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The Importance of Occupational Health and Safety (OHS) and OHS Budgeting in terms of Social Sustainability in Construction Sector

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Abstract

Now-a-days, sustainability is one of the most important goals of also the construction sector, as it is in most of the other sectors. However, sustainability in the construction sector is dealt mostly with its environmental and economic dimensions and its social dimension remains in the background. This situation causes the Occupational Health and Safety (OHS), which is perhaps the most important issue within the scope of social sustainability, to be addressed on its own, and its relationship with sustainability to be not introduced clearly. In this study, firstly, the relationship between social sustainability and OHS in the construction sector was discussed. Based on the fact that in construction projects the sustainability goal should be revealed forward to a great extent at the design stage, how to contribute to OHS by budgeting OHS activities together with project activities was explained. The study is expected to help construction sector stakeholders to understand the relationship between social sustainability and OHS, and to provide a clear picture of the role of budgeting in this respect.

Keywords: Social sustainability • Construction Sector • Occupational Health and Safety (OHS).

Introduction

Social sustainability and OHS in the construction sector

Ruckelshaus in 1989 defined sustainability as the doctrine of providing economic growth and development with mutual interaction within the broadest boundaries of ecology and protecting it within time [1]. World Health Organization (1994) defined sustainable development as the strategy to "meet the needs of the present world population without causing adverse effect on health and on the environment, and without depleting or endangering the global resource base, hence without compromising the ability of future generations to meet their needs" [2]. Accordingly, "human beings are at the center of concern for sustainable development. They are entitled to a healthy and productive life in harmony with nature". In spite of the fact that previously sustainable development was mostly used to address the environment and referred to the quality of sustaining the environment [3], today sustainable development is accepted to have three main dimensions; economic development, social development, and environmental protection. The United Nations 2005 World Summit outcome document referred to them as "interdependent and mutually reinforcing pillars". These dimensions are mostly known as triple bottom line (TBL) and also sustainability pillars. The triple bottom line (TBL) consists of three Ps: Profit, People and Planet. It aims to measure the financial, social and environmental performance of the corporation over a period of time [4]. In general, sustainability is related to resources including natural resources, financial resources, and human resources. Human resources may contain the workers, clients, investors, and every one of the stakeholders who influence the organization and would be impacted by its business. In this manner, sustainable development targets to preserve and maintain such resources as efficient as possible for the use of the present and future generations [5].

In brief, the significant concern of sustainable development is human beings and their quality of life. Accordingly, sustainable development considers the economy as totally fundamental for the human and his satisfaction in life. What's more, it regards the environment since the quality of every single person's life is influenced by nature, environment, and resources. It cares about society because the degree of fulfilment of people is significant. Thus, the social dimension has gotten less appreciation within the context of sustainable development [6].

Social sustainability and construction sector

Social sustainability, which covers traditional social policy areas and principles, and subjects like participation, social capital, economy, environment and quality of life, interests on how people, communities, and societies live together and how they act by taking into account the physical boundaries of the space they are in order to achieve their chosen goals. [7]. With its most general definition, "It is ensuring the efficient use of natural resources by present and future generations by the protection and development of social conditions which will support meeting human needs and ensuring environmental sustainability." Socially sustainable development is the development that enables the society to work as a whole by helping each other to achieve common goals and at the same time, it can meet the daily needs of individuals such as health, housing, nutrition, and cultural expression [8-10].

Literature Review

The sustainability goal in the construction sector should include environmental and economic goals as well as social goals. However, this is not the case in practice. According to Valdes-Vasquez while environmental and economic sustainability is getting increased focus in CE programs, social sustainability gets little consideration in the classroom to better understand the situation; it would be good to first understand what social sustainability means for the construction sector [11].

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Valdes – Vasquez and Leidy in 2012 defined social sustainability as a series of processes that improve safety, health, and wellbeing during the life cycle of activities and think about the need of both present and future partners [12]. According to them, integrating these perspectives and considering the whole project life cycle can give an increasingly comprehensive understanding of this concept for the construction sector than a particular definition allows. As indicated by Almahmoud and Doloi with regards to construction, the concept of social sustainability is represented through meeting and managing of different stakeholders from different sectors like industry, clients, and neighborhood communities [13].

From the point of view of construction firms, social sustainability focuses also on the implementation of corporate responsibility practices [14], which think about how the organization can address the needs of partners influenced by its operations [15]. For example, at the design phase, the designers, government offices and construction companies try to provide worker safety by eliminating potential security risks from the work site [16,17].

Miree and Toryalay stated that considering safety design and security design is very critical in the design phase, since health and safety issues concerning project stakeholders have been a common worry of social sustainability in construction projects [18]. Besides, the health and safety in construction requires increasing the health and safety performance of a project. It is agreed that health and safety is a significant prerequisite, which has to be provided for workers and surrounding community. For the construction workers, they ought to be given proficient information and vital protection so as to have the option to work under safe conditions [13]. In general, sustainability literature recommends that conditions of safe and healthy living and working are significant components of social sustainability together with the project's effect on the local community through its life cycle [19].

Occupational Health and Safety (OHS)

Definitions regarding the relationship between social sustainability and the construction sector reveal that the focus of the issue is OHS. The contemporary meaning of the concept of OHS apart from the diagnosis and treatment of occupational accidents and occupational diseases is to protect the health of the employee and eliminate the various dangers that may disrupt his/her health [20]. OHS is a holistic approach which aims total wellbeing of the employee at work. According to WHO (1995), subjects like safety, physiotherapy, occupational medicine and psychology, ergonomics, rehabilitation, etc. are related to occupational health. On the other hand, protection of employees from physical injury is safety [21,22]. OHS is defined by the International Occupational Hygiene Association (IOHA) as the science of expectation, identification, assesment and control of hazards emerging in or from the workplace that could damage the health and well-being of workers, taking into account the possible impact on the communities [23]. Consequently, OHS can be seen to concern the advancement and maintenance of the level of physical, mental and social prosperity of employees in all occupations [24].

In developed and developing countries, almost half of the total population consists of employees. With the developing technology and industrialization, poor working conditions in the workplaces have become a threat to OHS and consequently to public health. According to the estimations of International Labour Organization (ILO), some 2.3 million women and men around the world succumb to work-related accidents or diseases every year, which corresponds to over 6000 deaths every single day. Worldwide, there are around 340 million occupational accidents and 160 million victims of work-related illnesses annually. Some of the major findings in the ILO's latest statistical data include the following:

- Diseases related to work cause the most deaths among workers. Hazardous substances alone are estimated to cause 651,279 deaths a year.
- Younger and older workers are particularly vulnerable. The ageing population in developed countries means that an increasing number of older persons are working and need special consideration.
- The construction sector has a disproportionately high rate of recorded accidents [25].

For example, a statistics published in 2015 by EuroStat shows that a "fifth of all workplace accidents happened in the construction sector", but that accidents are occurring in every sector and job function [26] (Figure 1).

All these statistics show that OHS is an essential problem especially for underdeveloped countries, since a high standard of OHS correlates positively with high GNP per capita [21]. Now-a-days, industrialized countries are making serious efforts on OHS. These countries are aware about the fact that active input in OHS is correlated with the positive development of the economy, while low investment in occupational health and safety is a hindrance in the economic competition. They are trying to decrease occupational accidents and occupational diseases as low as possible. In this context, it can be said that

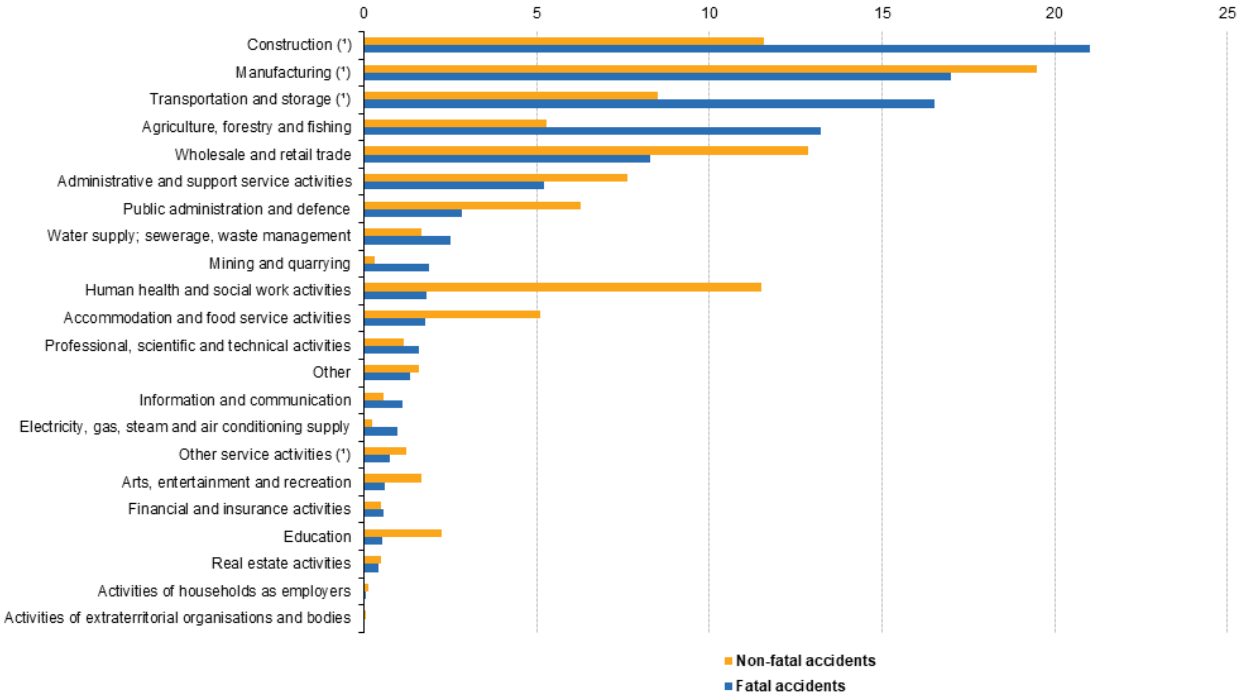

Figure 1. % of Fatal and non-fatal accidents at work in European Union Countries.

the issue of OHS in developed countries has become an independent branch of science and constitutes an important part of preventive health services in general public health [27].

According to Willard, the responsibilities of the firms to "people" are categorized into two distinct and overlapping groups [28]. These groups are the internal employees and the rest of the world, and in terms of internal employees, one of the issues towards which the firms should direct their policy and efforts is safety and health protection. In summary, the “people” component of the TBL advances that employees need to be able to rely on a safe work environment that continuously reduces the risk of injury. This is the basis for maintaining a sustainable workforce. Compensation claims, employee turnover, industrial accidents arising out of disregard for OHS issues have serious impacts on profitability and shareholders' wealth maximization [29]. As a result, providing OHS is both a humanitarian obligation and a legal obligation. The scientific studies revealed that the losses caused by occupational accidents are much more than the expenditures for security measures to ensure OHS. The most important dimension of the situation is the human dimension. Lost time and money can be recovered, but lost lives can never be brought back.

Social sustainability - OHS relation in construction sector

Kaluza et al. stated that it is a requirement to manage occupational safety and health effective in order to run a successful business [30]. Numerous studies demonstrated that general wellbeing and productivity levels of the workforce have a direct relationship with each other [31]. According to Amponsah, protecting the workers against occupational accidents, injuries, diseases physical and psychological overload have a positive correlation with the prudent use of resources and minimization of the unnecessary loss of human and material resources [29]. Occupational health and safety practices aim to manage health, safety, working capacity and well-being of the working population who contribute significantly to the overall socioeconomic development of the country strategically. Amponsah thinks that superior OHS policies are critical for sustainable development [29]. These policies provide superior intangible benefits such as improved environmental and social performance, higher employee job satisfaction and commitment, and increased innovation and creativity. On the contrary, although endeavors made in order to promote sustainability in the built environment, very little is done to integrate health and safety (H&S) into sustainability evaluation [32]. According to Molamohamadi although the major concern of both of these policies is humanwelfare and wellbeing, they look at it from different perspectives and attempt to arrive at this target through different ways [5]. While Sustainable Building (SB) projects consider energy, water and indoor environmental quality related issues, they pay little attention to OHS aspects [33,34]. The reason of this is that the sustainable development and OHS movements have traditionally operated in their own separate spheres and the synergy between them is little. The German philosopher, Schopenhauer (1788–1860), emphasized on the importance of health by stating that “health is not everything, but without health, everything is nothing” [35]. From this point of view, even though OHS is the most important part of social sustainability [36,37], little has been done to evaluate H&S aspects of SB at the project level [38,39]. For Gambatese et al. [16] and Hinze et al. [34], although SB projects offer the potential for improved energy and environmental performance, they are ultimately unsustainable if they compromise the OHS of the project.

OHS activities and budgeting them at design phase

According to Friend and Khon besides moral issues, OHS should also include economic issues, since the expenses of the accidents may far overweigh the costs of managing a workplace in a safe and healthy manner [40]. The cost of accident prevention is the cost of all sources used by contractors in the construction sector to meet the health and safety requirements in terms of OHS in their on-site applications. Construction workers ought to be equipped with efficient information and necessary protection so as to perform the work under secure conditions [13]. Costs incurred in such protection measures taken by all contractor project organizations, including subcontractors, are also considered to be safety investments. For doing the work in a secure way, personal protective equipment like safety boots, hard hat, highly visible clothing, safety glasses, and sunscreen should be provided to the workers [41]. Likewise, the working environment itself also ought to be planned and developed in a safe manner. For this, safety barriers and safety signs to warn workers of specific hazards and to communicate necessary precautionary measures and emergency actions should be provided. For the health and safety of the community living near the construction site, the arrangement of warning boards, sufficient fencing, and sign systems is a requirement. Thus, the public can be kept out of the construction site, since they probably won't know about the dangers of the location [11]. Additional measures to be taken for the health and safety of surrounding community may be the provision of alternate walkways, noise and dust pollution control and safe disposal of hazardous materials [13]. Although these measures appear to be the ones to be implemented during the construction phase, they reveal that a significant portion of these measures should be dealt with at the design stage.

Some studies proved that there is a correlation between a project’s design and the number of construction site injury and fatality incidents [16,42,43]. According to Valdes-Vasquez [11], for social sustainability, action should be implemented during construction and operation, but more advantages can be provided if it is also addressed during the planning and design phases where there are great possibilities for influencing project performance. The aim of Safety through Design concept, which is also known as Prevention through Design (PtD) or Design for Construction Safety [36] is to reduce construction worker injuries and fatalities besides improving the construction worker health. The National Institute for Occupational Safety and Health (NIOSH) in USA recognized this concept as a key strategy for improving work place safety [17]. According to this concept, designers (architects and engineers) can and should ensure the safety of the employees by eliminating potential safety hazards from the construction site during the design phase [44]. Thus, Safety through Design helps to encourage more sustainable construction projects [16]. Nevertheless, it is not possible to prevent all accidents in the design phase. Thus, to conduct a health and safety program during construction is also a critical obligation [45,46].

Providing safety through design requires also to budget OHS activities. This activity has two sides. While each element designed for preventing an accident during construction or use requires also budgeting them, on the other hand, budgeting a design element makes the implementation of the design element more inevitable. Therefore budgeting the OHS measures is as important as designing them.

The problem is the reluctance of the construction companies to take necessary OHS measures which they consider as extra financial burden. Lacking a safety culture, many companies in the construction sector shy away from taking necessary measures and contend only with simplistic and superficial requirements to prevent hazards in their on-site applications. Calculating and making a budget for the costs of prevention at the beginning of the construction projects would provide a better understanding of safety costs during the project implementation. This enhanced understanding will, then, result in a decrease of accidents, serious injuries, legal proceedings/ sanctions, trial expenses, and thus positively contribute to the reduction of overall expenditures and most importantly, to reduction of the loss of life. On the other hand, it is seen that budgeting all kinds of measures at the end of the project design phase, and doing the tender or budget planning accordingly, is critical for OHS. This situation seems to be one of the first and most critical steps in the prevention of construction sector accidents which have material and moral consequences.

For a very long time, in construction sector, costs of accidents have been included in cost estimation of construction projects because the construction sector has largely viewed accidents as the cost of doing business. In construction sector, OHS costs are divided into two categories, covering all financial losses in case of an accident on sites [47]. The first category is the costs of prevention (OHS measures) covering the expenses incurred by the contractor for accident prevention [48,49]. The second is ‘(direct or indirect)

accident costs' emerging during unavoidable accidents that happen despite all measures taken.

Studies about the costs of OHS as part of project costs in construction sector are not very common. A study was conducted by Tan [50] to compare the accident costs and safety measures for the implementation of a project in Turkey. Aminbakhsh, Gündüz and Sönmez [51] evaluated the safety risks with the Analytic Hierarchy Method in the planning and budgeting phase of a construction project. Chalos [52] proposed a conceptual safety cost model that defines accident/damage prevention benefit-cost analysis. Tappura et al. [53] discussed safety-based accounting management system by assigning a value to human life in cost-benefit analysis. Sousa et al. [54] proposed a new OHS Potential Risk Model that allows statistical estimation of OHS risk costs. They found that, since OHS costs are not calculated in the budgeting phase, the parties in the construction phase do not want to reduce their profits by spending money for safety. Today, the safety costs of a construction project are estimated at the very early phase of budgeting by using an "activity-based costing method" [55] processing work schedule data through the risk assessment techniques such as Fine-Kinney Method and the L-Matrix Method [56-58].

The components of total safety investments are classified as safety staffing costs, safety training costs, safety equipment and facilities costs, safety committee costs, safety promotion and incentive costs and costs of new technologies, methods or tools designed for safety [59-61]. These safety investments are classified as basic versus voluntary safety investments. Basic safety investments are the minimum safety standards required for the prevention of accident occurrence and the construction process externally required by industrial or government regulations. These costs, which constitute the compulsory part of safety investments, include the safety staffing costs, the compulsory part of the safety training costs, and the safety equipment and facilities costs. Voluntary safety investments are the ones preferred among the accident protection activities by companies themselves on a project basis. Safety investments such as in-house training activities, the safety committee activities, safety promotion and incentive activities and new technologies, methods or tools designed for safety activities are included in voluntary safety protection activities. Therefore, total safety investment is equal to the sum of basic and voluntary safety investment costs [62].

A study was conducted by Yılmaz [63] in order to estimate the compulsory costs of OHS measures in the Turkish construction sector at the tender stage. In this study, OHS costs were considered to be compatible with the classification by Teo and Feng [61], but a new component was added for fee for laboratory examinations. Using this proposed model, the actual OHS cost of a construction project of public buildings with a total construction area of 12,477.12 m^2 was estimated with 95% accuracy at the pre-tender stage.

In another study conducted by Yılmaz and Kanıt [64] using the same model and its calculation tool, the cost of work accidents in the sector was found to be 14.52 USD for each m^2 construction area in Turkey. In the same study, sum of the compulsory OHS costs was estimated to be 8.47 USD/m^2. These data indicate that every 1.00 USD investment in OHS in the Turkish construction sector results in a decrease of 1.71 USD in social costs.

Construction cost actually covers the entire lifecycle costs, including the design, projecting, construction, use and destruction of the building. The graph summarizing the system life cycle [65] is adapted in Figure 1 to the construction project management processes (Figure 2).

It can be stated that the most important and expensive component of the building cost is human health. In particular, the cost of production item that causes loss of life can reach to an intolerable dimension. Taking into account the OHS criteria in the phases of conceptual design and implementation projects and preparing of Health and Safety Plans along with the projects will prevent potential accident risks before occurring during construction. According to the risk hierarchy, which was scientifically proven many times and was supported by the facts, the risks of work accidents can be eliminated to a great extent in the project phase by making a design change, sometimes with the additions in the design and with some low-cost changes in the preliminary design phase of the project. In addition to all these, OHS is considered in the life cycle of a building or engineering structure and is being thought in the design phase including maintenance, repair, and renovation [66].

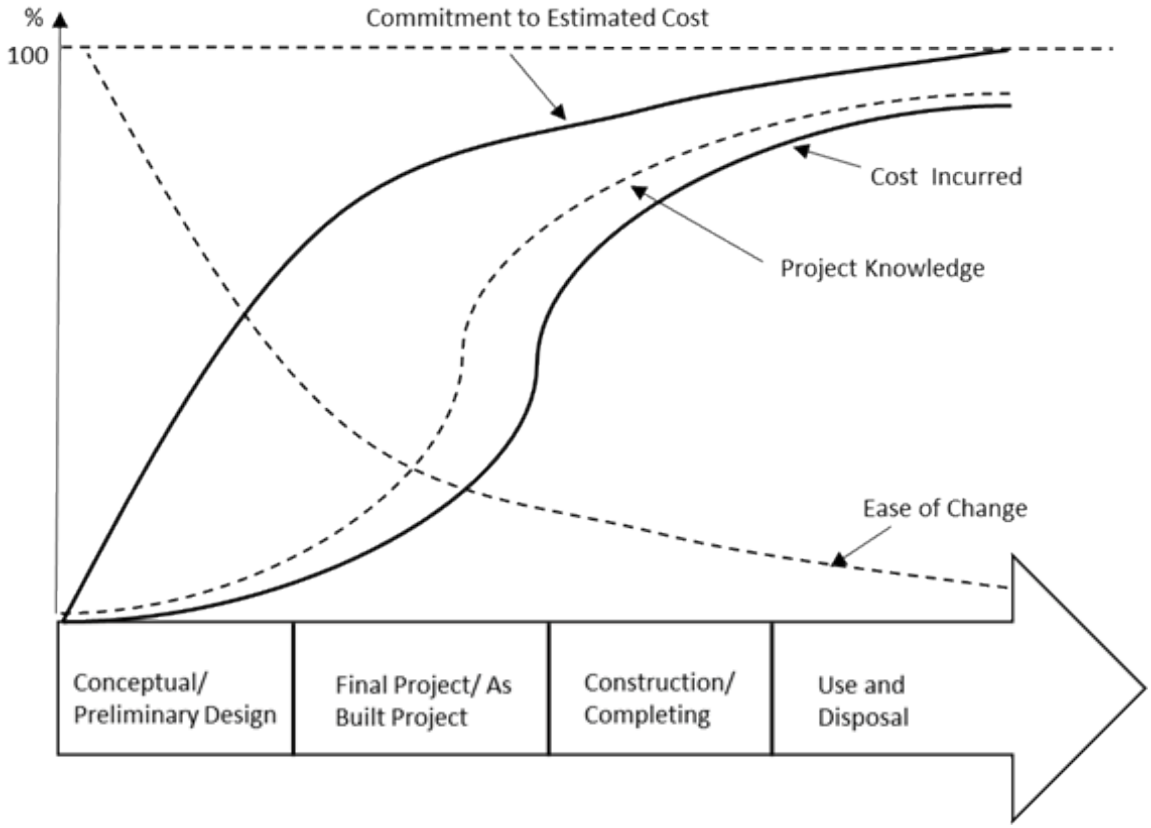

Figure 2. Life cycle, project cost dependence.

Discussion

As one of today's trendy terms, while too much use of sustainability is sometimes repelling, its importance for the present situation and future of the world is clear in consideration of its origin and meaning. The concept emerged as a result of the uncontrolled process of consumption-driven development, which was experienced with the uncontrolled increase in the population and especially after World War 2. This mentioned process caused deterioration of ecological balances, depletion of resources, reduction of water resources, air pollution, the start of the spread of chemicals and heavy metals in nature, global warming, desertification, acid rain, deforestation, ozone depletion along with developments such as increasing poverty and unemployment, unhealthy urbanization, and international inequality; thus sustainability emerged as the name of the development model, which aimed establishing a balance between environment and development, taking into account the human capital and the environment, careful use of all social, cultural, scientific, natural and human resources of society, and establishing a participatory process from a social perspective.

The importance of the concept in the construction sector, as one of the most resource-consuming sectors in the world, was easily understood, and many new concepts such as green building, sustainable building, eco-friendly building entered into our life. People need buildings to sustain their lives, and the construction, operation, maintenance, and destruction of these buildings result in a significant environmental impact along with the use of too many resources. According to the various studies, it is possible to say that buildings are responsible for 20% of the world's water consumption, 25-40% of energy consumption, 25-40% of greenhouse gas emissions and 30-40% of solid waste production. Although all these figures point out mainly the environmental importance of sustainability in the construction sector, currently, it is an inevitable fact that sustainability needs to be addressed as a whole with its environmental, economic and social dimensions.

On the other hand, in particular, the social dimension of sustainability has been kept in the background or it hasn't been cared about consciously. However, when the definitions of social sustainability are considered, it is clear that neither environmental nor economic sustainability can be achieved without social sustainability. According to Colantonio [7], social sustainability, which covers traditional social policy areas and principles, participation, social capital, economy, environment, and quality of life, deals with how individuals, communities and societies live together, and how they behave in order to achieve their goals. It could also be defined as the development, which provides working of the community as a whole to achieve the common goals, at the same time, which meets the individuals' everyday needs, such as health, housing, nutrition, cultural expression [8-10].

This study dealt with social sustainability, which is the most neglected dimension of sustainability also in the construction sector, in the context of occupational health and safety. Including the minimization of the use of natural resources and the waste generation during the construction, use and demolition phases, considering that the main objective of sustainability is the well-being of current and future generations, social sustainability may be evaluated as the most important dimension of sustainability for the construction sector.

Occupational health and safety seem to be the most important elements of ensuring social sustainability in the construction sector. It is evident that a construction project during which workers or those in the environment were damaged, especially they lost their lives, will be not sustainable, no matter how environmentally sensitive buildings were constructed.

Conclusion and Recommendations

This study argues that for a sustainable construction sector, first of all, social sustainability should be aimed and that social sustainability should aim firstly occupational health and safety. It is thought that only by acting from this point a whole sustainability goal can be made more realistic and that a more participative action will be achieved. For this aim, it should be gone beyond the classical approaches, which consider OHS as a discipline completely independent from social sustainability, and the measures aimed at OHS should be budgeted at the design stage. In this way, the cost of these measures will be foreseen from the beginning, and like it is not possible to give up a certain construction item, measures aimed at OHS will cease to be the elements that cannot be given up to maximize profit. Moreover, academic studies have shown that OHS costs to be budgeted are not big figures and even that they are already much smaller than accident costs. On the other hand, it is clear that there could not be any material equivalent of human life. As a result of considering OHS cost as an integral part of the total cost and taking into account as activity-based in each period from the design stage to the tender stage, it is thought that;

- A psychological effect about OHS could be created by increasing the interest of all stakeholders of the construction sector in the first place,
- Design criteria could be approached in terms of OHS,
- A healthy OHS plan could also be created during the project procurement process,
- An OHS working plan that is parallel to the working schedule program could be created,
- OHS measures could be deducted from being an expense item that could be easily disregarded by making them more visible and tangible,
- In practice, the production inputs required for an activity as well as the OHS measures accompanying that activity, the necessary equipment and installations for field security or personal security would be provided,
- The contractor would perform activities related to OHS more voluntarily since OHS expenses will become an expense that is reimbursed for the contractors rather being a general expense,
- OHS measures would be controlled more strictly by the administrations since they will become activities for which it will be paid,
- Ultimately employees could work in safer and healthier environments, fatal accidents and injuries could be prevented and it would be contributed to social sustainability and security culture in the sector.

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