A CONCEPTUAL DISASTER RISK REDUCTION FRAMEWORK FOR HEALTH AND SAFETY HAZARDS IN THE CONSTRUCTION INDUSTRY

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Abstract:
The health and safety hazard status of construction workers is constantly challenged by the projects in the built environment. In this article, various aspects of health and safety hazards for construction workers have been reviewed and investigated through a disaster risk reduction prism. This approach has further led to the perception of glancing at the construction sector as an ongoing disaster zone and equally provides a new management perspective. From this perspective, the occurrence of a disaster within the construction sector corresponds to the temporary or permanent ill-health or death of a construction worker. Geographical location is one of the factors that play an important role in addressing the health and safety hazards for construction workers. In addition to the location, geographical considerations equally encapsulate regional, cultural, governmental and work ethical effects. These effects may potentially contribute to disparities in the construction sector. With an increasing level of understanding for health and safety hazards in the construction domain, more efficient prevention measures can be taken in order to enable a disaster management cycle, capable of responding to the rigorous demands of the construction sector.

Keywords: Health and safety hazards, construction workers, disaster risk reduction, disaster, construction industry.

1. Introduction

An increasing world population motivates the inevitability of creating a growing number of housing opportunities. Although new construction and renovation projects constantly contribute to economic growth, these projects equally generate significant challenges with regards to the health of construction workers across the globe. In this article a number of health and safety hazards will be highlighted with respect to disaster risk reduction endeavors concerning construction workers. Given that, a distinct link might not be readily evident between disaster risk reduction and construction worker health and safety hazard considerations, one major objective of this article is to partially underline a potential view that the building sector can be regarded as an ongoing disaster zone. In addition, selected regional, cultural, governmental and work ethical differences that impact the working conditions of construction workers will be discussed in the context of the aforementioned view point. Due to the vast number of research areas that are interlinked with this topic, the scope of this review article is limited to only a macroscopic vantage point about disaster risk reduction and the focal point is further placed on a limited segment of the construction industry.

2. A closer view at the definition of disaster

In the daily news the frequency of the noun *disaster* is so common that many tend to shield away from this terminology. Thus, for the purpose of taking preliminary steps towards understanding events which involve disasters, identification of the meaning of a disaster is crucial. Disaster broadly refers to (Random House, 2011):

I) An occurrence that causes great distress or destruction

II) A thing, project, etc., that fails or has been

On a more detailed level, disasters can be categorized into the following types (EM-DAT, 2012): natural disasters, biological disasters, climatological disasters, complex disasters, geophysical disasters, hydrological disasters, meteorological disasters and technological disasters. Furthermore, each mentioned disaster category can also be broken down into the following subcategories:

- Natural disasters: drought, seismic activity, epidemic, extreme temperature, flood, insect infestation, mass movement dry, mass movement wet, storm, volcano, wildfire
- Biological disasters: epidemic, insect infestation
- Climatological disasters: drought, extreme temperature, wildfire
- Complex disasters: famine
- Geophysical disasters: seismic activity, mass movement dry, volcano
- Hydrological disasters: flood, mass movement wet
- Meteorological disasters: storm
- Technological disasters: industrial accident, miscellaneous accident, transport accident

The various disaster types listed, convey the global presence of disasters. In general, one could argue that the most frequent types of disasters mirrored in the media are natural disasters. Nonetheless, the impact of other types of disasters should not be neglected. In an exemplary case and for the purpose of encircling the construction sector, the number of technological disasters reported between the years 1900-2011 are shown in Figure 1.

Technological disasters cover as highlighted earlier, transport accidents, industrial accidents and miscellaneous accidents. These categories can subsequently include subdivisions such as: gas/oil leak, oil/chemical spill, building collapse, radiation, explosions, fire, poisoning, etc. In Figure 2, a global perspective regarding the reported number of people killed by technological disasters is exhibited for the years 1900 to 2011.

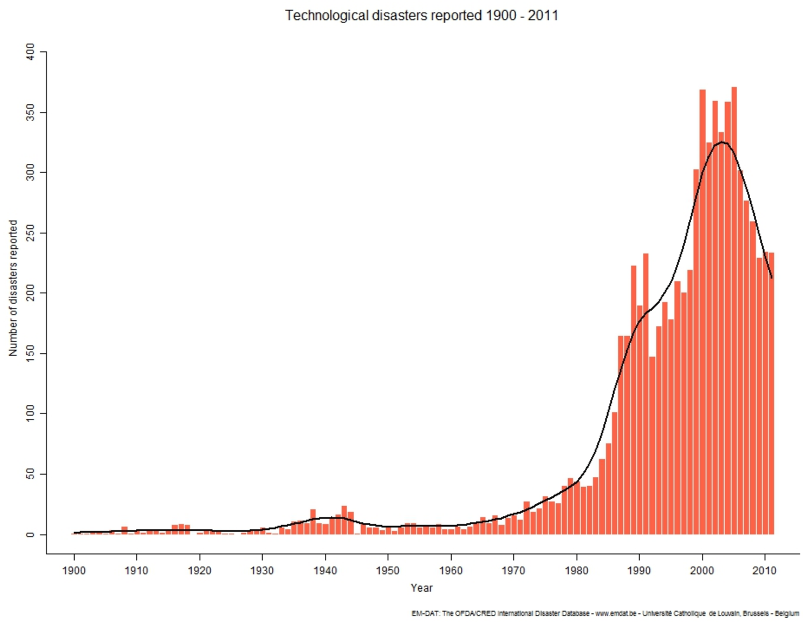

Figure 1. Number of reported technological disasters between years 1900-2011
Source: (EM-DAT, 2012).

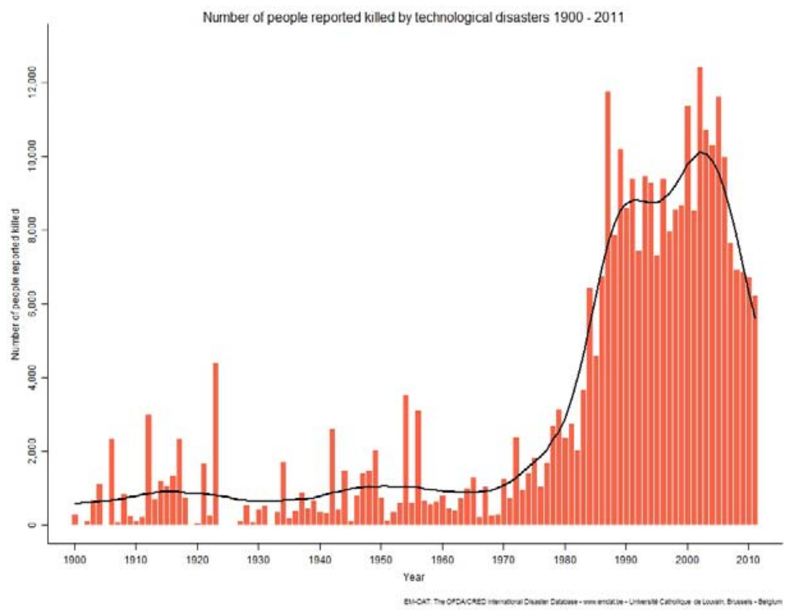

Figure 2. Number of reported people killed by technological disasters between years 1900-2011
Source: (EM-DAT, 2012).

As indicated by the trend line of this figure, historically, a rather steady increase of the death toll can be observed due to technological disasters. Despite this fact, Figure 3 further reveals that the number of people killed from this specific disaster category is far less than the number of people affected by it.

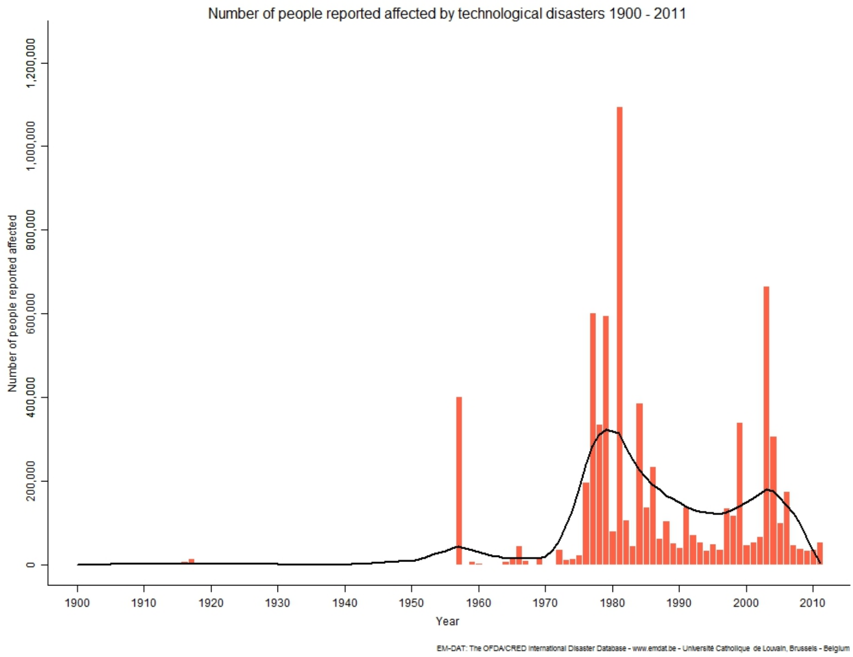

Figure 3. Number of reported people affected by technological disasters between years 1900-2011.
Source: (EM-DAT, 2012).

Although a wide range of disaster types have been listed to this point, it is legitimate to provide a broader perception regarding the definition of a disaster. Disaster can according to Khan, Vasilescu et al. (2008) be described as a sudden adverse or unfortunate extreme event which causes great damage to human beings as well as plants and animals. A combination of vulnerability and hazard, results in a disaster under the circumstances that reduction of potential chances of risk are not possible. Consequently, the impact of hazard on vulnerability causes the outcome of a disaster which can include disruptions, damages or casualties. From the early days of disaster studies (Prince, 1920) until a current view about disaster risk reduction, there has been a power importance struggle between the hazard and vulnerability blocks as explained by Alexander (2012). Extensive research work has been performed on disasters (Cuny, 1983; Heyman, Davis et al, 1991; Gilbert, 1995), hazards (Smith, 1992, Gabor and Griffith, 1980, Bogard, 1989) and vulnerabilities (Bohle, Downing et al, 1994; Chen, 1994; Anderson and Woodrow; 1991; Corsanego and Giorgini, 1993) either on individual basis or with a collective mindset to track the interactions between these elements (United Nations, 2006; Blaikie, Cannon et al, 1994; Heyman, Davis et al, 1991; UNDRO, 1982; Ebert, 2000; Coppola, 2011; Hague, 2005). The mentioned elements can also be considered for the construction sector. Prior to investigating the construction sector through the disaster prism, it is congruently important to recognize that the details of disasters can also be analyzed through the disaster risk management cycle shown in Figure 4.

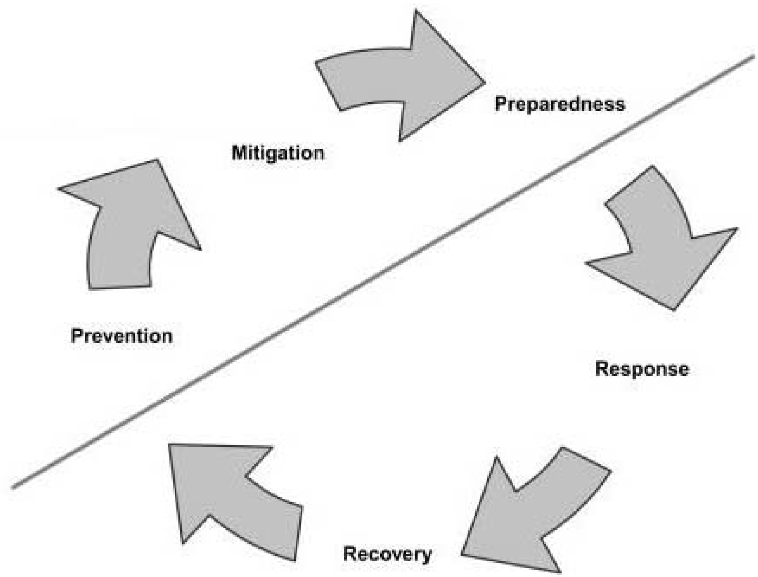

Figure 4. Disaster risk management cycle.
Source: (Keim, 2008).

Schipper and Pelling declare that prevention, preparedness, and mitigation - as well as response and recovery post-impact crisis management activities (Schipper and Pelling, 2006). Hence, the connections between all the indicated steps in Figure 4 are mapped out. In the following section, vulnerability, disaster and hazard will be discussed on a more profound level and within the context of the construction industry.

3. Viewing the building sector as an ongoing disaster zone

The construction industry is identified as of the most dangerous of all industries (Ringen and Stafford, 1996; Adsul, Laad et al, 2011; Jackson and Loomis, 2002, Ringen, Seegal et al, 1995; Sancini, Fioravanti et al, 2012). Hence, the consistent existence of a hazard block - typically represented in combination with the vulnerability block – as an enabler of a disaster is confirmed. In accordance with Figure 5, the vulnerability block is typically divided into three subcategories (Khan, Vasilescu et al, 2008): underlying causes, dynamic pressure and unsafe conditions.

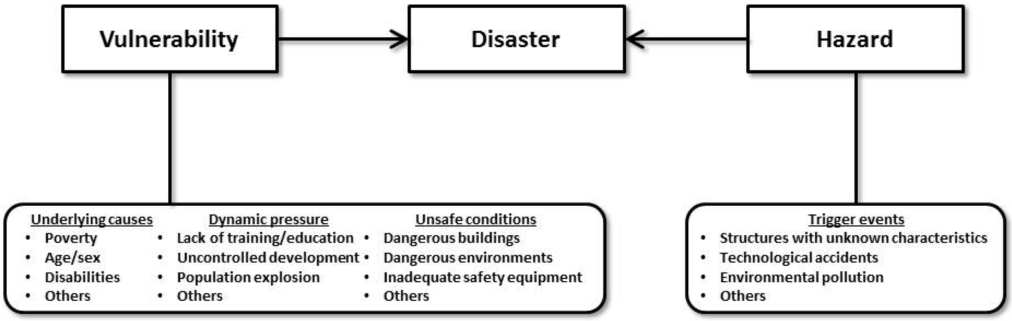

Figure 5. Vulnerability, disaster and hazard for a selected case in the construction industry

The subcategory of the hazard block further marks trigger events or events that are likely to trigger a certain type of disaster. In order to illustrate the standpoint that the activities within the construction industry indeed can be regarded as a disaster zone, sub-elements of each block have to be revisited with specific examples from the construction sector. One descriptive example that would reflect the listed items under the underlying causes subcategory is child labor within the construction industry. According to 1995 statistics from the International Labour Organization - a specialized agency of the United Nations - there are about 250 million children who engage in economic activity in developing countries alone (ILO,1999). For 48% of these children, work is a full-time activity. Among the economically active children in the 26 countries considered, 1.9% (equal distribution of boys and girls) work in the construction industry. Many suffer illnesses or injuries from their work and are subsequently forced to stop working due to work-related injuries and illnesses. But a large number of children still continue to work despite their frail health status. Dependent on their respective employment conditions, a considerable number of children work long hours every day of the week. There are also reports of low wages and unpaid working conditions which forces children to work extensive hours (ILO,1999). This facet of the construction industry provides a more transparent view about the function of the vulnerability block in a disaster scenario. Understandably, it would not be far-fetched to envision that many of the children who suffer illnesses and injuries in the construction sector also sustain disabilities due to stern working conditions. Hence, it can be established that there is an apparent link between the underlying causes block and the dynamic pressure block. One can reflect the view that it is highly unlikely for children who work long hours in the construction industry to be given the opportunity or access to adequate education or training. Factors such as uncontrolled development and population explosions add complexity to these conditions. Uncontrolled development can occur in hub areas and cities with population explosions (Bezanson, 1994). Other related effects could also emerge dependent on the conditions that might occur for specific instances.

The function of unsafe conditions in combination with items that collectively represent dynamic pressure and underlying causes, fuels the vulnerability block. Renovation, construction and related activities in the built environment involve dangerous environments or buildings. This statement can for instance be manifested by moldy buildings featuring airborne microbes (Rautiala, Reponen et al, 1996; Harrison, 1986) and harmful building materials (Natori, 2009; Fonte, Gambettino et al, 2009; Machovcova, 2010; Volland, Hansen et al, 2007; Simmons and Lewis, 1997; Warwick, 2000). The dangerous environments concern the health and hazard risks for construction workers in renovation projects and could amongst others include electrocutions (Chi, Yang et al, 2009; Zhao, Thabet et al, 2012; Janicak, 2008), fall from heights (Dong, Wang et al, 2012; Lin, Chen et al, 2011, Wong, Chan et al, 2009), and a wide range of injuries sustained from construction work and in the most extreme cases result in death (Carney, Wall et al, 2008; Hyoung-June, Young-Jun et al, 2009; Kartam and Bouz, 1998; Pines and Halfon, 1987; Ale, Bellamy et al, 2008). From this scenario, structures with unknown characteristics in combination with the effect of environmental pollution and technological accidents have represented the trigger events which fall within the hazard block in a disaster event. Conclusively, it can be asserted that all the ingredients which can result in a disaster are existent within the construction sector. Disaster in the construction industry corresponds to the temporary or permanent ill-health or death of a construction worker. In the following section, selected parts of the Swedish construction industry will be revisited in order to communicate the message that health and hazard risks for construction workers even exist in fully developed industrialized countries.

3.1 Selected glimpses of the Swedish construction industry

The total investment in the Swedish construction industry corresponds to approximately $ US 43 billion per year (Road2Science, 2012). In 2010, 85 percent of the population in Sweden lived on 1.3 percent of Sweden's area (Statistics Sweden, 2012). National effects such as the one elucidated, influence the construction sector. In the past five years, the number of construction companies has doubled in Sweden (Swedish Energy Agency, 2011). This increase partially depends on the Swedish program for repair, rebuild and extension, which essentially represents a financial support program in form of tax reductions for repair, rebuild and extension of buildings in Sweden (Swedish Radio, 2012). Despite the increase of construction companies in Sweden, a 10 percent drop has also been reported in the number of inspections by the Swedish Work Environment Authority (Swedish Energy Agency, 2011). This fact initiates debates regarding the safety status of the construction industry (Flanagan, Jewell et al, 2001). The current safety level of Swedish construction workers can be discerned through investigations about the occurrence of the number of fatalities within the Swedish construction sector in the past years.

Statistics from years 2009-2011, shown in Figure 6, indicate that the construction sector displays one of the largest numbers of fatalities among all working employees in Sweden. In year 2009, 25.7% of the reported fatalities among all working employees in Sweden belonged to the construction sector. In 2010, this number decreased down to 24.4%.

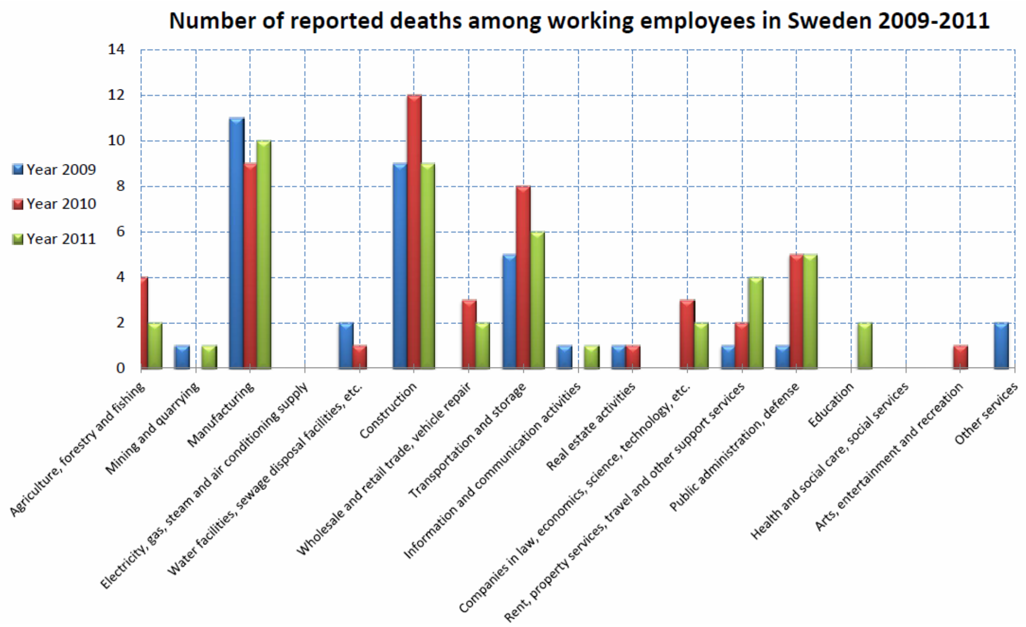

Figure 6. Occupational fatalities among employees in Sweden for the period 2009-2011
Compiled from: (Swedish Work Environment Authority Homepage, 2012)

In 2011, the decrease was even more notable and corresponded to 20.4% of the reported fatalities among all Swedish employees. Albeit the fact that the Swedish construction industry has had a decrease in the number of fatalities for the indicated time period, increasing number of construction companies in combination with a decreasing number of inspections is precarious. In recognition of the Swedish construction sector's leading position as one of the safest in the world on the subject of working conditions, physical health, injuries and accidents (Flanagan, Jewell et al, 2001), a number of studies related to the Swedish construction industry are examined. Perhaps the most efficient approach to establish some of the occupational health hazards of the Swedish construction industry is to analyze the latest set of statistics available.

Figure 7 unveils the occupational accidents of the private Swedish construction sector reported during 2011. Falls represent as shown, one of the largest portions of occupational accidents.

Moreover, loss of control in hand tools marks the second occupational accident category. The total number of reported occupational accidents in the Swedish construction sector was 906 for the year 2011. Nevertheless, the sheer fact that falls are amongst the most common occupational accidents in Sweden is not surprising as this phenomena is rather common in the global construction arena (Cheng, Leu et al, 2012; Kang, 2012; Tiesman, Konda et al, 2011; Bobick, McKenzie Jr. et al, 2010; Di Domenico and McGorry, 2009; Beavers, Moore et al, 2009; Gürcanli, Müngen et al, 2008; Gray, 2007).

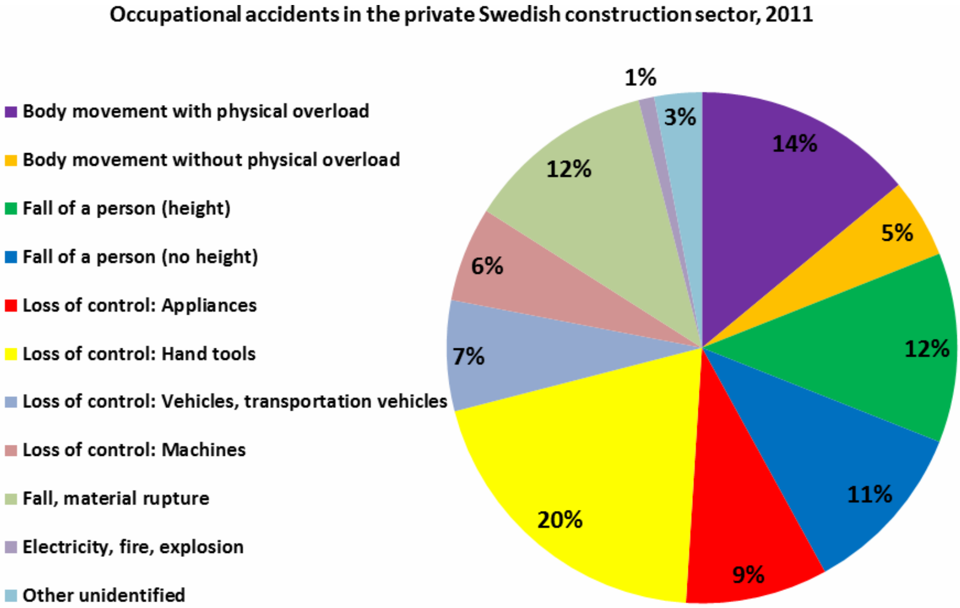

Figure 7. Categorized occupational accidents reported to the private Swedish construction sector in 2011
Compiled and arranged from Source: (Samuelson, 2012).

There has however also been Swedish prevention studies that have targeted falls. In one exemplary case, Lindblad highlighted safety rails and design solutions for actual construction settings (Lindblad, 1990). With special emphasis on construction strength, safety and ergonomic considerations, the suggested safety design solutions were proposed as one preventive measure to falling accidents in the construction industry. The aim of highlighting selected research endeavors related to the Swedish occupational accidents and diseases in building construction within this section is not provide the reader with a comprehensive review forum for all the conducted research on these areas, but rather to underline some of the research efforts in mitigating the effect of certain elements under the hazard block in Figure 5.

For the recorded occupational accidents in the private Swedish construction sector 2011, the most frequent occurrence of accidents - following falls - were observed for various categories representing loss of control and body movement with and without physical overload. As a selected paradigm among all the listed occupational accidents in Figure 7, control of hand tools has been of both international (Frank, Franke et al, 2012; Li, 2003; Myers and Trent, 1988) and national interest (Örtengren and Cederqvist, 1991; Kadefors and Areskoug, 1993; Cederqvist and Lindberg, 1993). In Sweden, the transition to battery-powered hand tools were indeed welcomed as the utilization of manual tools such as manual screw drivers were reported to cause symptoms of overload disorders (Örtengren and Cederqvist, 1991). Kadefors et al. (1993) also performed one of the many ergonomic evaluations of hand tools and this facet of the Swedish construction industry represents the significant amount of research endeavors with regards to ergonomics (Halen, 1960; Eklund and Freivalds, 1993; Törner and Pousette, 2009; Gustafson-Söderman, 1987; Hammarskjöld, Harms-Ringdahl et al,1991; Björing and Hägg, 2000). Perhaps, a justification of the need for further research into this area becomes apparent once Figure 8 is studied in detail.

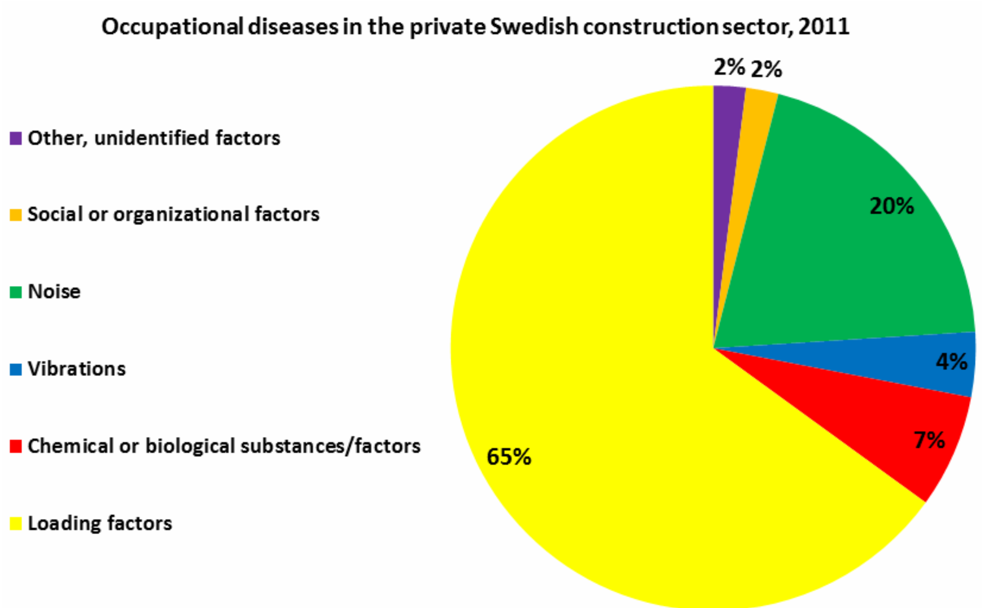

Figure 8. Categorized occupational diseases reported to the private Swedish construction sector in 2011
Compiled and arranged from Source: (Samuelson, 2012).

65% of all the 421 reported occupational diseases of the private Swedish construction sector in 2011 were related to loading factors, while 20% of all the reported occupational diseases from the same study were related to noise. In one of the subsequent sections, certain common death and ill-health causes of construction workers will be discussed in further detail. Prior to this section however, it is interesting to glance upon a number of interesting features of the Swedish construction industry.

In order to advance the level of understanding regarding the interaction of those elements that lead to a disaster scenario in the construction industry, it is important to visit a selected number of milestones from the Swedish construction industry. Construction safety has been an important priority for the Swedish construction industry. This statement is partially based on the interest the Swedish Work Environment Authority takes into ensuring safety at building sites (Swedish Work Environment Authority, 2012) and the large available research domain on this specific topic (Björing and Hägg, 2000; Helander, 1991; Hemström, Mahapatra et al, 2011; Persson and Larsson, 1991; Nik, Kalagasidis et al, 2012; Stocks, Hergens et al; 2010). In late 1960s, the construction unions and employers in Sweden established Bygghälsan, the Swedish construction industry's organization for working environment, occupational safety, and health (Sancini, Fioravanti et al, 2012). The interest for occupational safety in the construction sector has been rather continuous in Sweden. Grondstrom et al. conducted a study based on 114 non-fatal cases and 201 fatal cases in Sweden (Grondstrom, Jarl et al, 1980). Analyzing data from 1973, it was established that more than one third of the accidents occurred because of insufficient safety measures and about one fifth of the victims were injured because of technical and organizational insufficiencies. As exemplified through this research study, the authorities have been given the chance to investigate the work environment settings in consideration of possible safety legislations. Another example of the Swedish authorities' involvement for the benefit of the construction industry was through the "Starry Sky" project. In 1998, an agreement was reached between the Swedish Construction Federation, the Building Workers' Union and the National Labor Market Board in Sweden. As an informal tripartite sector management activity, the Starry Sky project was designed to maintain component manpower within the built environment during a period of reduced activity (EFILWC, 2002). The project included measures that aimed to keep building workers within the trade by developing their competencies. Throughout this project existing employees were offered further education with paid salaries, while unemployed building workers were offered their jobs in temporary placements. The salaries of unemployed workers were further supplemented by unemployment benefits. The program led to benefits for both unemployed construction workers and existing employees as they were able to again additional educational and work-related experience. This approach maintained a plentiful supply of component manpower for the following upturn in the industry increased the competitiveness. Furthermore, this proved to be a suitable effort for the State to assist the employed to move from employment policy activities to regular employment.

Yet, another aspect of interest for the construction industry is the validation of the construction workers. In a recent study, Persson conducted a validation of construction workers in Sweden (Person, 2010). This report concluded that there is an effective but uneven system of validation of construction workers' skills in Sweden. Hence, it was equally established that the current validation system had flaws and that further development actions would be needed to create a more cost-effective and flexible system that would provide the best possible value for the individual and the labor market. Budgetary constraints certainly affect the decisions companies and governmental authorities make regarding the health and safety hazard risks associated with the built environment. Closing of the Swedish National Institute for Working Life (Westerholm, 2007) and the fewer numbers of safety inspections by the Swedish Work Environment Authority (Swedish Energy Agency, 2011) portray two distinctive examples for the aforementioned statement. In addition to these multifaceted challenges, building structures with unknown characteristics could further endanger the lives of construction workers on a daily basis. In light of these aspects, additional details regarding this topic and the effect of regional differences on enabling disasters within the construction sector will be examined in the following section.

3.2 Regional differences

Murie identified a number of death and ill-health causes of construction workers according to the following (Murie, 2002):

- Falls
- Deafness
- Vibration syndromes
- Back injuries

- Other musculo-skeletal disorders
- Exposure to hazardous substances
- Dust
- Welfare and biological hazards
- Stress

Even though the listed death and ill-health factors only depict a fraction of all the ill-health and death causes within the construction industry, they still resonate with the previous findings of the Swedish construction industry. Thus, it is possible to identify commonalities in the construction sector. In this respect, one might pose the following question: *Given that the majority of death and ill-health problems and causes are known for the construction industry and the fact that many different construction safety measures are now in place, why does health and safety hazards still remain as a problem in the construction sector?*

This is a legitimate question and despite the fact that the answer to this question stretches beyond the scope of this review article, it is worthwhile to highlight a number pillars which can support the answer to such a posed question. One of the major reasons this problem is open-ended is rooted in the cause that the construction work is temporary by its nature (Ringen, Seegal et al, 1995). As construction workers often work at different building sites, a new safety dimension unfolds. Hence, even if a coherent prevention system is installed in place in one particular building site, this does not necessarily need to be the case for a different building site. Consequently, construction workers could essentially face different types of safety scenarios in their daily work. The transient work schedule of the construction workers also exposes them to different working environments that despite careful safety measures still could lead to different health and safety hazards. Abestos represents one of the hazardous materials that could lead to severe health effects for construction workers (Woodson, 2012). Building structures with unknown characteristics broadly refer to structures with ambiguities that could endanger the health of construction workers. The hazards associated with such buildings could range from electrical shocks to dangerous building materials.

The worker education and training in occupational safety and health has been considered for the construction industry (Heath, 2002; Menckel, 1990). In the wake of high observed reported fatalities in the 2006 construction and housing in Ireland, innovative health and safety training were proposed through virtual classes that apply the principles of multiple intelligence (Carney, Wall et al, 2008). Calhoun and Hallowell presented another related research study concerning the interrelationships among construction injury prevention strategies (Calhoun, Hallowell et al, 2010). The findings of this research project identified the most influential injury prevention strategies to be the employment of a site-safety manager, upper management support and commitment, work participation and involvement, safety and health committees, and a site-specific safety plan. An effort of educating construction workers in various aspects of health and hazards is not a global adopted approach. Hence, contingent on regional differences, different countries could potentially have different procedures with respect to their respective construction industry. This has clearly been observed in the European Union where migrant workers over less than a 10 year period, put the management of health and safety under pressure in the UK. The cause for the anxiety in this particular case was the change of UK construction industry's progressing relative successes in tackling safety issues to dealing with the health of construction workers (Bust, Gibb et al, 2008).

The legislation and policies of the construction sector might vary dependent on specific geographical locations. Hitherto, glances from the Swedish construction sector has revealed that there are a number of different governmental entities which participate in the process of ensuring enhanced health and safety hazard conditions for the Swedish construction workers. These efforts directly impact the occurrence of a disaster in the construction sector. Conversely to the set of available data containing occupational health statistics from the Swedish construction sector and extensive research endeavors, many countries do not even record the occupational health diseases or accidents that occur within their construction industry. Subsequently, it would be nearly impossible for those countries without any safety construction legislation in place to monitor and ensure more efficient safety measures within the construction industry once compared to those countries that make this particular effort.

The economy directly affects different approaches of disaster risk management. This certainly holds for attempts related to health and safety hazards for construction workers. Different countries can further be affected rather differently dependent on their economic status (Cho and Newhouse, 2012). Deacon concluded that the construction process was not complementary to workers health and that work related conditions exacerbate the illness arising from poor socio-economic conditions (Deacon, 2003). In an elucidating case, the adopted construction industry policy in Japan is not necessarily the same as in the UK since there are many remarkable differences between these countries (Sorrell, 2003; Haley, 1994). In the debate regarding safety and hazard risks, elements such as technical levels, work ethics and cultural heritage are brought to light (Haley, 1994; Demaid and Quintas, 2006; Ngowi, Pienaar et al, 2005; Shang, Wang et al, 2004). Revisiting the posed question once again, one can generally state that in order to adequately address the aforementioned question it is required that all the elements that independently or collectively affect the ill-health and death of construction workers have to be investigated in full detail. The proposed view point of glancing at the construction industry through an ongoing disaster zone spectacle yields to an alternative approach to disaster risk reduction. This approach consequently also bears a potential to ensure a safer environment for construction workers across the globe.

4. Future prospects

The future of the built environment is highly dependent on the health and safety hazards for construction workers. Therefore, there is an urgency for analyzing those factors that affect the health and safety hazards the most. On a general note, the main purpose of considering the construction sector as a disaster zone has been to enable a more efficient disaster risk management cycle. Under circumstances that the spotlight of various management efforts is placed on the prevention phase, this will result in a direct strategic step which has the potential to reduce the construction disaster risk.

As observed through the findings of the previous section, the sheer complexity of preventive measures for ensuring a safer environment for construction workers can however be linked to many different categories and subcategories. Even before any special efforts or initial steps are taken, the challenges readily emerge on the horizon. Therefore, it is of vital importance that various factors which could lead to the ill-health or death of construction workers are scrutinized in detail. Furthermore, additional pieces of information regarding the internal and external interactions of these elements could potentially shed light on the unexplored paths of opportunity to address the health and safety hazards for construction workers. Adopting the view point of glancing at the construction sector as a disaster zone enables a multilateral approach to a complex setting with objectives to enhance the health and safety status of construction workers worldwide, irrespective of their geographical locations.

5. Conclusions

In this article various aspects of health and safety hazards for construction workers have been reviewed and investigated through a disaster risk reduction prism. The following key features were identified through the findings of this study:

- Over the past century, an increasing number of technological disasters have been reported. Until the turn of the century, the general trend has equally pointed to an increasing death toll due to technological disasters which also include the activities of the construction sector.
- From a theoretical point of view, disaster can be perceived as a collective combination of hazard and vulnerability with subcategories such as: underlying causes, dynamic pressure, unsafe conditions and trigger events. All the aforementioned elements are present within the construction industry and this has led to the perception of glancing at the construction sector as an ongoing disaster zone. This viewpoint establishes that disaster within the construction sector corresponds to the temporary or permanent ill-health or death of a construction worker.
- Building structures with unknown characteristics may endanger the lives of construction workers worldwide and result in ill-health and death.
- The Swedish construction industry represents of the safest in the world on the subject of working conditions, physical health, injuries and accidents. Nonetheless, even this particular construction sector faces challenges with regards to the health and safety hazards for construction workers.
- Geographical location plays in important role in addressing the health and safety hazards for construction workers. Geographical considerations encapsulate regional, cultural, governmental and work ethical effects that contribute to disparities in the construction sector.
- With an increasing level of understanding for health and safety hazards in the construction industry, more efficient prevention measures can be taken in order to enable a disaster management cycle which is able to respond to the rigorous demands of the construction industry. This motivates further research into this specific subject matter.

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