Available online at www.sciencedirect.com

ScienceDirect

Procedia Economics and Finance 34 (2015) 35 – 42

Procedia
Economics and Finance

www.elsevier.com/locate/procedia

Business Economics and Management 2015 Conference, BEM2015

Construction Costs Analysis And Its Importance To The Economy

Renata Stasiak-Betlejewska [a], Marek Potkány[b]*

[a]*Czestochowa University of Technology, Faculty of Management, Al. Armii Krajowej 19B, 42-200 Częstochowa, Poland*
[b]*Technical University in Zvolen, Faculty of Wood Sciences and Technology, T.G. Masaryka 24, 960 53 Zvolen, Slovakia*

Abstract

Reliable estimates of construction costs and schedules presented by contemporary construction companies, their consultants and suppliers at the time of project approval are important for justifying a project on economic ground and for planning the means of financing it. The economic impact of a construction cost overrun is the possible loss of the economic justification for the project. A cost overrun can also be critical for creating policies within sustainable development on the basis of economic costs. The financial impact of a cost overrun results also in demand for construction investments credits. The paper presents a case of construction cost analysis for wooden energy efficient house that meets sustainable aspects. Analyzed object is characterized by high costs of the construction investment, that result from specific characteristics of the construction output (energy efficient wooden house). In the result of analysis of the construction investment costs for the efficient wooden house and its comparison with the costs of traditional construction investment on maintenance costs, it can be stated that additional cost resulting from the energy efficient house building is higher than costs of traditional construction investment (about 10%) and it can be treated as the investment in the energy efficient house solutions since it brings savings for home expenditures (5% annually).

Peer-review under responsibility of the Organizing Committee of BEM2015

Keywords: Construction, economy, sustainable development, construction costs, maintenance costs

1. Introduction

The construction industry, in accordance to system of industrial classification used for statistical and government purposes, is defined as industry that includes only companies that are involved with building and civil engineering. This categorization is derived from the United Nations International Standard of Industrial Classification (ISIC). Other American and European equivalents for this standard are following: the North American Industry

* Corresponding author name. Tel.: +421-45-5206-437
E-mail address: potkany@tuzvo.sk

Peer-review under responsibility of the Organizing Committee of BEM2015
doi:10.1016/S2212-5671(15)01598-1

Classification System (NAICS) and the General Industrial Classification of Economic Activities known as NACE. General definition of the construction industry based on world trends include needs of increasingly sophisticated economy, client demands, technological and social change, and globalization leading to competitive pressures. In the result the construction industry represents most of every nation's savings (Rangelova 2015).

The construction industry plays an important role in the economy since it provides demand for the production of goods and services from other related industries. Activities of the construction are also vital to the achievement of national socio-economic development goals of providing shelter, infrastructure and employment. In accordance to literature review, the construction activities affect nearly every aspect of the economy and that the industry is one of the driven factor of the economy growth, especially in developing countries (Ive and Gruneberg 2000; Hillebrandt 2000; Ganesan 2000; Anaman and Amponsah, 2007; Khan 2008; Oladinrin et. al. 2012; Rangelova 2015).

In accordance to Hillebrandt (1985), the construction industry is a complex sector of the economy, which involves a broad range of stakeholders and has wide ranging linkages with other areas of activity such as manufacturing and the use of materials, energy, finance, labour and equipment. The industry can mobilize and utilize local human and material resources in the development and maintenance of housing and infrastructure to promote local employment and improve economic efficiency (Anaman and Amponsah, 2007). Results of some studies have shown that there is an interdependence between the construction sector and other economic sectors (Turin 1969; Hua 1995; Wells1986; Bon 1992). Output from the construction industry is a major and integral part of the national output, accounting for a sizeable proportion in the Gross Domestic Product (GDP) of both developed and underdeveloped countries (Ganesan 2000; Crosthwaite 2000; Myšková 2009; Šatanová and Krajčírová 2012). Lowe (2003) stated, that the value added of the construction is in the range of 7% to 10% for highly developed economies and around 3% to 6% for underdeveloped economies. Field and Ofori (1988) stated that the construction makes a noticeable contribution to the economic output of a country; it generates employment and incomes for the people and therefore the effects of changes in the construction industry on the economy occur at all levels and in virtually all aspects of life (Chen 1998; Rameezdeen 2007). The state of the construction affects the availability of capital, government's decisions since the construction industry is frequently used as a tool by government to manage the local/national economy (Wibowo 2009). Construction economics deals with methods that enable one to make economic decisions towards minimizing costs and/or maximizing benefits to business organizations. Decisions within the construction are linked with economic and social fields that are associated with: project development, its location, suitability of a particular type of project. This industry is characterized by some features such as: unique character of the construction outcome (investment result), a large number of small companies, the general state of the economy influences demand, terms of construction projects' scale and expenses (Rangelova 2015). The construction productivity depends on several factors such as the built environment efficiency and nature. The availability of the properly configured and located resources within construction investment is affected by flexibility, mobility, the workforce and the productivity of companies involved in the investment (Lawson 2014). The outcome of the construction investment, that affects on the local and national economy, is a result of appropriate preparation of the design, the construction schedule and operation of the built environment which are connected with available construction resources (Teplická et al. 2012). These factors influence directly on the construction costs. The construction budget is affected also by resources' character and its availability that are associated with technological, economic and social aspects being a content of the sustainable development idea.

1.1. The sustainable construction as the element of the construction importance to the economy

Importance of the construction to the economy has been stressed by European Union by the LMI initiative (the Lead Market Initiative), that recognized this industry as one of six lead markets (leading) - susceptible to innovation and with great development potential. A lead market is the market of a product or service in a given geographical area, where the diffusion process of an internationally successful innovation (technological or nontechnological) first took off and is sustained and expanded through a wide range of different services (European Commission 2005). Global construction industry has been focused on the construction of products in the last decades. All remarkable achievements are driven by technology and innovations. In the 21 century European Society faces an overwhelming number of challenges that result from: demographic changes, climate change, globalization and declining natural resources (Hitka and Stipalova 2011; Gejdoš 2008; Sujova 2013; Hitka et al. 2014). Performance

of this industry is not the objective any more since the new objective is development for the sustainability (Rangelova 2015, Sedliaciková et al. 2014).

The sustainable development, as a doctrine, was established in the 80's of the twentieth century and today it increasingly dominates as a planned development model of countries and citizens. The concept of "sustainable development" refers to the process of development, which, striving to fully meet the needs of the present generation, in no way reduce the potential of future generations. This definition appeared the first time in the report "Our Common Future" prepared in 1987 by the World Commission on Environment and Development of the United Nations. This report recognizes that civilization has reached a level of prosperity that is tenable to provide proper management. The model of such economy assumes properly and consciously shaped relationship between economic growth, environmental care (not only natural but also artificial - man-made) and to human health. There are several definitions describing the sustainable development idea in the literature (Waas et al. 2010; Lipušček et al. 2010; Robert et. al. 2005; Giddings et. al. 2002) and its main idea is reduced to requiring such management of current resources to preserve nature in its unaltered state for future generations, while ensuring the well-being and comfort societies and its development. The concept of sustainable development is "development that protects the needs of today without limiting meet the needs of future generations" (Naciążek 2015). The new goal of the construction industry is implementation of new technologies and solutions considered as significant for three areas identified as priorities for the sustainable development:

- Environment – the construction and exploitation of buildings are the cause of 42% of final energy consumption in the EU, 35% of emissions of greenhouse gases into the atmosphere, as well as a significant consumption of raw materials such as water and aggregates (sand, gravel, etc.). The threat for the environment is the remains of the buildings demolition.
- Society - the average citizen of a developed country spends inside the buildings close to 80% of the life. Hence, the suitable internal environment and the comfort of apartments and offices have a huge impact on the quality of people's life.
- Economics - in the European Union the construction industry generates about 10% of GDP and employs 7% of the workforce.

Through its impact on the built environment, construction plays a central role in promotion of the sustainable development that is connected with basic changes among other in products and services by applying of economic, technological and social innovation and technologies used energy. The biggest problem of the construction is the low energy efficiency and associated high emission of carbon dioxide into the atmosphere. In Poland, there is a lack of additional initiatives to increase the share of energy from renewable sources in households (the notable exception is the action of subsidies for solar collectors, funded by the National Fund).

The policy of the sustainable construction is focused on taking actions to effectively reduce power consumption and strengthen the functioning of existing solutions by leading participation of public and private sector, whose main task will be to build homes in the technology of low-energy and zero-energy and promoting solutions in this field, while taking into account the level of optimal cost. The building sector is responsible for 1/3 of total energy consumption. The poor conditions of most of the existing buildings and newly built have a direct impact on the high energy consumption, thus still low energy efficiency. It should be noted that the optimal level of costs is the basic condition that must be satisfied in this aspect.

1.2. The role of governments regulations and financial sector in the construction industry development

Construction products market have multiple interactions with the rest of the economy and these are surveyed in this paper. It drives the following economic factors: house prices include income, the housing stock, demography, credit availability, interest rates, and lagged appreciation, the latter a potential mechanism for overshooting (Muellbauer, Murphy 2008; Belás et al. 2015). Significant importance of the construction to economy causes, that governments are concerned about efficiency of this sector by regulations within the market and related markets (including financial market) and policies (e.g. energy policy). The financial sector has a significant contribution to the economy by funding construction investments within credits demand (what was the object of the financial crisis that has started in 2007).

Global competition demands and the objectives of the sustainable development obligate governments to meet goals of the European Union strategy on sustainable development. In 2009 Polish Government adopted two documents: "Assumptions of Polish development management system" aimed at increasing the effectiveness of development policy implementation and improvement of the public institutions functioning as well as "Development strategy arrangement plan", promising medium and long term national development strategy under the nine strategic documents. There was among them the innovation strategy and the economy efficiency "Dynamic Poland 2020". Placing the construction among the national strategy's priorities result due to the fact that it constitutes one of the most energy-intensive, material-consuming and polluting category of human activity, and minimize these impacts requires taking reasonable efforts already at the stage of planning and design of investment. Mover, the construction largely shapes the social space, both in terms of visual and functional, and thus largely determines the quality of the public life. Therefore, the strategy highlights the construction potential for energy savings, which offers a reduction of energy consumption. European Union established principles for the requirements for the energy performance of buildings set by the Energy Performance of Buildings Directive (EPBD). Dating from December 2002, the EPBD has set a common framework from which the individual Member States in the EU developed or adapted their individual national regulations. New EPBD Directive adopted in 2010 recast introduces a benchmarking mechanism for national energy performance requirements for the purpose of determining cost-optimal levels to be used by Member States for comparing and setting these requirements. The EPBD recast now requests that Member States shall ensure that minimum energy performance requirements for buildings are set "with a view to achieving cost-optimal levels". The cost optimum level shall be calculated in accordance with a comparative methodology. With the methodology being supplied by the European Commission, the assessment of input data (e.g. climate conditions, investment costs etc.) and the calculation of the results is done by and on the level of individual Member States (Boermans et al. 2011).

2. Material and Methods

The construction costs analysis presented in the article concerns the chosen case of the wooden energy-efficient house construction investment located in Southern part of Poland. It is economically efficient solution due to the rising prices of electricity, heat or water. Applying a wood in the energy efficient house supports comfortable and healthy conditions for its users and ensures energy maintenance inside. In the construction costs estimation there were used the statistics of Central Statistical Office of Poland and market survey. The market prices presented in the article constitute the market average price for period 2013 – 2014.

In accordance to sustainable construction policy, the contemporary construction investment requirements are strictly connected with the budget creating, scheduling and choice of the appropriate materials that have a great influence on the building quality resulting from both technical requirements and economical efficiency. One of the most important factor within the choice of materials is the quality that affects on the material cost. A choice of construction materials and technologies is defined by issues related with sustainable development in accordance to regulations and industry requirements including available solutions. It is justification for the choice of the wood as the construction material for the analyzed case since it is characterized by features related to economic (e.g. high energy efficiency, relatively lower cost of purchase), social and environmental aspects. Examples of sustainable development aspects applying in the analyzed wooden houses production are presented in the form of table 1.

Table 1. Examples of sustainable development objectives applied in the wooden houses production (prefabricated technology).

Sample topics	Example of economic dimension	Examples of social dimension	Examples of ecological dimension
Diversity and balance of action forms, as well as personal, ecological and economic resources of an enterprise	– diversity of economy areas (architecture, construction, building physics, technology, transport, investment organization, marketing, social psychology	– diversity of workers (well – qualified and non-qualifies), – improvement of social knowledge in different social groups (experts and common people – clients)	– diversity of applied natural resources (wood), – use of renewable natural resources

Sample topics	Example of economic dimension	Examples of social dimension	Examples of ecological dimension
Added value	– credits, – financial satisfaction of clients, – economical addend value of investment object and production result	– clients satisfaction (from health indoor climate), – skills and workers knowledge about process and product, – workers' satisfaction	– waste using, – removing of negative outcome (lower CO_2 emission)
Productivity efficiency of value and profits' creating	– range of profit, – stability of economic effects for society	– workers fluctuation, – clients fluctuation, – social involvement	– natural resources efficiency
Development evolution increase progress	– innovative programs, – investments in energy efficient solutions	– trainings and workers knowledge development, – clients awareness increase, – influence on local and urban infrastructure development	– investments in environmental technologies, – ecological investments

Energy efficient wooden construction is a new trend which, although it is forced to incur large costs during the construction phase, but guarantees a quick return on investment in the form of lower charges for water, electricity or gas. Although this type of investment forced to incur large costs during the construction phase, but guarantees a quick return on investment in the form of lower charges for water, electricity or gas. In the analyzed case, it can be stated, that specific conditions of the construction output affects significant costs of construction projects.

3. Results

The main feature of the energy-efficient house is the fact that long retains heat, but it also charges the heat with alternative energy sources such as sun, water or land. It seems to be almost self-sufficient. In the energy-efficient house the annual energy demand is from 30 to 60 kWh/m^2, and the energy demand for the traditional house is from 90 to 120 kWh/m^2. The energy demand of a passive house is the lowest (15 kWh/m^2). The construction investment in this case has to meet requirements of the European Directive 2010/31 that concerns energy performance of the house related with low energy demand. The energy demand is the crucial element of the energy performance of the house since the percentage of the energy expenditures constitutes the greatest part of the housing budget (70%). The energy needs of a house built in traditional technology is as follows: lighting 1.5%, cooking 8.3%, water heating 14.8%, electrical equipment 6.6%, space heating 68.8%. The construction costs calculation of the analyzed wooden energy efficient house is presented in Table 2.

The construction costs analysis includes also costs of installations at energy efficient wooden house. It can be assumed, that the cost of building energy-efficient home is almost the same as the cost of building of a traditional house. However, the greatest disparities in investment costs calculation occur only at the stage of installation. This stage of our calculations it is divided into two parts: standard installation (electricity, heating, water - sewerage system) and additional installations (required or recommended for installation in energy efficient house). Additional installations include: recuperation system (mechanical ventilation with heat recovery ejector, what significantly reduces the need to heat the house and its installation inside the building and it is necessary due to legal requirements), photovoltaic cells (energy-efficient polycrystalline solar cells with a capacity of 3 kWp). The total cost of the installations is: in the case of traditional house - 57 381 PLN and in the case of energy efficient house - 114 581 PLN. Important element of the wooden energy efficient house is also choice of the good quality windows that have a huge impact on the tightness of the house.

Table 2. Costs calculation for the construction investment of the wooden energy efficient house.

No	The construction investment element	Value [PLN]	The share in the construction costs [%]	Indicator PLN/1m^2 of the space	The living space area [m^2]
1	**BASIC STATE OF THE CONSTRUCTION (WOODEN)**	**105 589**	**46,9**	**648**	**162,9**
1.1	Spadeworks	2792,53	1,2	17	
1.2	Foundations	10777,78	4,8	66	
1.3	Foundation insulation	2668,38	1,2	16	
1.4	Prime coats	4186,54	1,9	26	
1.5	The walls of the ground floor	21118,69	9,4	130	
1.6	The walls of the attic	9128,96	4,1	56	
1.7	Reinforcement	7477,57	3,3	46	
1.8	The roof construction	10711,93	4,8	66	
1.9	The roof cover coat	36726,43	16,3	225	
2	**WINDOW AND DOOR JOINERY**	**19561,12**	**8,7**	**120**	
3	**FINISING STATE (WOOD)**	**100 039**	**44,4**	**614**	
3.1	Partition walls	7385,92	3,3	45	
3.2	The warming of the attic floor and the roof	12907,31	5,7	79	
3.3	Internal joinery	7598,22	3,4	47	
3.4	Plasters and internal wall claddings	10880,68	4,8	67	
3.5	Underfloor insulation	5071,05	2,3	31	
3.6	Floors	15363,89	6,8	94	
3.7	Painting	5211	2,3	32	
3.8	Elevation	28239,4	12,5	173	
3.9	Bands (Wood)	1366,99	0,6	8	
3.10	Entrance, patio, driveway (3,0x1,20m)	6014,55	2,7	37	
	Total	**225 189**	**100,0**	**1382**	

Significant importance for the estimation of energy – efficient construction costs has comparing it with traditional construction with regard to investment costs and maintenance costs. Table 3 contains comparison of the construction investment costs and maintenance costs for a wooden house heated by electricity.

Table 3. Comparison of the investment costs and maintenance costs for the wooden energy efficient house and the house built with applying traditional technologies (standard building).

Dwelling house with attic with usable area (162,9 m^2)	Investment and maintenance costs of the house meets current regulations	Investment and maintenance costs of the energy efficient house
Investment costs	551 000 PLN	634 000 PLN
Increase of the investment costs with regard to traditional construction	0	83 000 PLN
Heating energy consumption	120 kWh/m^2/year	50 kWh/m^2/year
Energy saving compared to standard building	0	70 kWh/m^2/year
Annually energy savings in the maintenance costs compared to standard building	0	8967,00
Simple return on investment	-	9 years

4. Discussion

Comparison of the construction investment costs and maintenance costs for traditional and energy efficient construction confirms that investment costs in the case of energy efficient house building are much higher than traditional one in about 10%. A return investment period close to 10 years is a long period for clients who support their construction investment by credit (supported by Polish National Fund of Environment Protection and Water Economy). Economic forecasts state that energy prices will rise above inflation and it justifies decision on building an energy efficient house. It should be also noted, that European Directive 31/2010 EU requires energy performance meeting by new buildings what affects clients' decisions. It confirms, that construction investment on wooden energy efficient house is economically and legally justified decision. There are following economic advantages of the energy efficient house building: lower heating costs comparing with traditional house heating costs, forecast on the energy prices increase, support of the investment by special credits, fulfilment of the energy performance requirements (Energy Performance of Buildings Directive), comfort and health safety conditions.

Energy efficient construction affects the whole economy since it concerns: supplies of the construction materials, renewable energy sources applied in the heating and electricity systems, shortening of the construction investment period (short period of wooden house building), regulations on the energy saving solutions used in the construction. Maintenance costs of wooden energy efficient house fall and are lower than traditional one what influence on the energy demand and in the consequence it results in the energy price policy changes. Moreover, obtained energy standard of the wooden house certainly increases the value of the building, especially the prospect of changing EU building regulations and environmental actions. Besides, it brings a real comfort such a detached house with lower bills for heating. Higher investment costs for energy efficient construction constitute a real barrier for clients who seems to be interested in new technological solutions and would like to meet requirements of Energy Performance of Building Directive. It is also barrier for implementing principles of sustainable development idea that support a balance between economic, environmental and social aspects.

5. Conclusion

The literature review and results of research findings analysis confirms, that costs of the construction costs for energy efficient house are higher than in the case of traditional construction investment. The analysis of the energy efficient investment costs should include not only simple costs estimation, but it should contain also a comparison of the investment costs and maintenance costs that are decisive element in taking decision process on the construction technology choice. It is driven by European regulations on energy performance of buildings, what constitutes an element of the sustainable development policy. It should be noted, that for every building there is an optimum combination of elements shaping its energy standard depends on: architectural form, structure, function, utility, type of materials used, location. Building a house, there are crucial elements which do not significantly raise the investment costs, but have a big impact on reducing energy consumption what creates national energy policy.

Acknowledgements

This paper is the partial result of the Ministry of Education of Slovak Republic grant project *VEGA* No. 1/0268/13, „Perspectives of facility management application for the increasing of competitiveness within the woodprocessing and forestry companies in the context of outsourcing principles" This work is related to the scientific program of the "Improving quality of processes, products and services" BW 615/201/07 supported by Polish Ministry of Science and Higher Education.

References

Agung, I.M., Wibowo, M.M. (2009). The contribution of the construction industry to the economy of Indonesia: a systematic approach. Discussion Paper. Construction Management. Civil Engineering. Department. Diponegoro University. Indonesia.

Anaman K.A. and Amponsah, C. (2007). Analysis of the causality links between the growth of the construction industry and the growth of the macro economy in Ghana. Institute of Economic Affair. Accra. Ghana.

Belás, J., Bilan, Y., Demjan, V., Sipko, J. (2015). Entrepreneurship in SME Segment: Case Study from the Czech Republic and Slovakia. Amfiteatru Economic, Vol 17, Issue 38. p. 308-326 ISSN 1582-9146

Boermans, T., Bettgenhäuser, K., Hermelink, A., Schimschar, S., (2011). Cost optimal building performancerequirements Calculation methodology for reporting on national energy performance requirements on the basis of cost optimality within the framework of the EPBD, European Council for an Energy Efficient Economy.

Bon, R., (1992). The future of international construction: secular patterns of growth and decline. Habitat International, 16(3), 119–28 Census and Statistics Department of HKSAR (1985–2002) Hong Kong

Chen, J.J. (1998). The characteristics and current status of China's construction industry, Construction Management and Economics, 16, 711-719.

Crosthwaite, D. (2000). The global construction market: A cross-sectional analysis. Construction Management and Economics, 18, 619–627.

European Commission. 2005. COM (2005) 474

Field, B. and Ofori, G. (1988). Construction and economic development – a case study. Third World Planning Review, 10(1), 41–50.

Finkel, G., (1997). The Economics of the Construction Industry. Library of Congress Cataloging – in Publication Data. USA.

Ganesan, S., (2000). Employment, Technology and Construction Development. Ashgate, UK

Gejdoš, P. (2008). Process oriented quality management- effective tool of companies management. Wood processing and furniture production in South East and Central Europe: Innovation and competitiveness 2008, Belgrade: Belgrade University, p. 80-84, ISBN 978-86-7299-149-9.

Giddings, B., Hopwood, B., O'Brien, G., (2002). Environment, economy and society: fitting them together into sustainable development, Sustainable Development, Volume 10 (4).

Hillebrandt, P.M. (2000ň. Economic Theory and the Construction Industry, 3rd, Macmillan Press Ltd, UK

Hitka, M., Štípalová, L. (2011). Comparing level of employee`s motivation in wood processing businesses with manufacturing companies in Slovak republic. *Drvna industria*. Vol. 62, No.3, 2012, p. 185-192 ISSN 0012-6772.

Hitka, M., Hajduková, A., Balažová, Ž. (2014). Impact of Economic Crisis on Changes in Motivation of Employees in Woodworking Industry . *Drvna industria*. Vol. 65, No.1, 2014, p. 21-26. ISSN 0012-6772.

Hua.B.G., (1995). Residential construction demand forecasting using economic indicators: a comparative study of artificial neural networks and multiple regression School of Building and Estate Management, National University of Singapore

Ive, G and Gruneberg, L., (2000). The Economics of The Modern Construction Sector, Macmillan Press Ltd, UK

Khan R.A. (2008). Role of Construction Sector in Economic Growth: Empirical Evidence from Pakistan Economy. Advancing and Integrating Construction Education, Research & Practice, International Conference on Construction In Developing Countries, Karachi, Pakistan.

Lawson, R. (2013). The importance of construction sector to the overall economy. Walesbusiness.org. The Business Blog for Wales.

Lowe, J.L., (2003). Construction Economics, www.callnetuk.come/home/johnlowe70/

Lipušček, I., Bohanec, M., Oblak, L., Zadnik Stirn, L. (2010). A multi-criteria decision-making model for classifying wood products with respect to their impact on environment. Wood and Rother renewable resources. The International Journal of Life Cycle Assessment. Vol. 15 (4).

Muellbauer, J., Murphy, A. (2008). Housing markets and the economy: the assessment, The Oxford Review of Economic Policy. Oxford University Press.

Myšková, R. (2009). Satisfaction of Financial Managers with Accounting Information System. Proceedings of the 3rd International Conference on Management, Marketing and Finances, WSEAS; Norwegian Univ Sci & Technol. p. 76-81. ISBN:978-960-474-073-4.

Naciążek, B. (2015). What is a zero energy house and zero energy plus house in the sustainable building. Construction Guide.

Oladinrin, T.O., Ogunsemi, D.R., Aje, I.O. (2012). Role of Construction Sector in Economic Growth: Empirical Evidence from Nigeria. Jorunal of the Environment. Vol. 7 No 1.

Rameezdeen, (2007). Image of the construction industry. Department of Building Economics, University of Moratuwa, Sri Lanka.

Rangelova, F. (2015). *Fundamentals of economics in sustainable construction*. Bultest Standard Ltd. Bulgaria.

Robert, K.W., Parris, T.M. & Leiserowitz, A.A. (2005). What is Sustainable Development? Goals, Indicators, Values, and Practice, Environment: Science and Policy for Sustainable Development, Volume 47 (3).

Sedliačiková, M., Volčko, I., Jelacic, D. (2014). Factoring and Forfeiting in Slovakia and Possibilities of its Application in Wood-Working Industry. Drvna Industria. Vol. 65 Issue: 1 p. 51-57, ISSN 0012-6772.

Sujová, A. (2013). Business Process Performance Management - A Modern Approach to Corporate Business Management. In: Economic Forum 2013, Liberec: TU Liberec, p. 542-550. ISBN 978-80-7372-953-0.

Šatanová, A., Krajćírová, L. (2012). Application of Accounting and Reporting in a Cost-Oriented Quality Management in Wood-Processing Companies. *Drvna Industrija*, Vol.: 63 Issue: 4 pp: 283-289, ISSN 0012-6772.

Teplická, K., Culková, K. , Manová, E. (2012) Using of operation analysis models in selected industrial firm. *Acta Montanistica Slovaca*, Vol. 17, No. 3, 2012, pp. 151-157, ISSN 1335-1788

Tse, R. Y. C., & Ganesan, S. (1997). Causal relationship between construction flows and GDP: Evidence from Hong Kong. Construction Management and Economics, 15, 371–376.

Turin**,** D.A., (1969). Construction Industry, based on the Proceedings of the International Symposium on Indusm'al Development held in Athens in Nov-Dec 1967, New York, Monograph no. 2.

Waas, T., Verbruggen, A., Wright, T. (2010). University research for sustainable development: definition and characteristics explored. Journal of Cleaner Production, Volume 18, Issue 7

Wells, J. (1986). The Construction Industry in Developing Countries: Alternate Strategies for Development, Croom Helm Ltd, London.

Wibowo, A. (2009). *T*he Contribution Of The Construction Industry To The Economy Of Indonesia: A Systemic Approach. Discussion Paper. Construction Management, Civil Engineering, Department, Diponegoro University, Indonesia.