ARTICLE

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

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ABSTRACT

Nowadays, sustainability is one of the most important construction sector goals, as it is in most 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. This study discussed the relationship between social sustainability and OHS in the construction sector. 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. We intended to contribute to the provision of OHS and thus the social sustainability of construction projects by revealing how the budgeting will be done and how much OHS budget will be, by referring to the studies in the literature conducted about OHS budgeting and presented robust numerical data. 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

1. Introduction

Even though sustainability was used to address the environment as of its first appearance and aimed to sustain the environment in a quality way, nowadays, it has become a concept that is accepted to have three pillars: environmental protection, economic development, and social improvement. It has been understood that it is impossible to protect the environment without providing economic development and creating a socially equitable system. Similarly, sustaining the economy without a habitable environment and a good social environment is so difficult, and neither the environment nor the economy has any meaning without social sustainability, whose focus is people.

On the other hand, overall sustainability is an issue that can be achieved with the contribution of all sectors related to production. Sustainability is extremely important in the construction sector since this sector consumes
lots of resources in the construction, use, and demolition stages of the buildings, the economy is extremely important at every stage of the sector, and the social life is shaped around the buildings created by this sector. However, as in most other sectors, in the construction sector, sustainability’s economic and environmental dimensions are emphasized, and social sustainability remains in the background. This situation causes neglect of many social aspects of construction projects.

This situation causes OHS, which is actually one of the most critical parts of social sustainability in construction projects, not to be dealt with together sustainability and handled completely independently. However, it is clear how weak the environmental, economic or social sustainability claim will be in a sector in which per year 2.3 million and per day 6000 employees die due to 340 million occupational accidents and 160 million occupational diseases.

One of the most important reasons for the failure of providing OHS in the construction sector is that the OHS expenditures, which are not included in the design and tender stages, are seen as an extra cost during the construction phase and tried to be avoided. In fact, the budgeting of OHS costs during the design phase will be extremely beneficial in terms of the contractor’s prediction and implementation of OHS activities and the employers requesting the contractor’s full implementation. This study was carried out from this point of view. The social sustainability-OHS relationship in the construction sector and the importance of OHS budgeting in this relationship were revealed. Studies in the literature, which were carried out about OHS budgeting and presented the amount of budget needed for OHS with numerical data, were examined. In this way, in a construction project, how OHS budgeting will be done and how much budget is needed were revealed. Thus, we aimed to contribute to the stakeholders’ understanding of the relationship between social sustainability, OHS, and OHS budgeting in construction projects and their taking action in this direction.

2. Social Sustainability and OHS in the Construction Sector

2.1 Sustainability

Ruckelshaus 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]. According to World Health Organization, sustainable development is the strategy to meet the demands of the current world population without causing an unfavorable impact on the environment and health, and without draining or imperiling the worldwide resource base, thus without trading off the capacity of people in the future to meet their demands. Accordingly, human beings are at the focal point of worry for sustainable development. They are entitled to a healthy and productive life in amicability with nature. Although previously sustainable development was generally used to address the environment and was pointed out to the environment’s sustaining quality [2], nowadays, sustainable development is acknowledged to have three fundamental dimensions: environmental protection, economic development, and social development. The United Nations 2005 World Summit result report referred to them as “interdependent and mutually reinforcing pillars.” These dimensions are generally known as sustainability pillars and triple bottom line (TBL). TBL comprises of three Ps: Profit, People, and Planet. It intends to quantify the organization’s environmental, financial, and social performance over some time [3]. Essentially, sustainability is associated with resources, which include human, natural, and financial resources. HR may contain the laborers, customers, investors, and all partners who impact the organization and would be affected by its business. This way, sustainable development focuses on preserving and keeping up such resources as productive as possible to utilize the present and future generations [4].

To sum things up, the critical concern of sustainable development is individuals and their life quality. Correspondingly, sustainable development regards the economy absolutely as the key for the human and his fulfillment in life. Also, it considers the environment since the quality of everyone’s life is impacted essentially by the environment, nature, and resources. It considers society since the level of satisfaction of individuals is important. Hence, the social dimension got less acceptance within the context of sustainable development [5].

2.2 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 to achieve their chosen goals [6]. 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 society to work as a whole by helping each other to achieve common goals. At the same time, it can meet individuals’ daily needs, such as health, housing, nutrition, and cultural expression [5-9].

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 increases focus on CE programs, social sustainability gets little consideration in the classroom. To better understand the situation, it would be well first to understand what social sustainability means for the construction sector [10].

Valdes-Vasquez and Leidy defined social sustainability as a series of processes that develop wellbeing, health and safety and think about the need for both present and future partners [11]. According to them, incorporating these perspectives and regarding the whole project life cycle may give an increasingly comprehensive grasp of this concept for the construction industry than a distinct definition allows. As indicated by Almahmoud and Doloi, with regards to construction, the social sustainability concept is represented by meeting and managing different stakeholders from different sectors like industry, clients, and neighborhood communities [12].

From the perspective of construction firms, social sustainability focuses likewise around the usage of corporate obligation practices [13], which consider how the organization can address the demands of partners impacted by its operations [14]. For instance, at the design stage, the designers, government offices and construction firms attempt to provide worker safety by wiping out potential security risks from the site of work [15-16].

Miree and Toryalay stated that considering safety design and security design is critical in the design phase since health and safety issues concerning project stakeholders were a general worry in construction projects in terms of social sustainability [17]. Besides, in construction, it is required to increase a project’s safety and health performance. It is agreed that health and safety is a significant prerequisite, which has to be provided for workers and the surrounding community. The construction workers ought to be given proficient information and vital protection to have the option to work under safe conditions [12]. In general, sustainability literature recommends that healthy and safe working and living conditions are critical parts of social sustainability along with the project’s impact on the local society through its life cycle [10].

2.3 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 [19]. OHS is an all-encompassing methodology which intends complete prosperity of the employee at work. As per WHO, subjects like security, physiotherapy, work-related medication and psychology, ergonomics, rehabilitation, and so on are associated with occupational health. On the other hand, safety is protecting the workers from physical injury [20]. The International Occupational Hygiene Association (IOHA) characterized OHS as the science of prediction, identification, assessment, and control of hazards arising in or from the working environment that could harm employees’ wellbeing and health, considering the potential effect on societies [21]. Therefore, it is considered as the development and upkeep of the degree of workers’ physical, mental, and social prosperity in all occupations [22].

Almost half of the total population consists of employees in developed and developing countries. With the developing technology and industrialization, poor working conditions in the workplaces have become a threat to OHS and public health. According to the International Labour Organization (ILO) statistics, about 2.3 million people worldwide die due to occupational accidents or diseases every year, which means that over 6000 deaths occur every day. Annually, 340 million occupational accidents occur, and there are 160 million victims of occupational diseases. The latest statistical data of ILO points out the following critical findings:

(1) Occupational diseases are the main cause of deaths among employees. Only hazardous substances are predicted to lead to 651,279 deaths a year.

(2) Especially the younger and older employees are vulnerable. The population is aging, especially in developed countries; thus, the number of older people working increases day by day, and this situation requires special consideration.

(3) The rate of accidents recorded in the construction industry is disproportionately high [23].

For example, statistics presented in Figure 1 and published in 2015 by EuroStat shows that a “fifth of all workplace accidents happened in the construction sector,” but that accidents occur in every sector and job function [24].
All these statistics show that OHS is a fundamental problem, especially for underdeveloped countries, because there is a positive correlation between high OHS achievement and high GNP per capita \[1\]. Nowadays, industrialized countries are making serious efforts on OHS. These countries are aware that active input in OHS is correlated with the economies’ positive development, while low investment in OHS is a hindrance in the economic competition. They are trying to decrease occupational accidents and occupational diseases as low as possible.

In this context, OHS’s issue in developed countries has become an independent branch of science and constitutes an important part of preventive health services in general public health \[25\].

According to Willard, the companies’ responsibilities to individuals are categorized into two groups, which are distinct and overlapping \[26\]. 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 outline, the TBL individual component advocates that workers should have the option to rely on a safe workplace that persistently diminishes the danger of injury. This situation is the basis for keeping up a sustainable labor force. Negligence for OHS issues causes an increase in employee turnover, occupational accidents, and compensation claims, which affect the profitability and wealth maximization of shareholders adversely \[27\]. 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.

2.4. Social Sustainability-OHS Relation in the Construction Sector

Kaluza et al. stated that it is necessary to manage occupational safety and health effectively to run a successful business \[28\]. Numerous studies demonstrated that the workforce’s general wellbeing and productivity levels
have a direct relationship with each other [29]. According to Amponsah, protecting the employees against work-related physical and psychological overload, diseases, accidents, and injuries positively correlates with the careful utilization of resources and minimization of avoidable human and material resources loss [27]. OHS practices intend to manage the employees’ safety, health, working capacity, and wellbeing, thus providing the continuation of their strategic contribution to the country’s socio-economic development. Amponsah thinks that superior OHS policies are significant in terms of sustainable development [27]. These policies provide significant intangible benefits such as improving social and environmental performance, better job satisfaction and commitment of the employees, and the increase of innovation and creativity.

On the contrary, although endeavors were made to promote sustainability in the built environment, very little is done to integrate health and safety (H&S) into sustainability evaluation [30]. According to Molamohamadi, although the main concerns of both of these policies are humans’ health and wellbeing, they look at it from different perspectives and attempt to achieve this aim by following different ways [31]. While Sustainable Building (SB) projects consider energy, water and indoor environmental quality-related issues, they pay little attention to OHS aspects [31-32]. This is because 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), accentuated the significance of health by expressing that “health is not everything, yet without health, everything is nothing” [33]. From this point of view, even though OHS is the most important part of social sustainability [15, 34], little has been done to evaluate SB’s H&S aspects at the project level [35-36]. For Gambatese et al. and Hinze et al., although SB projects offer the potential for improved energy and environmental performance, they are ultimately unsustainable if they compromise the OHS of the Project [15, 32].

3. OHS Activities and Budgeting them at Design Phase

As indicated by Friend and Khon, other than moral issues, OHS should also incorporate economic issues since the costs of the accidents may far outweigh the expenses of managing a working environment healthily and safely [37]. The expenses made for preventing the accidents are the expenses made for all sources utilized by contractors serving in the construction industry to meet OHS’s safety and health prerequisites in their on-site applications. Employees in the construction industry should be outfitted with adequate knowledge and essential protection to work under safe conditions [12].

All contractor organizations’ expenses, including sub-contractors, are also considered investments of safety for taking these protection measures. For safely accomplishing the work, Personal Protective Equipment like helmets, safety boots, safety glasses, and special clothing should be given to the laborers [18]. Moreover, the workplace itself also should be arranged and developed safely.

For this, the employers ought to provide safety signs and safety barriers to caution laborers of specific hazards and convey fundamental precautionary measures and emergency activities. It is required to provide adequate fencing, warning boards, and signs to protect the safety and health of the people living near the construction site. In this manner, they can be kept out of the Project area since they are likely not aware of the area’s risks [10]. For nearby community safety and health, extra measures like arrangement of alternate walkways, control of the dust and noise pollution, and safely disposing of the hazardous material could be taken [12]. Although these measures will be applied during the construction stage, a critical segment of these measures ought to be planned at the design stage.

Some studies proved a correlation between the design of a project and the number of injuries and fatal incidents in the construction site [15, 39, 40]. According to Valdes-Vasquez, for social sustainability, action should be implemented during construction and operation. However, more advantages can be provided if it is handled during the planning and design stages when it is possible to affect project performance greatly [10]. The aim of the Safety through Design concept, which is also recognized as Design for the Safety of Construction or Prevention through Design, is to reduce construction worker injuries and fatalities besides improving construction worker health [15].

The National Institute for Occupational Safety and Health (NIOSH) recognized this concept as an effective strategy for improving workplace safety [16]. According to this concept, the workers’ safety could and should be ensured by the architects and engineers by wiping out possible safety hazards from the construction site at the design stage [42]. So, Safety through Design will contribute to the sustainability of construction projects [15]. Nevertheless, it is not possible to prevent all accidents in the design stage. Thus, implementing a safe and healthy program during construction is also a binding obligation [42, 45].

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

The problem is the construction firms’ hesitation to implement the required OHS measures that they consider it as an extra economic burden. Numerous construction industry companies lack a safety culture and avoid implementing required measures and battle just with oversimplified and shallow requirements to prevent risks in their on-site implementations. Ascertaining and preparing a budget for providing safety at the start of the construction projects would give a superior comprehension of safety costs during the project’s implementation. This improved understanding will reduce the number of accidents, injuries, legal proceedings/sanctions, and reduce trial expenses, and by this means, contribute to the decrease of overall expenditures and, most significantly, the number of life losses. 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 preventing construction sector accidents that have material and moral consequences.

Since the construction industry considered accidents as the cost of doing business for a long time, expenses made due to accidents have been involved in the projects’ cost estimation. OHS costs are handled in two groups in the construction industry, covering all financial losses in case of an accident on the site. The first group is the expenses of prevention (OHS measures), including the contractor’s expenses for preventing accidents. The second group is “(direct or indirect) accident costs” arising due to unavoidable accidents that occur despite all measures taken.

Studies considering the OHS costs as part of project costs in the construction sector are not so common. Tan conducted a study comparing the costs of accidents and the costs of a project’s safety measures implemented in Turkey. Aminbaksh, Gündüz and Sömmez assessed the safety risks of a construction project with the Analytic Hierarchy Method in the planning and budgeting stages. A safety cost model, which explains accident prevention benefit-cost analysis, was proposed conceptually by Chalos. Tappura et al. developed an accounting management system based on safety by appointing a value to human life in the cost-benefit analysis. Sousa et al. suggested a new OHS Potential Risk Model in which it is possible to estimate the OHS risk costs statistically. They found that the contractors do not want to lessen their profits by expending money for safety in the construction phase since OHS costs are not calculated in the budgeting phase. Nowadays, a construction project’s safety costs are predicted at the very early stages of budgeting by utilizing an “activity-based costing method” . These methods process the work schedule data by utilizing risk assessment methods like the L-Matrix Method and Fine-Kinney Method.

The costs of safety staffing, safety training, safety equipment and facilities, safety committee, safety promotion, safety incentive and new technologies, techniques or tools designed for safety comprise the total safety investment cost . Some of these investments are considered basic, and some others as voluntary safety investments. Basic safety investments are the investments to provide minimum safety standards necessary for preventing an accident and required externally due to regulations imposed by the industry or government. These expenses constitute safety investments’ compulsory part and involve the cost of safety staffing, the compulsory part of the safety training cost, and the costs of safety equipment and facilities. Voluntary safety investments are the investments made for the occupational accident prevention activities selected by the firms on a project basis. Safety investments made for in-house training activities, safety promotion activities, safety committee activities, and new technologies, techniques, or tools designed for safety activities are involved in voluntary safety activities. So, the total safety investment cost is the sum-up of basic and voluntary safety investment costs.

Yılmaz conducted a study in the Turkish construction sector to estimate the OHS measures’ compulsory costs at the tender phase. In this study, OHS costs were considered compatible with Teo and Feng’s classification, but a new component was included for laboratory examination costs. By utilizing the model proposed in this study, the actual OHS cost of a project belonging to a public building having a total construction area of 12,477.12 m² was predicted with 95% accuracy at the pre-tender phase.

Yılmaz and Kanıt conducted another study, and by utilizing the same model and its calculation tool, they found that the cost of occupational accidents in the construction industry was 14.52 USD for each m² construction area in Turkey . They estimated in the same study that the compulsory OHS costs were 8.47 USD/ m². These data points out that it is possible to provide a decrease of 1.71 USD in social costs by every 1.00 USD investment in OHS in the Turkish construction sector.

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 is adopted in Figure 2 to the construction project management processes.
Figure 2. Life cycle, project cost dependence

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 an intolerable dimension. Considering the OHS criteria in the phases of conceptual design and implementation projects and preparing 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 of in the design phase, including maintenance, repair, and renovation [52].

4. Conclusion

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 considering its origin and meaning. The concept emerged from the uncontrolled consumption-driven development process, which was experienced with the uncontrolled increase in the population, 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 to establish a balance between environment and development, taking into account the human capital and the environment, attentive use of all cultural, social, scientific, human and natural resources of society, and establishing a participatory process from a social perspective.

The concept’s importance was easily understood in the construction sector, as one of the most resource-consuming sectors globally, and many new concepts such as green building, sustainable building, and 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 various studies, it is possible to say that buildings are responsible for 20% of the world’s water utilization, 25-40% of total energy utilization, 30-40% of solid waste production and 30-40% of global greenhouse gas emissions. Although all these figures point out mainly the environmental importance of sustainability in the construction sector, it is currently inevitable that sustainability needs to be addressed 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 (2009), 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 behave 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 [7-9] (Hatfield and Evans, 1996; Gilbert and Stevenson, 1996; Pugh, 1996).

This study dealt with social sustainability, which is the most neglected dimension of sustainability in the construction sector in the context of OHS. Including the minimization of the use of natural resources and the waste generation during the construction, use and demolition stages, considering that the main objective of sustainability is the wellbeing 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

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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.

This study argues that social sustainability should be aimed first, and social sustainability should first aim to provide occupational health and safety for a sustainable construction sector. It is thought that sustainability goals can be made more realistic only by acting from this point 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 human life could not be any material equivalent. 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:

(1) A psychological effect about OHS could be created by increasing the interest of all stakeholders of the construction sector in the first place,

(2) Design criteria could be approached in terms of OHS,

(3) A healthy OHS plan could also be created during the project procurement process,

(4) An OHS working plan that is parallel to the working schedule program could be created,

(5) OHS measures could be deducted from being an expense item that could be easily disregarded by making them more visible and tangible,

(6) 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,

(7) The contractor would perform activities related to OHS more voluntarily since OHS expenses will become an expense that is reimbursed for the contractors rather than a general expense,

(8) OHS measures would be controlled more strictly by the administrations since they will become activities for which it will be paid,

(9) 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 safety culture in the sector.

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