows agreement. The respondents also agreed that the most substantial challenge faced by project managers while managing green building construction is the time factor. This result is similar to the findings from Hwang (2012), who mentioned that longer time required for pre-construction is the most daunting challenge faced by project managers executing green construction projects. In a nutshell, Project Managers play a significant role in successfully delivering a green building project. However, their awareness about challenges in the project is important when they are managing green construction. Therefore, all their knowledge and skills can help to ensure that they can carry out their proper role and responsibilities in the green construction process thus minimizing the challenges.

## 6.0 References

- Adler, A., Armstrong, J.E., Fullers, S.K et.al (2006). *Green Building: Project Planning and Cost Estimating*, 2nd Ed., R.S. Means, Kingston, Mass.
- Choi, C (2009) „Removing Market Barriers to Green Development: Principles and Action Projects to Promote Widespread Adoption of Green Development Practices 1 (1), 107-136
- Crawley, D. and Aho, I. (1999). „Building environmental assessment methods: environmental performance or sustainability?“. *Building Research & Information*. Vol. 27 (4/5). pp. 300 – 308.
- Department of Statistics Malaysia (2013) Available: < <http://www.statistics.gov.my>>, [Accessed: 30th December, 2013]
- Ding, M. (2005). Developing a multi criteria approach for the measurement of sustainable performance. *Building Research & Information* 33(1), 3-16.
- Glavinich, T., (2008) „Contractor's Guide to Green Building Construction: Management, Project Delivery, Documentation, and Risk Reduction,“ John Wiley & Sons, Inc., Canada
- GBI Rating Certification. (2014). [image] Available at : Green Building Index, 2012 [ Accessed 8th January 2014]
- Griffith, A. (2002). Management systems for sustainable construction: integrating environmental, quality and safety management systems. *Environmental Technology and Management*, 2(1/2/3), 114-126.

- Hakkinen, T., and Belloni, K. (2011). Barriers and Drivers for Sustainable Building". *Building Research & Information*, 39(3), 239-255
- Delnavaz, M., (2012) „Project Managers" Role in Sustainable Building Process". Published Master"s dissertation, Faculty of Civil Engineering, Chalmers University of Technology, Sweden.
- Hoffman, A.J. and Henn, R., (2008) „Overcoming the social and psychological barriers to Green Building", Available: <<http://oae.sagepub.com/>>, [Accessed: 20th December 2013]
- Hwang, B.G. and Ng, W.J., (2012) „Project management knowledge and skills for green construction: Overcoming challenges", 31, pp. 272-284
- Hwang, B.G., Tan, J.S., (2010) „Green Building Project Management: Obstacles and Solutions for Sustainable Development. *Sustainable Development*" Available: <<http://dx.doi.org/10.1002/sd.492>> [Accessed: 10th July, 2013]
- Kubba, S., (2010) „Green Construction Project Management and Cost Oversight". Oxford, UK: Architectural press
- Ling, J.U., (2003) „The project manager"s personal characteristics, skills and roles in local construction industry". Published Master"s dissertation, Faculty of Civil Engineering, University Technology Malaysia
- Malaysia Green Technology & Renewable Energy Industry (2011). *Malaysian Green Technology and Renewable Energy Industry Overview*. Available: <[www.ice.gov.it/paes/asia/malaysia/upload/.../GT\\_&\\_RE\\_Report\[1\].pdf](http://www.ice.gov.it/paes/asia/malaysia/upload/.../GT_&_RE_Report[1].pdf)> [Accessed: 22th April, 2013]
- McGraw-Hill Construction (2013), *Green Building Smart Market Report: Design & Construction Intelligence*, New York. Available: <<http://www.construction.com>> [Accessed: 22th June, 2013]
- Muir, B. (2005). *Challenges Facing Today"s Construction Manager*. 1st ed. pp. 1-8
- Osman, W.N, et al (2012) „Green Technologies and Their Application in Malaysian Construction Industry", The 3rd International Conference on Technology and Operations Management "Sustaining Competitiveness through Green Technology Management" Bandung-Indonesia, pp. 76-79
- Pedler, S. (2002). *Handbook of project manager: a survey of the literature*, 5th ed. New York. Free Press
- Peng, W., Low, S.P (2010) „Project Management and Green Buildings: Lessons from the Rating Systems", pp. 64-70
- Pitt, M., Tucker, M., Riley, M., & Longden, J. (2009). Towards sustainable construction: promotion and best practices. *Construction Innovation*, 9(2), 201-224.
- Princeton University Dictionary (2000). „Challenges Meaning", Available: <<http://www.princeton.edu.com>> , [Accessed: 20th October, 2013]
- Reverso Dictionary, 2008. "Barrier Meaning", Available: <<http://dictionary.reverso.net/english-cobuild/barrier>>, [Accessed: 20th, 2013]
- Riley, D., et al (2003) „Procurement of sustainable construction services in the United States: The contractor"s role in green buildings", 26, pp. 66-69
- Shi, Q., Zuo, J., et al. (2013) „Identifying the critical factors for green construction - An empirical study in China", 40 pp. 1-8
- Tagaza, E., and Wilson, J.L., (2004). *Green Buildings: Drivers and Barriers Lessons Learned From Five Melbourne Developments*. Report Prepared for Building Commission by University of Melbourne and Business Outlook and Evaluation.
- United Nations Environment Programme (UNEP) (2007). *Buildings and climate change: Status, Challenges and Opportunities.*" Available: <<http://www.unep.org>> [Accessed: 1st June, 2007]
- Zhang, X.L., Shen, L.Y., Wu, Y.Z., (2011) „Green Strategy for Gaining Competitive Advantage in Housing Development: A China Study. *Journal of Cleaner Production*" 19(1) 157-167