Management and Production Engineering Review
Volume 8 • Number 3 • September 2017 • pp. 13–21
DOI: 10.1515/mper-2017-0024

DECISION MAKING TOWARDS INTEGRATION OF SUSTAINABILITY INTO PROJECT MANAGEMENT; A MULTILEVEL THEORY BUILDING APPROACH

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Received: 30 December 2016
Accepted: 17 February 2017

Abstract
In recent years project management has reached into a new paradigm because of integration of sustainability into the projects. The paper argues that multilevel approach is the key driver of successful sustainable project portfolio management. Hereby, this paper strives to underpin the theory and the logic behind the sustainable project management, while providing sustainable competitive advantages. Therefore, it develops an innovative multilevel framework, and analyses the current project management products and processes, and consequently presents a more holistic insight for the implementation of sustainability in project portfolio management.

Keywords
multilevel theory building, front-end eco-efficiency, stochastic frontier analysis, sustainable development, sustainable decision making.

Introduction

Nowadays sustainability is one of the most significant challenges that societies are faced with and sustainable development plays an important role in every business strategy. Hence, project management must be carried out in the context of sustainable development, in order for projects to meet or exceed the needs and expectations of the current and the future generation. Recently, sustainable management has been mentioned as a core activity for creating project success and it has gained significant attention in project management research and practices [1].

In spite of the numerous researches available on how to cope with general sustainable management, the project portfolio management area has not been benefited adequately [1]. Despite of all promising improvements in project management science till now, because of the complex environment of projects there is a possibility that past project management research might have failed to recognize the crucial elements that correctly control the project success [2]. Unsatisfied stakeholders, in addition to the lack of a correct corporate social responsibility strategy that should be supported by economic sustainability factors have been reported as frequent causes for project failure [3]. In this regard, this is of high importance to evaluate whether the current concept of sustainability implemented in the project management community (displayed in project management standards) can help to meet sustainability expectations and also whether developments within the other supporting fields and resources (such as project management software) can be beneficial to the sustainable project management(SPM).

A sustainability perspective

The idea of sustainable development was introduced in 1968 by the term ‘tragedy of the Com-

mons', and claimed that the solution to the over-use of the environmental problems on earth requires societal considerations as well [4]. Traditionally, sustainability has been determined as 'triple bottom line' (TBL) while trying to balance people (social), planet (environmental) and profit (economic) elements [5]. Porter and Kramer challenge the traditional concept of profit making in companies and argue that problem of productivity and growth of global economy requires decision making based on innovative methods that focus on shared values and social responsibilities, as well [6].

Sustainability can be measured with the help of several tools and techniques that generally can be divided into three main categories:

- Indicators: consist of a variety of quantitative indicators that can represent the main elements of sustainability (environmental, economic and social), such as, material flow analysis (MFA) and ecological footprint. The ecological footprint is an indicator to calculate the sustainability of a population based on the resource consumption corresponding land area [7].
- Product related assessment tools: to evaluate the material or energy flows of products and services; such as life cycle assessment tools that focus on the flow of production and consumption of goods and services in the whole life cycle (cradle to the grave). Material-Input-Per-Service (MIPS) and ecological rucksack are well-known index that fall in this category, as well. The ecological rucksack represents the actual material intensity of a product is the amount of material (kg) required to complete the production of a product minus the actual weight of the product. In other words, it is the weight of material that is extracted from natural resources to deliver one kg of resources [8].
- Integrated assessment tools: consist of a group of methods to pave the decision making process and multi-criteria analysis that can assess the complex project, policies and model and trends with multiple inputs to provide a comprehensive approach such as systems dynamics tools let [9].

In practice the strategy behind the sustainability can interchangeably be replaced with eco-efficiency [9]. The International Standard for Organization (ISO) is a well-known organization for standards setting explains that 'Eco-efficiency as assessment is a quantitative management tool which enables the consideration of the life cycle environmental impacts of a product system alongside its product system value' [10].

There are different ways to measure and define the eco-efficiency [11]. The general definition of eco-efficiency is based on the ratio of GDP/CO_2 [12]. Basically, production processes take inputs such as energy, natural resources and produce GHG such as Co_2. Based on the Intergovernmental Panel on Climate Change (IPCC) report, the main reason for the generation of GHG is energy production based on the fossil fuels and efficiency improvement can decrease the GHG generation and consequently has a positive impact on sustainability [13]. In eco-efficiency logic the environment and economic efficiency, both are essential elements that should be considered simultaneously to provide sustainability and competitive strategy for a company or country [14]. GDP at the macro level (or return on investment on company level) solely cannot be an indicator to present the sustainability of an economy, and eco-efficiency as an indicator that combines both environmental and economic elements can better be applied [15]. Eco-efficiency defines this goal based on the maximum of production or services while minimizes environmental pressure occurs and it can be formulated by using multi criteria decision making methods; e.g. [16, 17].

Nevertheless, the sustainability objectives and project oriented business are in contrast to some extent. A sustainable development perspective should be applied in project management if the following principles are considered [18]:

- Companies or projects should be benchmarked against the needs of society.
- Main values for decision making in projects are people, planet and profit, and not only scope, time, budget management.
- Sustainability is about the long term as well as short term objective. In addition a global scale for project management rather than a local is required.

The next section evaluates that: how general sustainable development management theory and mainly the three pillars of sustainable development have been reflected in project management best practices and if they can provide fruitful contributions?

Methodology

This research proposes a multilevel theory for the current shifts in the project management knowledge area [19]. Therefore, this paper answers some main questions, and reveals the potential linkages between the different methodological levels, as follows: what are the real values for project management, and how successful sustainable project management process can be fulfilled? What are the key derivers? and then, how in practice it can be achieved?

Accordingly, this study is developed into two main sections: At first, the organization of project management is evaluated. Next, the outer part of the framework (including inputs, outputs and strategies) is discussed; as presented in the Fig. 1 (adopted from [20]).

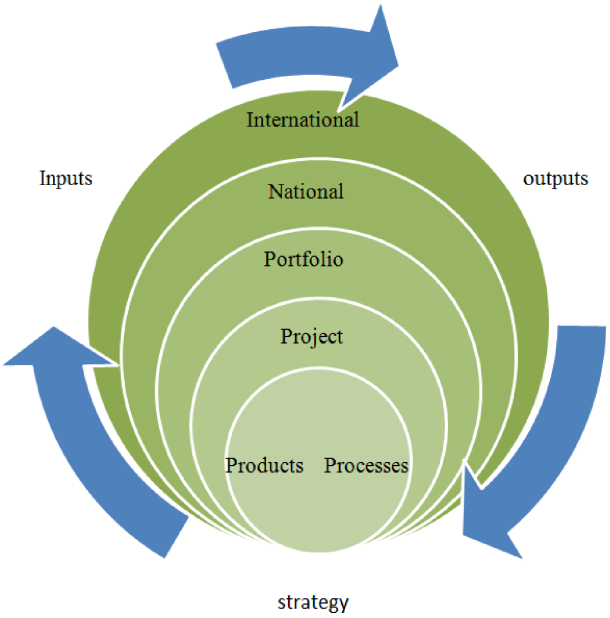

Fig. 1. Multiple levels evaluated in this study.

An analysis of current project management practices from point of view of sustainable development

Generally, internationally and globally used standards, e.g. the Project Management Body of Knowledge (PMBOK) or PRINCE2 are considered as the best practices that influence fundamentally project management. These standards are developed by the experts who accept these as the best or most common measures that have been made based on their experience in a variety of industrial organizations and projects. In addition, they have been implemented for project management certifications worldwide and they reflect a shared understanding of what a project manager should do in order to manage a project in a successful way [21]. Thus, it is important to investigate the idea and the guidelines in these standards because of the worldwide influence of project management standards.

Therefore, in this section the literature on the best practices of project management that has been defined in three project management standards is analysed, in order to identify how sustainable development perspective have been discussed in current project management practices. Hence, the three sustainability principles (people, planet, profit) in each standard are explored and also the comprehensiveness status of these elements in the selected standards in order to find out for instance; how sustainable management elements are mentioned in each "process group" of PMBOK. Consequently, the activities and tools and techniques for each sustainable management element that proposed by each standard is identified (presented in Table 2). The evaluated standards in this paper that are also used for certification of project managers are: (1) The Guide to the Project Management Body of Knowledge 5th edition (PMBOK) (PMI, 2013); (2) The International Competence Baseline, ICB (IPMA, 2006); (3) PRINCE2 (OGC, 2009). In addition, the same analytical method is applied to compare the findings across the well-known project management software (case study of two software) that commonly utilized in the project management office (PMO) and it has been illustrated in Table 3.

PRINCE2 as a project management methodology determines the main interest area of the project as the overlapping area of business, user and supplier which does not conform to TBL [22]. PRINCE2 does not explicitly refer to sustainable development principles, and it narrowly considers the project stakeholders and environmental elements. The standard refers to the stakeholder in communication, risk management (to involve stakeholders) and also in the organization theme, raises the issue and remarks the environmental pressure groups as an example of possible stakeholders. Regarding environmental criteria PRINCE2 proposes to involve the environmental factors in the tailoring section. The 'project cost management' is the section that is discussed well, but not from the point of view of sustainability. It can be concluded that the PRINCE2 provides a limited approach about sustainability in project management.

The PMBOK is a guide rather than a methodology and the standards acknowledge that project managers should take the advantages of methodology based standards such as the PRINCE2 methodology to implement the project management framework. In the introduction section of PMBOK the importance of a sustainable competitive advantage in project management (and portfolio) is noted and briefly mentions the relationship of sustainability and project management organization success [23]. The method that is implemented in whole standards is based on the project management "Process Group" and "Knowledge Area" mapping and by defining the input/output and tools & techniques. Utilizing this method, the standard has determined

the "Enterprise Environmental Factors" as an input to all processes while there are no tools and techniques. The stakeholder and cost management as two separate knowledge area have been discussed, although each topic is isolated from others [24]. PMBOK offers some techniques for cost management and planning such as return on investment (ROI), but the lake of attention to the main economic sustainability indicators such as business agility exists [1].

The ICB as an internationally used project management competence baseline, has defined the competence elements of 'Health, security and safety & environment' in the 'contextual competences' and also notes interested parties (stakeholders) in 'technical elements' and recommends to include their expectations 'in the requirements, objectives, scope, deliverables, time schedule and costs of the project plan' as possible process steps. Nonetheless, in the environmental context superficially mentions about the need for integration of social, technical and environmental aspects. Similarly, ICB cannot address a clear pathway for project management sustainability [25, p. 105].

Overall, in all the above mentioned standards stakeholder, environmental and economic components can be recognized implicitly though with different approaches; however no explicit consideration about sustainable development principles exist and consequently the lack of methods that helps to integrate these pillars of sustainability into project management is considered. The main findings are shown in Table 1 the economic pillar is not illustrated in this table because within these standards the economic considerations have been well-discussed (by far more than the people and environment section), though from point of view of project cost management, and did not mention about the main indicators of economical sustainability Such as: direct economic performance, market presence and indirect economic impact [1].

Likewise, the project management software are among the commonly utilized project management tools and resources. Project management office (PMO) uses project management software to manage the projects in order to control the time, cost and scope, and these software are linked to the performance of project management. As these software are the key tools for management of projects, and they are considered as an important foundation for the management of projects, so it is important to evaluate their potential from the sustainable project management perspective. There is a wide variety of software that companies can utilize, and some of them are more international and widely used such as: Primavera (P6, P3 and etc.) and MS project [26]. This section primarily explains the capability and possible potential that these software can offer to manage a project sustainably, and also to provide sustainable advantages for the organizations. This can be considered as a simulation or a critical review of the current measures of PMO while they strive to manage a project.

Oracle group offers a variety of applications that can cope with different aspects of project management, such as risk and plan. Primavera P6 Professional Project Management software is widely used in PMOs that are coping with mega projects around the world. The program is based on the concept and the methodology of PMBOK in the project life cycle [27]. The software is meant to keep the project under control regarding time, cost (resource) and scope, but has almost no option to involve environmental, and very few in case of social (stakeholders) components; for instance the "threshold and issue" option can help to observe the KPI of projects. Overall, there is no option to carry out sustainability assessment directly with this program individually [28].

Similarly, MS project offers possibilities to meet the deadlines, budget control and the right selection of resources [29]. MS project is recognized as a main competitor of Oracle, and presents almost similar function, but with a more user friendly approach [30]. It is worth mentioning that SAP as a well-known ERP system offers a variety of software with more integrated approach towards sustainability and project management [31], but there are some main disadvantages that usually PMO is not willing to implement SAP as a project management tool that are mainly complexity and implementation costs [32]. However, there is a possibility to aggregate primavera and MSP with SAP [33]. Table 2 shows an overview of main findings.

Although these software do not show an explicit option for sustainable management, but there are some areas that overlap with the sustainability idea. For example: 'resource allocation and levelling' can exhibit a relationship of the mentioned software and the sustainability concept; where it is possible to choose a strategy that would be more efficient in case of resource usage by resource allocation and levelling techniques [35]. Likewise, PMBOK explains resource levelling as a process of improvement in fluctuation of resource load to provide a balanced level of the work force which can help to decrease the excess resources and facilitate resource usage that lead to reduction in demand and costs [23]. Therefore, from sustainable prospective it means: to do the same job with less resource.

Table 1
Analysis of Prince2, PMBOK and ICB.

Standards	Pillars PPP (except economic)	Definition and comprehensiveness	Activities	Tools & techniques
PRINCE2	People	As a part of organization, risk and communication	Recognizing Reporting	Engagement in project Reporting
	Planet (environmental)	Tailor Prince2 to the project environment	customization	Adapt the themes Revise terms and languages, product description and roles Adjust the process documentation
PMBOK 5th	People	Stakeholder as a knowledge area included in all process groups except closing, and social needs in Business Case (project integration management knowledge area)	Identify, plan, Manage and control	Stakeholder analysis – Expert judgment-Meetings-Analytical techniques-Communication methods – Interpersonal skills – Management skills-Information management systems Facilitation Techniques
	Planet (environmental)	EEF is considered as an input to all process (but Fail to mention the Environmental explicitly)	No explicit consideration	No explicit consideration identified
ICB	People	As a part of technical competence element, and project manager should identify all the interested parties	Possible process steps: Identify, analyze and communicate to interest parties, develop a strategy, include their interests into project, risk management; ensure satisfaction, Carry out management plan, manage changes, documentation	Possible process tools: Stakeholder identification; develop internal and external networks formal and informal
	Planet (environmental)	Health, security, safety & environment (Contextual competences), efficiency (Behavioural competence elements element) mentions Social and environmental costs	Possible process steps: Identify applicable law, environmental risks, requirements and existing responsibilities, – Evaluate the actual situation, Develop plans and processes, Monitor and control, Report, Document lessons learned	Environmental factors need to be taken into account in all the project phases: Design, usage of product, its decommissioning and disposal. Material-energy – Co2 – waste – recycling should be considered by Internal and independent external auditing

Table 2
Analysis of P6, MSP from SD perspective.

Software	Pillars	Potential Tools &Techniques	Sustainable Development
Primavera P6	People (Stakeholders)	(Communicating project status to stakeholders example: Status reports that describe where the project is in terms of cost, scope, and schedule progress reports forecasts that predict future) [34]	No explicit consideration (possibility to aggregate with SAP)
	Planet (environmental)	Risk Management calculation (type, impact, exposure value)	
	Profit (economic)	Assigning resource and resource levelling (s-curves), cost plan and control	
MS project	People (Stakeholders)	implicit relationship (such as communication with stakeholders)	No explicit consideration (possibility to aggregate with SAP) [33]
	Planet (environmental)	(common planning tools such as: Creating Dependencies Between Projects [29]	
	Profit (economic)	Almost similar to Oracle P6 (such as Project cost planning and control and etc., with some minor differences)	

Nevertheless, there is a close relationship between software and standards of project management while these standards, themselves, have failed to respond the need of sustainability management properly. Despite the promising improvements in project planning software in the current decade, it can be observed that still these software focus to meet the need of project management according to the iron triangle of project management and regardless of pillars of sustainability: people, planet and profit [27, 36]. In addition, a general limitation in this evaluation is that project management practices may vary across project types, and also each company may show different tendencies and preferences to utilize a variety of standards and software that already exists in the market, which may not be among those that have been assessed in this study.

Overall, this section has reviewed three internationally used project management standards to evaluate and reflect the current understanding of sustainable project management by identifying and applying the concepts from sustainable development theory within general management. This research has highlighted the lack of sustainability considerations in project management organizations and PMO, which raise the demand for further attention both from the side of researchers and practitioners. Also, this structured analysis extends the conceptual frameworks for SPM, such as: products, processes and organizational pillars of SPM e.g. [37].

Meanwhile, project policy requires a comprehensive approach to analyse the project strategy in accordance with the sustainability concepts and provide the optimal economic profit, while considers the environmental and social values; and this strategy should be formulated from the holistic portfolio level. Generally, the main impact of the front-end will be a well-defined project selection output [38]. On the other hand, ideation efficiency is a critical factor for successful portfolio management [39]. Therefore, in the next section a case study as a model is presented in a higher level (national/international) that can realize the concept of integration of sustainability into project management.

Discussion

This section shifts the discussion toward the higher level of the framework, and illustrates how to cope with the front-end considering a sustainable approach. Therefore, stochastic frontier analysis (SFA) method is implemented for the evaluation of technical efficiency of observations, or in other words, the efficiency of portfolio (here countries) [40].

SFA is a parametric statistic method to calculate the relative efficiency (& inefficiency) of a group of observations, for instance projects or companies, while it can take multiple inputs to deliver an output (as a ranking) [41]. This method is an alternative method for the DEA (non- parametric); while noise consideration in SFA is the main difference between these two methods. However, the link between SFA and project management knowledge area has not been explored properly in the literature.

The eco-efficiency of 15 European countries, between 2008–2012 is calculated, while the output is GDP, and inputs are determined as CO_2 and domestic material consumption. Data collected has been from Eurostat database and from 2008–2012 [42]. The year 2008 is the starting point of the first commitment of the Kyoto protocol, and also the Europe economic crisis.

In this case study Cobb-Douglas production functions is utilized [43]. The production function determines the maximum of output that any combination of inputs can produce or "Largest possible output that can be produced by given inputs" [44]. Therefore, considering f as a production function we have:

$$\text{Maximal output} = f(\text{Input, Z variable}) \tag{1}$$

and the stochastic frontier model and efficiency levels can be illustrated as [45]

$$E[e^{-u}|\,\epsilon] = \left[1-\varphi\left(\sigma_* - \frac{\mu_*}{\sigma_*}\right)\right] \cdot \left[1-\varphi\left(\sigma_* - \frac{\mu_*}{\sigma_*}\right)\right]^{-1} e^{-\mu_* + 0.5\sigma_*^2}, \tag{2}$$

where

$$\mu_* = \epsilon\gamma = \epsilon\lambda/(1-\lambda^2),$$
$$\sigma_*^2 = \sigma^2\gamma(1-\gamma) = \sigma^2\lambda^2/(1+\lambda^2)^2.$$

Table 3 presents the results of the evaluation and the rankings between the years 2008–2012. The results shows that Germany and Luxemburg are ranked as the most efficient and Portugal and Greece as least. In addition, since 2008, the eco-efficiency has decreased in the studied countries. Also the case study shows that well-developed countries has relatively better eco-efficiency ranking. Though, the focus is to provide an overview and it does not discuss the reason behind the good or bad performance of these economies. Besides, likelihood ratio test is conducted to evaluate the impact of inefficiency (H0: no inefficiency, only noise). The P-values reject the hypothesis, and approve significant technical inefficiency in the model.

Consideration of noise analysis in the (sustainable) portfolio optimization is a matter of great im-

portance. Furthermore, in real decision making conditions, it is prevalent that the output quantity, in addition to the input values, depends on other variables such as influence of experience of the project manager, or weather condition, and etc.; therefore, these variables should be considered in decision analysis [46]. Accordingly, the role of innovation as a key driver for sustainability as a requirement for the success of portfolio management demands extensive attention [47].

Table 3
Yearly rankings of eco-efficiency for the E15 countries.

Countries	Years				
	2008	2009	2010	2011	2012
Luxembourg	2	2	1	2	1
Germany	1	1	2	1	2
Austria	10	8	9	6	3
United Kingdom	5	10	7	4	4
Netherlands	4	3	3	3	5
France	7	6	5	5	6
Italy	9	9	10	7	7
Denmark	6	4	4	8	8
Belgium	12	11	12	9	9
Sweden	11	12	8	10	10
Finland	8	7	6	11	11
Ireland	3	5	11	12	12
Spain	13	13	13	13	13
Greece	14	14	14	14	14
Portugal	15	15	15	15	15
Mean Efficiency	76.2%	75.6%	74.6%	69.3%	70.3%
$\widehat{\sigma_U^2}$ (estimation of inefficacy)	0.18	0.16	0.19	0.29	0.28
$\widehat{\sigma_V^2}$ (estimation of noise)	0.01	0.01	0.01	0.00	0.00
P-value	0.01*	0.03*	0.03*	0.01**	0.00**

In this context some studies have illustrated the application of previous methods such as AHP and DEA to present a pathway to integrate sustainability in project management [48]. Likewise, integration of SFA with other performance assessment methods is another area that requires further attention.

Conclusion

The successful management of projects has considerable importance in every society; based on the estimations one-third of the worldwide gross domestic product (GDP) is spent on projects so it is expected that in the future projects will be considered as an important area for integrating sustainable development principles. Therefore, in order to be able to cope with the needs and challenges in society the real needs of the project must be recognized and managed [49].

This research expands the current understanding of SPM and in some parts proposes new fields of research. Therefore, it answers several crucial questions both from theoretical and practical point view and argues that real value creation for project management can only be realized when a comprehensive understating of sustainability issue is considered, and a holistic front-end management can be the key driver of successful SPM.

Integration of sustainability into management of the project expands the system boundary of project management and reveals the complex aspect of project management. Furthermore, the request for sustainable development from the society side or legislations will make the future of project management tasks more challenging. Hence, organizations are seeking a more sustainable and environmentally friendly approach in their projects and it is basically expected that the decision making process be started from the portfolio level. The concept of integration of sustainability in project management is an emerging field of research and this paper links the topic into a broader context. This study provides a framework for portfolio management practitioners, and SFA has been implemented as a method for measurement of sustainability as it can favourably provide a single index based on the various inputs of production.

This research benefits both practitioners and researchers in the area of project and portfolio management, and also furthers developments of next generations of project management standards and software, and consequently improves the sustainable project management decision making process and the knowledge of project management in the context of sustainable management by bridging the gaps in this field. In spite of all deficiencies in the current standards and methods, as our research has highlighted, even the current tools and techniques present some potential to cope with this issue. Further development of the project management profession requires project managers that take the responsibility of sustainability in a full life cycle of the projects. This study remarks that the importance of the sustainable management issue should be highlighted in the portfolio organizations.

References

[1] Silvius G., Schipper R., Planko J., Van Den Brink J., *Sustainability in Project Management*, Gower Publishing, 2012.

[2] Besner C., Hobbs J.B., *The perceived value and potential contribution of project management practices to project success*, Project Management Journal, 2006.

[3] Silvius G., *Change the Game: Sustainability in Projects and Project Management*, [in:] Green Business Process Management, Springer, pp. 161–177, 2012.

[4] Turner G., *Comparison of the limits to growth with 30 years of reality*, Global Environmental Change, 18, 397–411, 2008.

[5] Elkington J., *Cannibals with Forks*, Oxford, 1997.

[6] Porter M., Kramer M., *Creating shared value*, Harvard Business Review, 89, 1.2, 62–77, 2011.

[7] Singh R.K., Murty H.R., Gupta S.K., Dikshit A.K., *An overview of sustainability assessment methodologies*, Ecological Indicators, 9, 1, 189–212, 2009.

[8] Ness B., Urbel-Piirsalu E., Anderberg S., Olsson L., *Categorising tools for sustainability assessment*, Ecological Economics, 60, 498–508, 2007.

[9] Wall-Markowski C.A., Kicherer A., Saling P., *Using eco-efficiency analysis to assess renewable-resource – based technologies*, Environmental Progress, 23, 4, 329–333, 2004.

[10] ISO 14045, *Environmental management – eco-efficiency assessment of product systems – principles, requirements and guidelines*, ISO 14045, 2012.

[11] Wursthorn S., Poganietz W.R., Schebek L., *Economic – environmental monitoring indicators for European countries: A disaggregated sector-based approach for monitoring eco-efficiency*, Ecological Economics, 70, 3, 487–496, 2011.

[12] Schmidheiny S., Zorraquín F., *Financing Change: The Financial Community, Eco-efficiency, and Sustainable Development*, The MIT Press, 1998.

[13] Metz B., Davidson O.R., Bosch P.R., Dave R., Meyer L.A., *Climate Change 2007: Mitigation of Climate Change*, Cambridge University Press, 2007.

[14] Kuosmanen T., Kortelainen M., *Measuring Eco-efficiency of Production with Data Envelopment Analysis*, Journal of Industrial Ecology, 9, 4, 2005.

[15] Kuosmanen T., *Measurement and Analysis of Eco-efficiency An Economist's Perspective*, Eco-Efficiency and Industrial Ecology, 9, 4, 15–18, 2005.

[16] Robaina-Alves M., Moutinho V., Macedo P., *A new frontier approach to model the eco-efficiency in European countries*, Journal of Cleaner Production, 103, 15, 562–573, 2016.

[17] Halkos G.E., Tzeremes N.G., Kourtzidis S.A., *Regional sustainability efficiency index in Europe: an additive two-stage DEA approach*, Operational Research, 15, 1, 1–23, 2015.

[18] Gareis R., *Rethinking Project Management*, [in:] Sustainability Integration for Effective Project Management, Newtown Square, PA., Project Management Institute, 2013.

[19] Hitt M.A., Beamish P.W., Jackson S.E., Mathieu J.E., *Building Theoretical and Empirical Bridges Across Level: Multilevel Research in Management*, The Academy of Management Journal, 50, 6, 1385–1399, 2007.

[20] Starik M., Kanashiro P., *Toward a Theory of Sustainability, Uncovering and Integrating the Nearly Obvious*, Organization & Environment, 26, 1, 7–30, 2013.

[21] Eskerod P., Huemann M., *Sustainable development and project stakeholder management:what standards say*, International Journal of Managing Projects in Business, 6, 1, 36–50, 2013.

[22] Axelos, Prince2, TSO, 2009.

[23] PMI, PMBOK® Guide – Fifth Edition, Project Management Institute, 2013.

[24] OGC, Managing Successful Projects with Prince2, TSO, 2009.

[25] IPMA, ICB IPMA Competence Baseline Version 3.0, International Project Management Association, 2006.

[26] Jugdev K., Mathur G., *Classifying project management resources by complexity and leverage*, International Journal of Managing Projects in Business, 5, 1, 105–124, 2012.

[27] Primavera, *Primavera Training Manual Course 102*, Primavera, 2006a.

[28] Oracle, *Primavera P6 Project Management*, 2009, [Online]. Available: http://docs.oracle.com/cd/E17784_01/Product_Manuals/PMRefMan.pdf. [Accessed 2015].

[29] Chatfield C., Johnson T., *MS project 2010 Step by step*, Washington: Microsoft Press, 2010.

[30] Gharaibeh H., *Evaluating Project Management Software Packages Using a Scoring Model – A Comparison between MS Project and Primavera*, Journal of Software Engineering and Applications, pp. 541–554, 2014.

[31] SAP, http://help.sap.com, 2015, [Online]. Available: http://help.sap.com/ppm60 & http://help.sap.com/bosuspm.

[32] Anderson G., *Sams Teach Yourself SAP in 24 Hours*, Pearsons, 2011.

[33] Oracle, *Oracle*, 2015, [Online]. Available: http://www.oracle.com/us/products/applications/primavera/047067.pdf.

[34] Oracle, *www.oracle.com*, 2015, [Online]. Available: http://www.oracle.com/us/products/applications/primavera/primavera-p6-r8-data-sheet-193061.pdf.

[35] Frost C., *www.oracle.com*, 2015, [Online]. Available: http://www.oracle.com/ocom/groups/public/@opn-public/documents/webcontent/040031.pdf. [Accessed 2016].

[36] Primavera, *Primavera Training Manual Course 106*, Primavera, 2006b.

[37] Marcelino-Sádaba S., González-Jaen L.F., Pérez-Ezcurdia A., *Using project management as a way to sustainability. From a comprehensive review to a framework definition*, Journal of Cleaner Production, 99, 1–16, 2015.

[38] Edkins A., Geraldi J., Morris P., Smith A., *Exploring the front-end of project management*, Engineering Project Organization Journal, 13, 2, 71–85, 2013.

[39] Heising W., *The integration of ideation and project portfolio management – A key factor*, International Journal of Project Management, 30, 582–595, 2012.

[40] Kodukula P., *Organizational Project Portfolio Management: A Practitioner's Guide*, J. Ross Publishing, 2014.

[41] Coelli T.J., Rao D.S.P., O'Donnell C.J., Battese G.E., *An Introduction to Efficiency and Productivity Analysis*, Springer, 2005.

[42] European Commission, "Eurostat", 2015 [Online]. Available: http://ec.europa.eu/eurostat/data/database [Accessed 2015].

[43] Coelli T., Henningsen A., *Frontier: Stochastic Frontier Analysis. R package version 1.0.*, http://CRAN.R-Project.org/package=frontier, 2013.

[44] Bogetoft P., Otto L., *Benchmarking with DEA, SFA, and R*, Springer, 2011.

[45] Battese G., Coelli T., *Prediction of firm-level technical efficiencies with a generalized frontier production function and panel data*, Journal of Econometrics, 38, 3, 387–399, 1988.

[46] Henningsen A., *Introduction to Econometric Production Analysis with R*, ed., 2015.

[47] Nidumolu R., Prahalad C.K., Rangaswami M.R., *Why sustainablity is now the key driver of innovation*, IEEE Engineering Management Review, 2015.

[48] Sánchez M., *Which of DEA or AHP can best be employed to measure efficiency of projects?*, International Journal of Production Management and Engineering, 3, 2, 111–122, 2015.

[49] Turner R.J., Huemann M., Anbari F.T., Bredillet C.N., *Perspectives on Projects*, Taylor & Francis, 2010.