AN EMPIRICAL SURVEY ON THE AWARENESS OF CONSTRUCTION DEVELOPERS ABOUT GREEN BUILDINGS IN MACEDONIA

by

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Original scientific paper
https://doi.org/10.2298/TSCI170915023S

Green construction is becoming priority in developing a new scope to the construction itself. It emerges from the inevitable need to raise the environmental concern and to make effort to build sustainable, by balancing between the conservation of the environment and maintaining prosperity in development. Green design does not only make a positive impact on public health and the environment, it also reduces operating costs, enhances building and organizational marketability, increases occupant productivity, and helps create a sustainable community. This survey aims at determining the stage of knowledge and awareness about green buildings among most involved stakeholders. The survey targets basic understanding about green building and reveals the opinion about the advances and possible barriers for regulated construction of green buildings. This survey is conducted using the method of structured questionnaires and is based on the responses of 181 construction developers including designers, architects, civil engineers, technicians, workers in construction industry, investors, as well as legal representatives (decision makers). The overall results show high level of familiarization with the concept of green buildings (more than 75% of the respondents), and even higher percentage in expressing support of the idea for green buildings (less than 6% gave negative answers). The results obtained from three structured groups of questions (awareness, advantages & barriers, and possible areas for intervention) are discussed in comprehensive manner, by additional comparison with the results for global trends, in order to analyze thoroughly the current stage of awareness about green buildings in Macedonia.

Key words: *green building, sustainable construction, BREEAM, energy efficiency, awareness*

Introduction

Buildings have enabled mankind to meet their social needs first of all for shelter, but also to meet human's economic needs for investment and development. However, the price for satisfaction of these needs is becoming concerning high, resulting in an irreversible damage to our environment. This awakes a growing realization around the world to alter or improve our conventional way of development into a more responsible approach which can satisfy our needs for development without harming our environment. The chance for improvement initially arrived under the title of *sustainable development*, as introduced in 1987 in Brundtland Report. Since then, many progressive world events had taken place to increase the awareness on envi-

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ronment and sustainability agendas such as Rio Earth Summit 1992, Maastricht Treaty 1992, Kyoto Conference on Global Warming 1997, Johannesburg Earth Summit 2002, and Washington Earth Observation Summit 2003 [1].

Construction industry must inevitably change its historic methods of operating with little regard for environmental impacts to a new mode that puts the concern for the environment in the focus. Sustainable construction, usually pronounced as *green construction*, describes the responsibility of the construction industry in attaining sustainability [2-4]. The concept of sustainability must be applied in a manner in which the project will be conducted by balancing between the conservation of the environment and maintaining prosperity in development.

In 2008, the EU chose the construction sector as one of six market areas that are most important to ensure faster development towards more sustainable future [5]. The EU's Energy Efficiency Plan 2011 (EEP) [6] has identified the construction sector as the area where the greatest significant energy and emissions savings can be made. The plan requires 3% of all public buildings to be renovated per year until 2020. After 2020 all buildings constructed must be virtually carbon-free.

While the interest in improving resource efficiency in the construction sector is growing at national and at EU level, different national public and private approaches have increased the complexity of the working environment for all stakeholders. Due to the lack of common objectives, indicators and data, and the lack of mutual recognition of different approaches, the Commission in 2014 have released the EC Communications [7] with recommendations regarding indicators for assessing the sustainability of buildings, the issues of practical implementation of a framework containing core indicators and promoting the exchange of best practice and collaboration. Globally, total share of green construction is in average of 24% from total construction actions, according to the 2016 report [8]. Countries with green activity above the global average of 24% include South Africa, Singapore, India, Germany and Mexico. In EU, after Germany (where 35% of total construction activities are green activities) leading countries in implementation of green construction are Poland and UK (34% and 27%, respectively).

In Macedonia the concern of environment and sustainable development has been increased, too. Therefore, different institutions that concern sustainable issues – environmental, social, and economical – have been established, beside other non-governmental organizations. In Macedonia there are no mandatory obligations for building green, but only to the extent of energy efficiency of buildings. Regarding the existing practice, there isn't officially accepted single rating system for labeling greenness of buildings, neither certified buildings according to some of the internationally used certifying systems. In the last two decades, the construction practices in Macedonia shifted toward modern building systems, by replacing traditional more natural building materials with modern ones. Thus there is an urgent need to return back to more sustainable systems integrated into modern perspective, through establishing new building practices based on green thinking and applications.

In order to act, all involved actors in the construction sector must become aware of the significance of the sustainable construction and its need. Therefore a comprehensive study about the state of knowledge and awareness of all involved stakeholders in construction sector in Macedonia is necessary, in order to be able to plan following activities. The scope of this paper is determining the state of knowledge and awareness about green buildings (GB) in Macedonia of most involved stakeholders, directly involved in the process of construction. The goal of the survey is to level the basic understanding about GB and to reveal the opinion of the respondents about the advances and possible barriers for regulated construction of GB. Additionally, in order to compare the status of GB in Macedonia with the global one, the results from this study are compared to the

latest global trends [8] concerning the same issues, in order to have more realistic insight into the current situation and necessary actions that should be undertaken on national level.

Current status of green buildings

An overview of green buildings

Green design does not only make a positive impact on public health and the environment, it also reduces operating costs, enhances building and organizational marketability, increases occupant productivity, and helps create a sustainable community. The main areas usually included in the EU regulations are:

– energy consumption,
– water and resource consumption,
– indoor climate, and
– building materials.

Energy demand in buildings in recent years is for sure the focused area for the regulation of buildings. Macedonia as a country has also developed a comprehensive system of national legal acts (in accordance with the European one) which transposes the main provisions of the EU Directives [9]. The measures related to the construction sector mainly include: obligation for minimum requirements for energy efficiency of public and private buildings; as well as all existing buildings and their parts that are reimbursed, are in compliance with the fulfilment of the requirements for *buildings with nearly zero energy consumption* by December 31st, 2018 (until 30th June 2019 for Macedonia as signatory of the EC Treaty) and by possession of certificate of energy performance and providing regular technical audits of existing heating and air conditioning.

This covers energy consumption for heating, hot water, cooling, ventilation and lighting, but also energy consumption for production and recycling of building materials is relevant to consider. Application of mandatory energy audit for buildings [10] started from 2014, and despite it is strictly implemented for all new constructions and is obligatory for issuing official permission for use of new buildings, the practice has shown the existence of performance gap between the planed and actual energy consumption. This is due to the lack of regulations and tools for controlling actual final energy consumption of buildings. The existing information about the performance gap is still very poor since the occupation time of new buildings is still not long enough to do more precise studies, but even the early monitoring studies for comparing planed and actual energy consumption of new buildings (for at least one year of occupation) show existence of discrepancies of planed and measured values.

Water shortages, drought, flooding and water quality problems are affecting most European countries. Regarding to this, Macedonia is still in the unique position that virtually all potable water can be produced from pumped groundwater, melt water, *etc*. by means of simple treatment principles. Unlike energy consumption, water consumption in buildings is highly unregulated. This is the case in Macedonia, as well as in most of the rest of the world. However, in recent years this area has been brought into focus for future legislation regarding: reduced water consumption, use of rainwater, drainage and recycling, surrounding vegetation and water needs. Indoor climate is extremely important for building users' comfort. A good indoor climate has a positive impact on people's health as well as concentration, learning and working abilities. In relation to building materials, the priority has to be given to materials that take the utmost account of the environment in the manufacture, use and disposal. In Macedonia, we have set requirements for the indoor characteristics of materials, *i. e.* the content of chemicals and degassing, fire protection, *etc*., while there has not yet been statutory regulation of other dimensions of material consumption.

Certification schemes for sustainable building

The GB today covers a very wide spectrum of buildings and projects claiming to be green or sustainable. One of the biggest challenges concerning GB is the vague definition and thus the broad framework of what can be described as green or sustainable. Building sector has witnessed the development of two types of assessment tools: the one based on criteria system and tools that use life cycle assessment (LCA) methodology.

The criteria-based tools are defined as a system of assigning point values to a selected number of parameters on a scale ranging between *small* and *large* environmental impact, tab. 1. These tools are considered as comprehensive environmental assessment schemes. Among the criteria-based tools are BREEAM (Great Britain) – BREEAM (2005) [11]; GBTool (Canada) – IISBE (2005); LEED (US) – USGBC (2005) [12]; EcoProfile (Norway) – Byggforsk (2005), Environmental Status (Sweden) (2005), High Quality Environmental standard – HQE (France) (2002), and German Sustainable Building Council DGNB (2007).

Table 1. Most common GB criteria-based certification systems and scoring

	BREEAM	LEED	DGNB	HQE
Criteria	Management Health Energy Transport Water Materials Waste Innovation	Sustainable site Water efficiency Materials and resources Indoor air quality Innovation and design	Ecological quality Economical quality Socio-cultural quality Process quality	Eco-construction Eco-management Comfort Health
Scoring	Unclassified Passable Good Very good Excellent Outstanding	Certified Silver Gold Platinum	Bronze Silver Gold	Passable Very good Excellent Exceptional

Currently, most frequently applied certification system is BREEAM for Europe and LEED for USA. There are also specific tools developed at national level for assessment of the GB, mostly in the Asian countries and Middle East [13], that are adjusted and designed to fit and correspond to the regional and climate conditions.

On the other hand, methods for environmental assessment of buildings based on LCA are aimed to be used for selection of building design, building material, and local utility options during the design isographic regions, each with a distinct climate. Within LCA, different weighting methods based on different basis for valuation are used. Examples of tools of this category that contain LCA component are Bees (USA)-OAE (2004), Beat (Denmark)-DBRI (2005), EcoQuantum (The Netherlands) and KCL Eco (Finland) – KCL (2005) [14-17].

Green buildings in Macedonia

The concept of green construction in Macedonia is still in its very beginning phase. It is primary reflected through the regulation concerning energy efficiency of buildings, which become mandatory with the new law for construction [9], but still the other issues of green construction like efficient consumption of water and other resources as well as obligation for indoor climate quality are not under legislation. Nevertheless, Macedonia as a candidate country is following the EU trends and directives and subsequently introduces initiatives and actions.

In 2014 the local branch of the World Green Building *i. e*. Macedonian Green Building Council (MGBC) was established as a not-profit organization that serves as a country-wide platform for the promotion of sustainable building practices. The Council acts as a network for all parties involved through awareness rising of professional and innovative sustainable building practices in general [18]. The network of international organizations for GB MGBC exchanges experiences and provides useful information on sustainability and GB practices for the members of the council, by offering services such as building certification and professional training programs on Green Building [19]. However, regarding the official numbers of the Royal Institution of Chattered Surveyors RICS, Macedonia does not have any certified building regarding any of the GB standards [20].

Methodology and research design

Assuming that the increase of awareness would grow an increase in demand of GB [21-23], this paper aims to understand how far the concept of green construction has penetrated the Macedonian construction industry. The paper is based on the empirical survey about the awareness of GB issues, involving more than 180 respondents that represent the main relevant stakeholder groups, involved in construction industry in Macedonia. The instrument used for data collection is fulfilling written questionnaires including questions focused on leveling the understanding of the concept of green construction and the extent of use of *green* knowledge in current and past projects, realized by the respondents. The method for data analysis is based on statistical processing of data, both qualitatively and quantitatively.

Target groups

This survey is based on the responses of 181 construction developers including designers, architects, civil engineers, technicians, workers in construction industry, investors, as well as legal representatives (decision makers), that have responded to the questionnaires submitted to more than 310 respondents.

Realization of the survey

We have selected target groups as the most relevant regarding green construction. The respondents in the survey were chosen among the professionals gathered at two most adequate events in Macedonia related to sustainable construction, which were organized during 2016. The first event was the final conference of the project BuildUpSkills BEET, held on 14 March 2016, that have gathered more that 250 people involved in construction sector for the purpose of issuing certificates for skills for implementation of energy efficiency measures in buildings [24]. The event involved both workers and installers (as representatives of qualified workforce), but also building professionals (engineers, designers, architects) as well as investors and decision makers. The other event was the training of designers of NZEB within the project MENS (participants at two training cycles during April and October 2016), that involved around 60 building professionals [25]. According the official numbers for the share of different occupations in the total number of employed in construction sector [26], our respondents structure is appropriate to reflect the real employees distribution – see fig. 1 (according to [26] engineers are 8-10%, building professionals – technicians up to 18%, and qualified workers 72-75%). This ensures that the survey gives a proper insight of the issue in question.

The survey had a positive feedback of 58,4% responses received, despite the fact that these events were huge, difficult for organization and not primarily dedicated to green issues of constructing, but still they involved the most relevant groups for gathering opinion.

Survey topics and structure

The subject of the survey was collecting and analysis of responses to the structured questionnaire. The questionnaire incorporates three main sections for levelling opinion of the respondents.

– The first section of questions aimed at levelling overall awareness about the GB and the state of existing/not existing practices of green construction in Macedonia.
– The second group of questions was designed to identify and set aside the most significant benefits, barriers and cheerleaders on why to build *green*, according to the opinion of the most relevant professionals – the construction developers (the respondent groups).
– The last section of the questionnaire should give an insight of the potential of Macedonian companies involved in building sector to respond to the requests for GB, in the current state of knowledge and practical skills.

Survey data analysis

After the collection of the responses, the data were processed in statistical manner, both quantitatively and qualitatively. The results are accordingly represented graphically which allows best representation of the findings, but also qualitatively for certain questions concerning professional opinion expressing.

Results and discussion

The following section will present the results about the status of GB in Macedonia, obtained by statistical analysis of the answers from fulfilled questionnaires. Firstly, the structure of involved respondents is presented in fig.1. The presented layout shows that all relevant stakeholders in the process of construction are adequately involved in the survey.

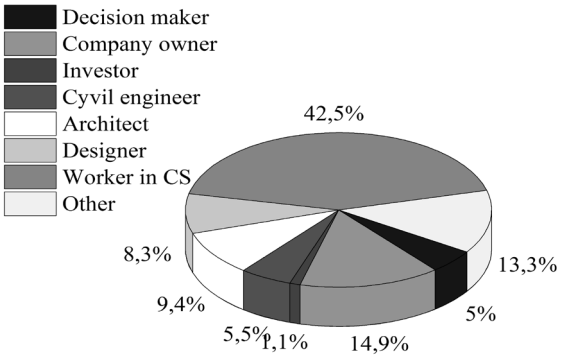

Figure 1. The structure of the survey respondents (*for color image see journal web site*)

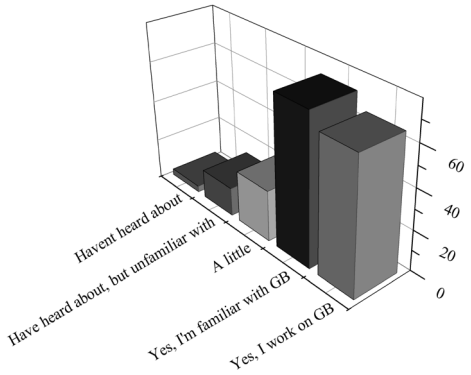

Figure 2. The stage of familiarization with the concept of GB; question formulation: *Are you familiar with the concept of GB?*

Results concerning the 1st group of questions

The first section of questions aimed at levelling overall awareness about GB in Macedonia. Regardless to the professional background and occupation, as well as regardless to the level of knowledge about GB, the respondents were asked to state whether they approve or not the concept of GB. This general question was answered negative by less than 6% of the respondents. The negative answer was given exclusively by the respondents who haven't previously heard about the concept of GB, or are not very familiar with it.

The stage of familiarization of the respondents with the concept of GB is assessed by answering the question: *Are you familiar with the concept of GB?*. The answers are given in fig. 2. The results show that there is a high level of familiarization with the concept of GB. These results should be considered carefully, based on the observation that a high percentage of basic building workers have stated that they currently work on GB (particularly 37 workers out of total 66). By our opinion, such answer is obtained by workers that work on implementing measures for energy efficiency in buildings, which they assume as the only content of GB.

Another question reflecting the status of presence of green construction in Macedonia was formulated as: *Do you know about any cases of GB in Macedonia?*. The results presented in fig. 3 express sufficient awareness of the respondents for the absence of green practice. Again due to the misunderstanding of GB only by means of energy efficiency, the answer *Yes, there are many cases*, should also be considered carefully, according to the above explanation.

The opinion about *where the GB principles* should be implemented, in order to reach the greatest impact, is presented through the results shown in fig. 4, and it is also compared to the global average for 2015 [8]. The respondent's tendency identifies implementation of GB practices in residential objects to have the greatest impact, especially through construction of new residential objects. Second by importance is the construction of new public objects. The respondents have not identified the construction of new commercial objects as a priority in green construction, despite it is a top 1 priority for GB actions globally. Regarding the potential of acting green through reconstruction activities, the respondents gave significant importance to the reconstruction of residential buildings. It is interesting to note that reconstruction is identified as potential GB action mainly by the owners of construction companies (44% of them chose this option), the workers in CS (35% of them) and decision makers (33% of them), while the professionals (civil engineers, architects and designers) have identified reconstruction as priority in GB actions with less that 12%.

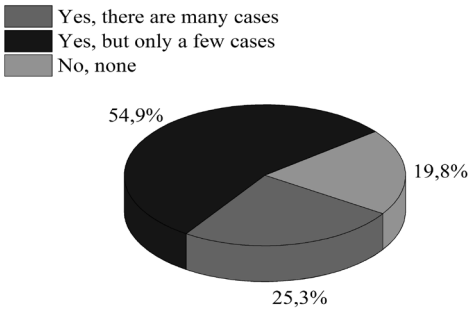

Figure 3. The opinion about the presences of GB cases in Macedonia; question formulation: *Do you know about any cases of GB in Macedonia?"*

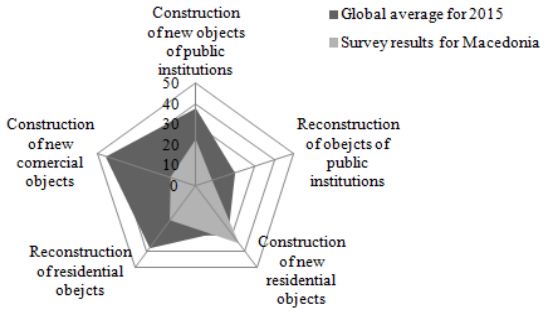

Figure 4. Distribution of the target points *Where should the GB construction have the greatest impact?*, according to the construction developer's opinion and compared to the global average for 2015

Results concerning the 2nd group of questions

The second group of questions was designed to identify and set aside the most significant benefits, barriers and triggers for building *green* in Macedonia. The answers were given by levelling the importance and validity of the proposed options by marking with 1 the most significant issue, and with 5 the issue with the lowest significance. The results are presented in terms of the choices that have greatest impact (1st and 2nd choice of respondents), and by comparing these findings with the global average for 2015 [8], see figs. 5-7.

Figure 5 represents the levelling the opinion of the survey respondents, about the expected environmental benefits of GB construction. The distribution of the answers is explicitly identifying reduction of energy consumption as most common benefit. Identification of energy efficiency and reduction of energy consumption as first association of GB, is present throughout the whole survey, and is also in line with the global average. It is noticeable that reduction of water consumption is rarely (even hardly) considered as benefit, in fact it is usually considered as an issue with the lowest significance. This is somehow reflecting the fact that still there is lack of awareness about efficient use of water resources in Macedonia, due to the fact that the country have enough resources of clean water.

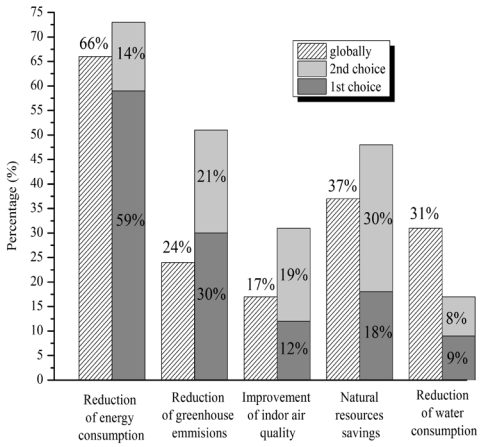

Figure 5. Levelling the most important benefits expected by GB construction, according to the opinion of the respondents

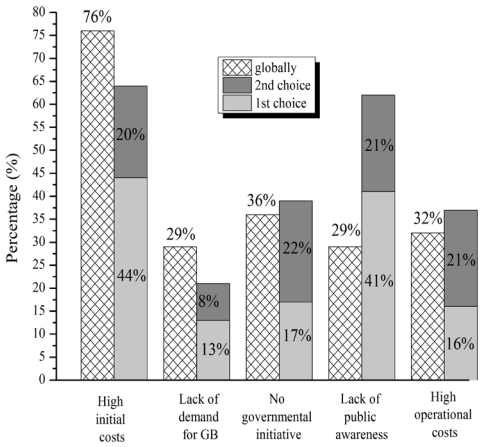

Figure 6. Levelling the importance of barriers for implementation of GB construction, according to the opinion of the respondents

As barriers for more organized implementation of GB construction in Macedonia, construction developers have pointed both high initial costs and lack of public awareness (fig. 6). The opinion regarding the lack of governmental initiative (and mandatory regulations) is very non-polarized, meaning that it is equally identified as very important but not so important. These findings are similar with the related one from the global report for 2015, except for the issue of public awareness. In Macedonia, the respondents have identified lack of awareness as one of the most important barriers, opposite to the global situation, where the awareness is on higher level and thus not marked as a barrier for growth of green construction, globally.

The respondents were also asked to identify the most important triggers for introduction of GB. The results shown in fig. 7 are interesting to comment especially regarding the answer *Because GB is the right thing to do*, answered by 37% of the respondents in our survey, compared to the percentage of only 8% of respondents on global level, that have answered the same (according to the 2015 report). According to the answers, striving for environmental protection is expected to be the main trigger to build greener in Macedonia, opposite to the global opinion where the market demand is identified as main trigger. The role of decision makers through mandatory obligations for GB is levelled, but it is not considered as relevant as is the market demand for GB, that is expected to rise in the years that follow, and in the same time it is the most important trigger for green construction globally.

Results concerning the 3rd group of questions

Study participants were asked to identify the green product categories that they currently use or think that they are capable to use. These results are compared to the global average for 2015 and with the expectations for 2020 [8]. The complete result of the survey concerning the potential for acting *green* in Macedonian construction is given in fig. 8. Large number of respondents (87%) reported that they use at least one type of green product on their projects (using lightening systems as green product is reported by 73% of respondents). These findings generally demonstrate that *some* green products are already adopted across the construction industry, but at moderate levels only. The use of renewable energy sources, especially photovoltaic, as opportunity for wider green actions is identified by more than 42% of respondents which implement this service.

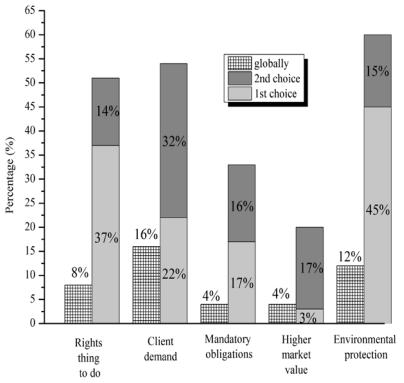

Figure 7. The distribution of the main identified triggers for implementation of GB construction in Macedonia, according to the opinion of the respondents

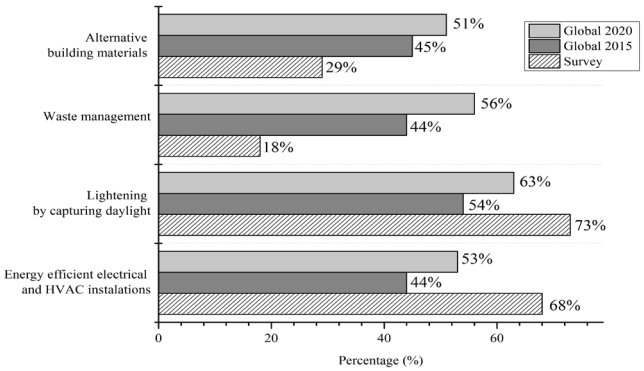

Figure 8. An insight of the potential of Macedonian construction companies for acting *green*, compared to the global findings

The global focus on energy conservation is evident in the answers of this survey too, showing high popularity of electrical products like lightening, which can yield a high degree of energy savings with relatively small investment. The respondents have also answered that they are prepared to enable using daylight for lightening (please notice that these answers are obtained mainly by the designers and architects who are familiar with the concept of daylight capturing). Because significant share of respondents were installers of electrical or HVAC installations, it was expectable to obtain answers identifying this product as potential to implement. However, on global level mechanical systems have much lower use, possibly due to the investment required and the fact that they are less likely to be included in renovation/retroft projects. Waste management is also expected to have global growth of 12 percentage point gain by 2020. Opposite to the global trends, waste management is not recognized as GB service that Macedonian companies are able to offer. Instead more than 50% of the respondents have answered that they are not familiar with this issue. The use of alternative building materials is also much lower than the global average, due to the slow penetration and acceptance of new building codes into the traditional construction habits in Macedonia.

Conclusions

The construction, management, use, change, and demolition of the built environment can damage the environment to a substantial extent. Fortunately, people are now beginning to realize the pitfalls of building unsustainably. The advantages of building sustainable have been revealed through much research and case studies conducted abroad [27]. In Macedonia, the active implementation of sustainable development by the government and construction developers is still desired future. As can be assessed, from this survey, it seems that the advantages of sustainable practices have not been firmly seized due to the slow permeation of this concept among the construction practitioners. In fact, many construction developers believe that the implementation of this concept is at low level. However, a high percentage of them stated that they approve the concept of GB, by giving less than 6% negative answers. General observation is that frequently construction workers with basic skills (lower level of qualification) misunderstand GB only by means of energy efficiency.

The important insight is given with the comparison of the results from this survey with the global one. Regarding the identification of main barriers and benefits, the distribution of answers is in line with the global trend, and for the identified triggers there is still a sufficient correspondence, having in mind that the global most relevant trigger, the client demand is currently not recognized by Macedonian construction industry, leaving this way the environmental concern as leading trigger for building green. The biggest discrepancy with global situation is shown in the prioritizing types of building that should be *green*. While in Macedonia residential construction is the one with hugest activity and thus identified as priority for green construction, worldwide this priority is given to the commercial buildings. This is again due to the highest share that residential construction has in the total construction activities in Macedonia.

There are many factors that impede an active implementation such as lack of knowledge, poor enforcement of legislation, education *vs.* experience and passive culture. More strategies and actions should be pursued actively to speed up the process in creating a sustainable-oriented construction industry.

Acknowledgment

The authors acknowledge sincere appreciation for the projects BuildUpSkills BEET No. IEE/13/BWI/682/SI2.680171 [24] and Meeting of Energy Professional Skills (MEnS) under H2020, grant agreement No. 649773 [25], for enabling their participants to participate in the survey.

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Paper submitted: September 15, 2017
Paper revised: October 26, 2017
Paper accepted: November 10, 2017