

This is not the version of record. The final published version of: Umar, Tariq (2021) The costs of accidents in Qatar, Oman, and Saudi Arabia construction industry. *International Journal of Sustainable Real Estate and Construction Economics (IJSRECE)*, 2(1), pp. 61-81 can be found at <https://doi.org/10.1504/IJSRECE.2021.118079>

The Costs of Accidents in Qatar, Oman, and Saudi Arabia Construction Industry

Abstract:

Considering the construction projects and the current status of occupational safety in the Gulf Cooperation Council (GCC) region, this article attempts to estimate the costs of accidents in construction. The parameters used in these estimates include the values of the current projects in the three main countries including Qatar, Oman, and Saudi Arabia; and the amount disbursed by the government organizations against injuries, disabilities, and deaths. The total costs of an accident in Oman are estimated at US\$ 415,620 with an economic burden of US\$ 205.73 Million/year. In Saudi Arabia, the costs of an accident are estimated at US\$ 91,940, while the economic burden of the Saudi economy is estimated at US\$ 261.11 Million/year. Similarly, the costs of an accident in the Qatari construction industry stand at US\$ 205,526. The costs of an accident in these countries are quite higher than the costs in the USA, UK, AUS, and SA.

Key Words: Health & Safety, Costs of Accident, Direct costs, Indirect costs, Construction industry, Qatar, Oman, Saudi Arabia.

1. Introduction:

Accidents in construction include not only direct physical injury to persons or damage to property but also short and long term effects or incidents due to other exposures on sites that affect the workers' health and physical well-being. Costs associated with accidents in the construction industry can be categorized as direct and indirect costs. Direct costs tend to be those associated with the treatment of the injury and any unique compensation offered to workers as a consequence of being injured and are covered by workmen's compensation insurance premiums. Indirect costs include reduced productivity for both the returned worker(s) and the crew or workforce, clean-up costs, replacement costs, costs resulting from

delays, supervision costs, costs related to rescheduling, transportation, and wages paid while the injured is idle (Hinze, 1994). The costs of accidents (direct and indirect) can be substantial. Both the direct and indirect costs are used in this research to arrive at the total costs of accidents in the GCC construction industry. Research conducted in the UK showed that indirect costs are eleven times more than direct costs (Mfi, 2003). The costs of accidents in the USA were determined as 6.5% of the total value of completed work and in the UK it is approximately 8.5% of the tender value (BRT, 1995; Anderson, 1997). Waehrer et al., (2007) considered that costs of work-related accidents that result in injuries and sickness can be classified into main three categories a) direct costs, b) indirect costs, and c) quality of life cost. The cost components they included in the direct costs were;

- Payments for hospital
- Payment for the physician, and allied health services, rehabilitation, nursing home care, home health care, medical equipment, and burial costs
- Insurance administrative costs for medical claims
- Payments for mental health treatment, police, fire, emergency transport, coroner services, and property damage

Indirect costs were further classified into the following categories;

- Worker productivity losses which include wage losses and household production losses
- Administrative costs which include the cost of administering workers' compensation wage replacement programs and sick leave

The quality of life costs was referred to the value attributed to the pain and suffering that workers and their families experience due to the accident which causes injury or sickness.

Research conducted in the UK on cost and benefit analysis revealed that when total costs of accident prevention were compared to the total benefits of accident prevention, the benefits far outweigh the costs of accident prevention by a ratio of approximately 3.1, which means that when contractors, irrespective of their sizes, spend £1.00 on accident prevention, they gain £3.00 (Ikpe et al., 2012). The cost of accidents can be understood by contractors and represents a tangible measure that can be related to project financial accounts and both the income statement and balance sheet of a contractor (Tang et al., 2004; Booth and Panopoulos, 2005). The costs of the accident also affect the workers and society, as illustrated in Table 1. Thus, this category of cost is very often at the forefront of considerations of the costs of health and safety.

Stakeholders	Intangible Costs	Tangible Costs
Worker	Pain and suffering, moral and psychological suffering (especially in the case of death and permanent disability)	Loss of salary, reduction of professional capacity, loss of time (medical treatment), site compliance of health, and safety issues
Family and friends of the affected worker	Moral and psychological suffering, medical and family burden	Financial loss, extra costs, loss of time to take care of the injured worker
Coworkers	Bad feeling, worry, or panic (in case of serious or frequent accidents)	Loss of time, an increase of workload, and training of temporary staff
Employer	Bad reputation, litigation cost, insurance cost, and compensation cost	The decrease in production; damages to machinery, equipment, and material; quality losses; recruitment and training of new staff; increase of production costs; increase of insurance premium; administrative costs; litigation costs; and absenteeism
Society	Reduction of the human labor potential, and reduction of the quality of life	Loss of production, an increase of social costs, medical treatment and rehabilitation costs, and decrease of standard of living

Table 1: Costs of Accidents Incurred by Stakeholders (Ikpe et al., 2012)

Top management of construction organizations is considered to be reluctant to spend money on occupational safety and health. This is due to the fact that accidents normally don't happen in construction projects on a regular or daily basis (Agumba and Haupt, 2012; MacEachen et

al., 2010). It is therefore essential that the top management should have an awareness of the costs of accidents in their projects. This will help them to change their perception and will make them prepare to spend on safety and health matters. Hinze (2006) noted that if the actual cost of accidents is well known to the management, they will be able to make effective decisions related to the safety and health in their organizations or projects. The true cost of accidents will enable top management to consider safety and health not only a part of workers' well-being but also from an economic perspective. The true cost of accidents would also be more attractive for the owner as there could be great economic benefits for them. In this regard, the relationship between costs of safety and health and its benefits was best projected by Ikpe et al., (2012) as shown in figure 1. This figure indicates that if the prevention costs reduce, the costs of accidents will increase. Similarly, if the cost of prevention will be more the benefits arising from the low number of accidents will more.

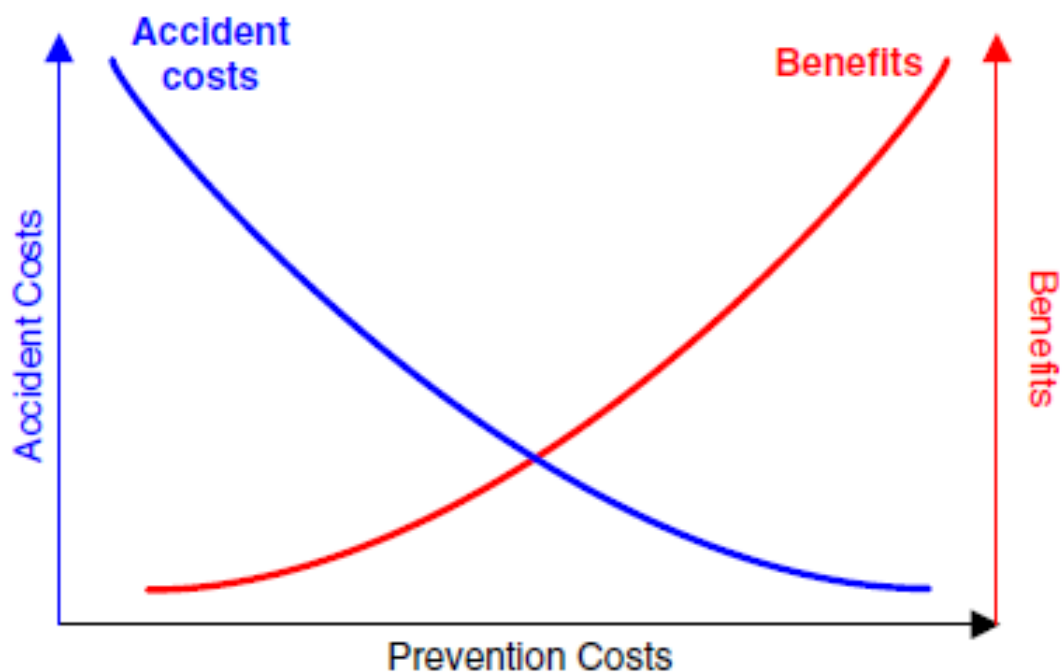


Figure 1: Typical Relationship Between Accident Costs and Prevention Costs

There have been a number of research studies around the world in which an attempt is made to estimate the costs of an accident in construction; however, there is no study on the costs of an accident in construction in any of the GCC countries (Umar, 2017). The number of accidents in these countries is comparatively high due to different reasons that include climatic conditions of the region, organizational factors, and social factors (Umar and Egbu, 2018-a; Umar et al., 2019-a). In this article, an attempt is made to estimate the costs considering the three main GCC countries including Qatar, Oman, and Saudi Arabia. A mix research method that includes qualitative and quantitative approaches as described by Umar and Egbu (2018-b) has been adopted to achieve the aim and objectives of this research. Two methods have been used to estimate the costs of accidents in the selected GCC countries. In the first method, the average value (%) of the costs of accidents is used with the current construction projects in the selected countries. The average value (%) of the costs of accidents is established in section 3, while the current construction projects obtained from different sources are presented in sections 3.1, 3.2, and 3.3. In the second method, the costs of accidents are calculated considering the number of construction workers in a specific country and the amount disbursed by the social insurance organization against the injuries or deaths in that specific country. Similarly, the average cost of an accident established in the USA, UK, ASU, and SA along with the number of accidents in the selected GCC countries are also used to determine the total costs of accidents in these countries. The results of the costs of accidents are further confirmed through a semi-structured interview process held with the construction industry professional in the GCC region. While knowing the costs of accidents in the GCC construction industry, all the stakeholders including government, contractors, consultants, clients, and the insurance organizations will put their efforts more seriously to reduce the number of accidents at construction sites. The next section discusses the costs of accidents in the construction industry.

2. Costs of Accidents in Construction:

The purpose of this section is to review the costs of accidents in the United States (USA), United Kingdom (UK), South Africa (SA) and Australia (AUS) and to establish an average cost of an accident in the construction industries of these countries. This average cost of an accident is then used to estimate the cost of an accident in the selected GCC countries. This is done due to the limited data available in the selected GCC countries to estimate the costs of accidents in the construction industries of Qatar, Oman, and Saudi Arabia. The review on the costs of accidents in the USA, UK, SA, and AUS is provided in the following paragraphs.

A research study funded by the Center to Protect Workers' Rights (CPWR) in the United States reported that the average cost of fatal or non-fatal injury arising from an accident in construction is US\$ 27,000. This cost is almost double than the average cost of fatal or non-fatal injury in other industries which stood at US\$ 15,000 (Waehrer et al., 2007). The statistics published by the National Institute of Occupational Safety and Health (NIOSH) in the United States indicate that the average cost of an accident which results in the death of a worker is US\$ 867,000 (NIOSH, 2006). This cost, however, doesn't include the cost of quality of life losses. The average cost of a fatal accident in the construction industry of the United States estimated by Waehrer et al., (2007) stands at US\$ 1.0 Million, which is comparatively more than the estimate made by the NIOSH. Overall, if the cost of the quality of life losses is also added with the average cost of a fatal accident in construction, then the total average cost will stand at US\$ 4.0 Million. In other words, the cost of the quality of life losses resulted from a fatal accident in the United States construction is equal to US\$ 3.0 Million. In terms of direct costs of non-fatal accidents in the United States construction industry, which required medical treatment, was estimated at \$777. This, however, doesn't include the cost of work or productivity which stood at US\$ 618. Thus the direct cost of non-fatal construction accidents required medical treatment with the cost of work or productivity

can be estimated at US\$ 1,395. Similarly, the direct cost of a fatal accident that requires medical treatment in the US construction industry costs around US\$ 18,300 (Miller et al., 2002; Waehrer et al., 2007). This can be translated to an average direct cost of the accident, either fatal or non-fatal, which is equal to US\$ 9,850.

A research study on the cost of accidents carried out in South Africa (SA) considering a total of 100 different types of accidents including 14 fatal accidents, estimated the total cost, including direct and indirect, of all these accidents at US\$ 2.37 Million (Haupt and Pillay, 2016). The direct cost of all these accidents was estimated at US\$ 0.726 Million, while the indirect cost of accidents stood at US\$ 1.64 Million, double than the direct cost. This can be translated that one accident in South Africa either fatal or non-fatal cost around US\$ 23,700. The direct cost of one accident in South Africa can be therefore US\$ 7260, while the indirect cost will be US\$ 16,400. The cost of one accident either fatal or non-fatal estimated in the United States (~US\$ 27,000) and in South Africa (~23,700) is considered to be comparable as the difference between both the estimates stands at 12.30%.

Description (Direct Cost)	Number of Accidents (2006-2007)	Total cost (£ Million)	Conversion Factor (from £ to US\$)	Total cost (US\$ Million)	Cost Per Accident (US\$)
Workplace Fatality	232	337	1.28766	433.94142	1,870,437
Major Injury	353,000	6,263	1.28766	8064.61458	22,846
Minor Injury	481,000	118	1.28766	151.94388	316
Illness	551,000	9764	1.28766	12,572.71224	22,818
Total:	1,385,232	16,482		21,223.21212	

Table 2: Direct Cost of Accidents in UK (HSE, 2011)

Similarly, the HSE (UK) report published in 2011, on the cost of accidents, which considered the 2006 – 2007 available data, established the direct cost of a total of 1385232 accidents and illness was US\$ 21,223.21 Million as shown in table 2 (HSE, 2011). The direct costs of one

accident (fatal or non-fatal) in the UK will there cost US\$ 15,300 if all the accidents including fatal, non-fatal with major or minor injuries and illness are considered. This direct cost of one accident in the UK (~US\$ 15,300) is double the direct cost of an accident in South Africa (~US\$ 7,260). This is maybe due to the fact the direct costs of one accident in the UK also include the cost of illness; however, the direct costs of an accident in South Africa don't include this. If the direct cost of an accident in the UK is calculated based on the fatalities and injuries accidents only, then this will be equal to US\$ 10,370; which represents a difference of 30% between the UK and South Africa accident costs. The UK direct costs of an accident (~US\$ 10,370) is closer to the direct cost of the accident in the USA (~US\$ 9,850), the difference is only 5%. If the average costs of the accidents which involve fatalities or major injuries are considered, the cost per accident in the UK will stand at US\$ 24,000.

Statistics published by the "Safe Work Australia" indicate that in 2012-2013, work-related accidents which resulted in injuries and illness put a burden of US\$ 44.02 billion on the Australian economy. This is a huge amount which is equal to 4.10% of the total Australian GDP (SWA, 2018). The statistics further reveal that the majority of the cost (~95%) was borne by the workers and society. To be more specific, the workers bear 77%, society bear 18% and employers bear 5% of the total costs of accidents in Australia (AUS). Accidents that result in injuries are accounted for US\$ 19.95 billion (~45%) of the total cost. Roughly, the direct cost of an accident in Australia is estimated at US\$ 27,100, which is almost the same as the direct cost of an accident in the United States (~US\$ 27,000).

The statistics related to the costs of accidents quoted from USA, UK, SA, and AUS show that the costs of accidents in these countries are not the same, but at the in the range of US\$ 23,700 ~US\$ 27,100 which gives an average values of the costs of accident in these countries (~US\$ 25,450) as shown in figure 2. This average cost of an accident (~US\$ 25,450) is used

in this research for further analysis to arrive at the costs of accidents in Qatar, Oman, and Saudi Arabia.

The next section describes the cost of accidents in the GCC region.

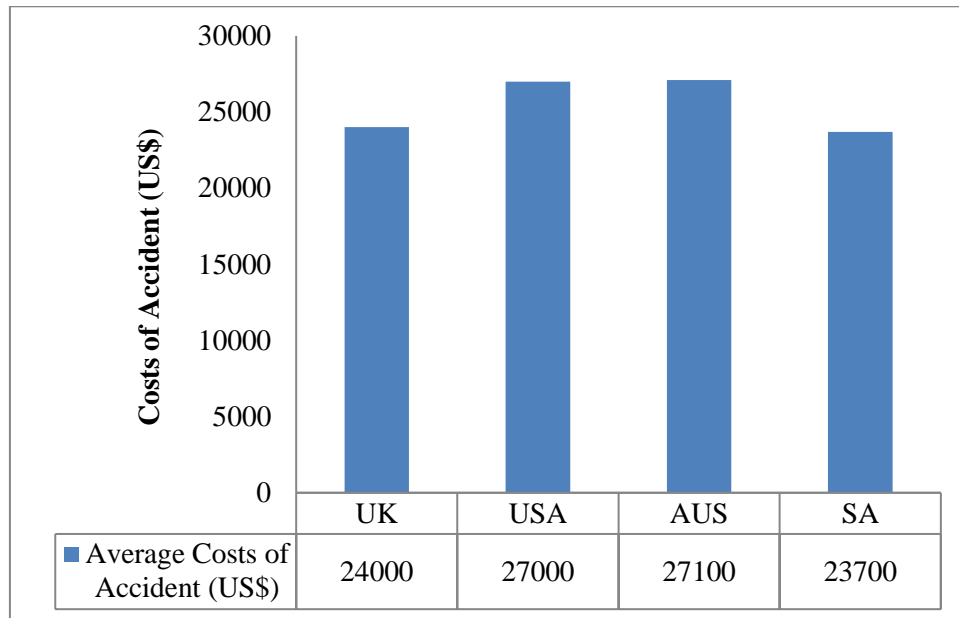


Figure 2: Average Costs of Accident (UK, USA, ASU, SA)

3. Cost of Accidents in GCC:

The Cost of Accidents in GCC construction estimated in this research is based on a number of assumptions and co-relations as there is a lack of availability of the raw data required for this purpose. For example, there is no organization in any of the GCC countries similar to the organizations available in the United States (for instance, OSHA), UK (for Instance, HSE) or Australia (for instance, Safe Work Australia). Considering the fact that the majority of the construction workers (> 90%) in GCC countries are expatriates, thus they are required to have private medical insurance. We contacted four medical insurance companies in Oman for cooperation in this research, however, no company responded. One major medical insurance company was also visited personally, however, this company refused to provide any insuree data. We also contacted five major construction companies in Oman for the same purpose;

however, no company comes forward to provide any data related to the costs of accidents and injuries. The cost of accidents, thus estimated in this article is based on the available data in three main countries within GCC including Qatar, Oman, and Saudi Arabia. The average cost of accidents in the USA, which is 6.5% of the total value of completed work and the UK, which is 8.5% of the tender value is used to establish the costs of accidents in the selected GCC countries (BRT, 1995; Anderson, 1997). Some of the recent studies reveal that the costs of accidents in construction in South Africa are 4.3% to 5.4% of the total project value (Shohet et al., 2018; Smallwood, 2004). Similarly, Everett and Frank (1996) noted that the costs of accidents in construction projects can be up to 15% of the cost of the construction. Similarly, Forteza et al., (2017) noted that the costs of accidents in the USA construction industry range from 6.5% to 7.9% of the total cost of the construction project. In another study conducted by Hallowell (2011), on the costs of accidents were reported to be 15% of the total cost of the residential project. While looking into these costs of the accidents reported above, the average costs of accidents can be calculated at 8.63% of the cost of the construction project. It has been, however, observed that the costs of accidents reported by The Business Roundtable (BRT, 1995) and Anderson, (1997) have been acknowledged and widely used by the construction management researchers as compared to the other studies. In this research, the USA and UK values of the costs of accidents reported by The Business Roundtable (BRT, 1995) and Anderson, (1997) are therefore used.

The results of this research were further confirmed through a semi-structured interview held with ten respondents from academic and industry. The results on the cost of accidents in Qatar are presented in the next section.

3.1 Cost of Accidents in Qatar:

In the first instance, the cost of accidents in Qatar is calculated based on the value of construction projects in 2018. The data published by a unique conference series related to the

projects in Qatar “Project Qatar” shows that the value of Qatar's major construction projects stood at US\$ 117.44 Billion (PQ, 2018). As noted in section 3, the costs of accidents in the USA were determined as 6.5% of the total value of completed work and in the UK it is approximately 8.5% of the tender value (BRT, 1995; Anderson, 1997). Since these costs were from different two regions, thus there is a difference of 2% in both the costs which can be usual depending on the system and procedure adopted in both the countries. Since such costs of accidents are not established in any of the countries in GCC, therefore the costs of accidents in Qatar construction projects in estimated based on the current project values and average costs of accidents established in the USA and UK. The average ratio of the costs of accidents in both countries is equal to 7.5% ($6.5+8.5/2 = 7.5\%$). Based on this rule, the total costs of accidents in the Qatar construction industry will be US\$ 8808 Million. The details of each category of the projects are shown in figure 3.

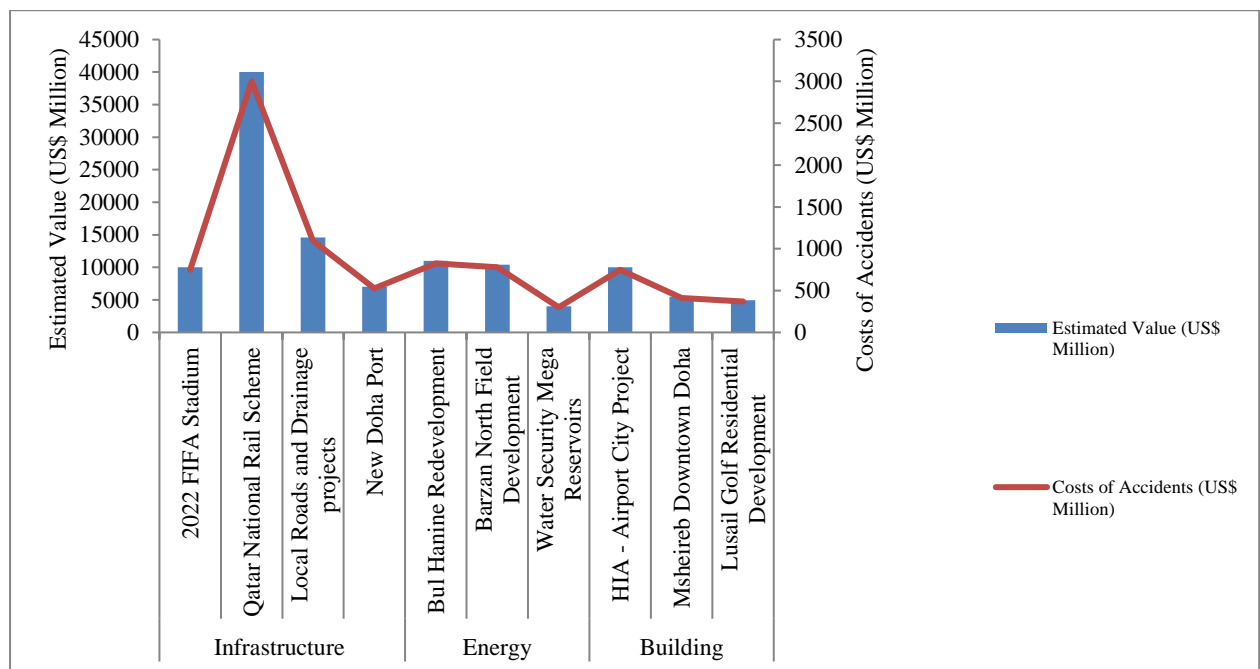


Figure 3: Costs of Accidents in Construction in Qatar

Similarly, one of the main project which has attracted the attention of the local and international organizations not only because the next football world cup will be held here but

also because of the worker's deaths in this project. Some of the reports show the number of construction workers that died in this project has already reached 1200. Several estimates predicting the number of deaths will reach 4,000 by the end of 2022 when the project will be completed (SM, 2018; ITUC, 2014; Ganji, 2016; Umar et al., 2019-b). If the costs of these accidents are estimated on the assumption that fatality costs in UK and Qatar are the same (~US\$ 1,870,437), 1200 fatalities will result in a total cost of US\$ 2,245 Million. Similarly, if the death toll will reach 4000 deaths by the end of this project, this will put a burden of US\$ 7,482 Million. Of course, this should be considered that this estimate presents the costs of fatalities arising from accidents in one construction project. This reflects that the actual burden on the Qatari economy from the costs of accidents in construction will be much more than the one quoted here.

In the second method to estimate the costs of accidents in Qatar, the statistics published by the General Retirement and Social Insurance Authority (GRSIA) of Qatar for the year 2017 are used. These statistics show that there were 75 deaths and one disability caused by work-related accidents in 2017. This is important to note that GRSIA only registers Qatari or GCC citizens into its insurance system. The total expenditures (benefits) caused by these deaths (~USD 4.31 Million) and disability (~1.37 Million) were US\$ 5.68 Million (GRSIA, 2017). The average indirect costs of one accident result in death or disability is, therefore, equal to US\$ 74,737. To determine the direct costs of these accidents, the equation developed by Haupt and Pillay (2016) was used. The assumption here is that the direct costs of an accident are half of the indirect costs. The total costs of an accident are calculated using equation No.1, which is equal to US\$ 205,526. The costs of an accident in Qatar (~US\$ 205,526) are almost nine times more than the average costs of an accident in the USA, UK, AUS, and SA (US\$ 25,450).

$$TCA = DC + 2.25 IDC \quad \dots\dots\dots\text{Equation No.1}$$

Where;

TCA = Total Costs of an Accident

DC = Direct Costs of an Accident (~US\$ 37,368)

IDC = Indirect Costs of an accident (~US\$ 74,737)

The next section aims to provide the results and discussion on the cost of accidents in Oman.

3.2 Cost of Accidents in Oman:

The cost of accidents in Oman is calculated on two different parameters as discussed in section 1. The first parameter is the same as used in Qatar, which is the construction project's values. The construction project data for the year 2015-2016 shows that the total value of different types of development projects was US\$ 163,568 Million (Umar, 2017; Umar et al., 2019-c). If it is assumed that that the cost of accidents in the USA, UK, and Oman are comparable and the average values of the costs of accidents from the USA and UK are applied in Oman, the total costs of accidents will be US\$ 12,268 Million as shown in figure 4.

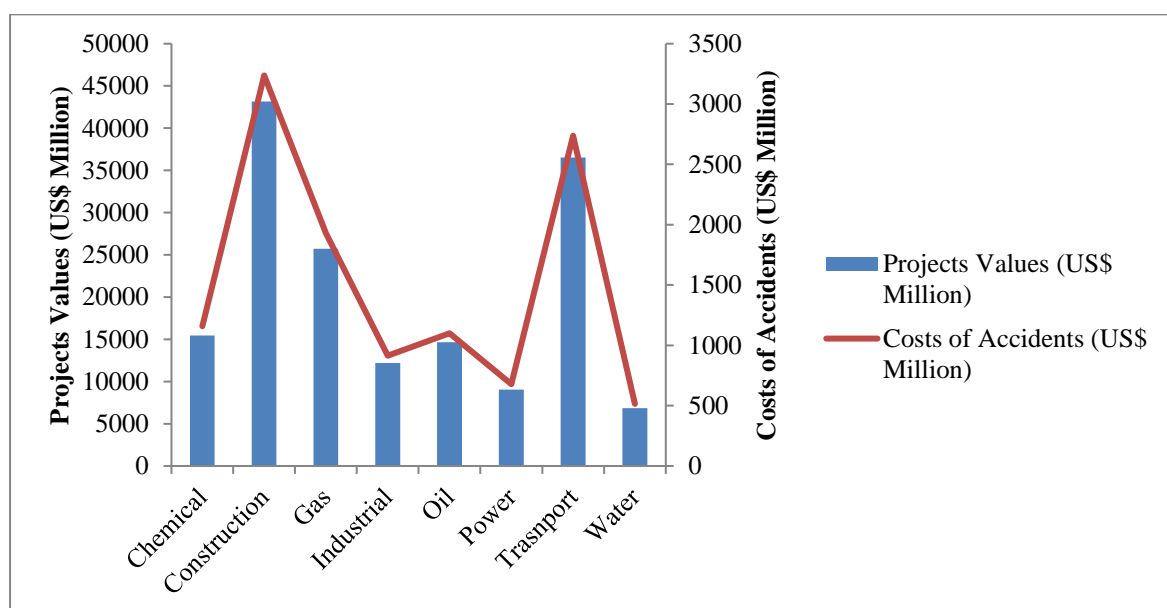


Figure 4: Costs of Accidents in Oman

The second estimate is based on the data obtained from the PASI in Oman which registered only Omani citizens in the system. The data shows that a total of 495 cases of work-related injuries were disbursed. The total number of active insurees by the end of 2017 was 233,859 (PASI, 2017). The causes of these injuries and types of benefits given for these injuries are given in table 3 and table 4.

Cause of Injury (Standard PASI Classification)	Number of Injuries	Percentage (%)
Traffic Accident	154	31.11
Slipping and Falling of Worker	133	26.87
Falling Object on the Injured	43	8.69
Getting Crammed Between Solid Objects	43	8.69
Crashing With Other Objects	31	6.26
Falling from the Top	30	6.06
Collision With Moving Machines	10	2.02
Others	51	10.30
Total	495	100

Table 3: Causes of Injuries Cases Disbursed by PASI

Types of Benefits Disbursed (Standard PASI Classification)	Number of Cases	Percentage (%)
Work off or Days off Allowance due to Work-related Injury	399	80.61
Work-Related Injury Lump Sum Compensations Partial Disability with less than 30%	46	9.29
Partial Disability Pension from (30%) to less than (100%)	25	5.05
Occupational Death Pension	21	4.24
Full Disability Pension (100%)	4	0.81
Total	495	100.00

Table 4: Types of Benefits Disbursed Against Injuries Cases by PASI

The costs of these accidents are calculated based on the average cost (~US\$ 25,450) of an accident derived from the average costs of accidents in the USA, UK, AUS, and SA. The

assumption is that the accident cost in Oman could be the same as the cost of an accident in the USA, UK, AUS, and SA. Based on this assumption, the cost of these accidents is estimated at US\$ 12.59 Million. Similarly, the amount of compensation disbursed by the PASI in 2017 against these cases (~495) is equal to US\$ 8.16 Million or US\$ 151,135 per injury (table 5). This can be classified as the indirect cost of the injury as this amount doesn't include direct costs such as medical treatment etc. The comparison of this indirect cost of injury in Oman (~US\$ 151,135/injury) with indirect of the accident in SA (~US\$ 16,400), reflects that the indirect cost of an injury in Oman is almost 10 times more than the cost of an injury in SA. To determine the direct costs of these accidents, the equation developed by Haupt and Pillay (2016) was used (equation No.1). The assumption here is that the direct costs of an accident are half of the indirect costs. Thus for the calculation of the total costs of an accident in Oman, the direct costs are considered as US\$ 75,567 per injury.

Type of Expenditure	Year			
	2016		2017	
	Amount (US\$, 000)	% of Total Expenditure	Amount (US\$, 000)	% of Total Expenditure
Full Occupational Disability Pensions	449.93	6	533.16	6.5
Partial Occupational Disability Pensions	975.29	12.9	1,141.74	14
Occupational Death Pensions	4,379.71	58.1	4,665.80	57.2
Work-Related Injury Lump Sum Compensation	314.69	4.2	332.90	4.1
Daily Allowance in Case of Work-Related Injury	1,422.63	18.9	1,487.65	18.2
Total Expenditures Against Work-Related Injuries and Occupational Diseases	7,542.26	100	8,161.25	100

Table 5: Types of Expenditure against Work-Related Injuries

The total cost of an accident in Oman is thus estimated at US\$ 415,620, which is 16 times more than the average costs of an accident in the USA, UK, SA, and AUS (~US\$ 25,450). The total costs of an accident in Oman result in an economic burden of US\$ 205.73 Million

per year on the Omani economy. The results and discussion on the cost of accidents in Saudi Arabia are presented in the next section.

3.3 Cost of Accidents in Saudi Arabia:

The costs of accidents in Saudi Arabia are calculated based on two methods, which are a) the values of the total projects in different sectors in Saudi Arabia and using a cost of accidents ratio which is 7.5% of the value of the projects; and b) the number of different types of accidents using an average obtained from a reliable sources and using the average costs of an accidents determine from the costs of accidents in USA, UK, SA, and Australia. The values of the different types of projects from 2015 to 2018 were obtained from the Venture Onsite website, which is of the leading organization tracking the construction projects across the Middle East and Africa region for more than 15 years. The contracts awarded in different sectors in Saudi Arabia are shown in figure 5 (Venture Onsite, 2018).

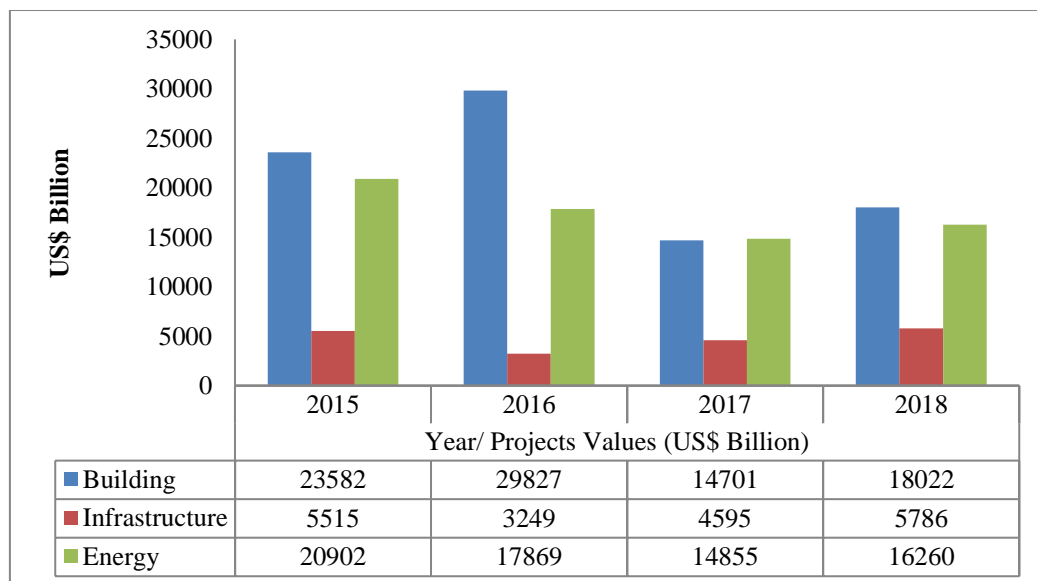


Figure 5: Contracts Awarded During 2015-2018 in Saudi Arabia (Venture Onsite, 2018)

To determine the costs of accidents in the development projects in Saudi Arabia, the average percentage (~7.5%) as the costs of accidents are used. The total costs of the accidents determined based on this principle are given in table 6. Since in this method the costs are

dependent on the value of the projects, therefore as the value of the projects reduces the costs of accidents reduced as well. It can be clearly evident from table 6 that the costs of accidents in 2018 are less than the costs of accidents in 2015. This doesn't represent that the safety performance in 2018 has been improved compared to 2015. But the fact is that the values of the project are less in 2018 than in 2015. This was due to the economic conditions of the country which is heavily reliant on oil and gas earning. The dip in petroleum prices has also affected the development projects not only in Saudi Arabia but across the GCC.

Sector	Year							
	2015		2016		2017		2018	
	Projects Values (US\$ Billion)	Costs of Accidents (US\$ Billion)	Projects Values (US\$ Billion)	Costs of Accidents (US\$ Billion)	Projects Values (US\$ Billion)	Costs of Accidents (US\$ Billion)	Projects Values (US\$ Billion)	Costs of Accidents (US\$ Billion)
Building	23,582	1,768.65	29,827	2237.025	14,701	1,102.575	18,022	1,351.65
Infrastructure	5,515	413.625	3249	243.675	4,595	344.625	5,786	433.95
Energy	20,902	1567.65	17,869	1,340.175	14,855	1,114.125	16,260	1,219.5
Total	49,999	3,749.925	50,945	3,820.88	34,151	2,561.33	40,068	3,005.1

Table 6: Costs of Accidents in Different Sectors of Saudi Arabia.

In the second method of estimating the costs of accidents in Saudi Arabia, the raw data was obtained from the General Organization for Social Insurance (GOSI), Saudi Arabia. The only accidents resulting in injuries, data that are available on the website were for the third quarter of 2018. Since the data for the whole year was not available; the numbers of different types of accidents were multiplied by 4 considering that GOSI divides one year into four quarters and assuming that the numbers of accidents in other quarters of 2018 were the same. This data is presented in table 7 (GOSI, 2018). The total number of accidents resulting in injuries or deaths in 2018 was estimated at 31,104. The average costs of one accident determined from the data obtained from the USA, UK, SA, and AUS were US\$ 25,450. Thus the total costs of these accidents will result in a burden of US\$ 791.59 Million to the Saudi economy. If the

costs of these accidents are estimated based on the average costs of an accident in Oman (~US\$ 415,620), this will result in a total cost of US\$ 12,927.44 Million.

Office name	Third Quarter Data (2018)				The Whole Year Data (2018)			
	Injuries distribution in the private sector by recovery situation				Injuries distribution in the private sector by recovery situation			
	Cured Without Disability	Cured With Disability	Death	Under recovery	Cured Without Disability	Cured With Disability	Death	Under recovery
Riyadh Office	864	182	7	612	3,456	728	28	2,448
Al Qassem Office	47	9	1	116	188	36	4	464
Hail Office	6	0	1	17	24	0	4	68
Al Kharj Office	0	1	0	26	0	4	0	104
Makkah/Jeddah Office	793	59	1	657	3,172	236	4	2,628
Makkah Office	319	24	3	137	1,276	96	12	548
Madinah Office	199	35	0	332	796	140	0	1,328
Tabouk Office	28	2	0	43	112	8	0	172
Al Taif Office	60	2	0	57	240	8	0	228
Yanbu Office	29	11	0	45	116	44	0	180
Eastren Region Office	1,181	23	2	504	4,724	92	8	2,016
Ahsa Office	197	7	1	188	788	28	4	752
Al Jouf Office	0	0	0	1	0	0	0	4
Jubail Office	228	17	0	127	912	68	0	508
Hafer Al-Batin Office	0	0	0	8	0	0	0	32
Northren Borders Office	1	3	0	2	4	12	0	8
Assir Office	29	4	0	305	116	16	0	1,220
Jazan Office	2	1	0	140	8	4	0	560
Al Baha Office	6	0	0	24	24	0	0	96
Najran Office	12	4	0	20	48	16	0	80
Bisha Office	1	2	0	11	4	8	0	44
Total	4,002	386	16	3,372	16,008	1,544	64	13,488

Table 7: Different Types of Accident in Saudi Arabia in 2018 (GOSI, 2018)

Similarly, the statistics published by the GOSI as shown in table 8, show that in the third quarter of 2018, a total of US\$ 13.44 Million against the disabilities or deaths caused by accidents at the workplace. The total number of disabilities (~386) and deaths (~16) in the same period were 402. Thus the indirect costs per accident which result in disability or death can be therefore estimated at US\$ 33,433. Although this cost as an indirect cost is

comparatively low than the indirect cost of an accident in Oman (~US\$ 151,135), however, it is still double the indirect cost of an accident in SA (~US\$ 16,400). The total cost of an accident in Saudi Arabia is estimated using equation No.1, assuming that the direct costs of accidents are half of the indirect costs. Thus, for this calculation, the direct costs of an accident are assumed as US\$ 16,716. The total costs of an accident in Saudi Arabia are thus estimated at US\$ 91,940. If the rate of disabilities and deaths arising from accidents in other quarters of the year will be the same, then the total number of such accidents could be 1608 (= 4 x 402). The total burden of these accidents on the Saudi economy will be therefore US\$ 147.84 Million per year. This is important to note that this amount could be more than what is estimated here as there are still cases (~3,372) in the same quarter which are still under treatment. Overall, the disabilities and deaths in the same quarter represent 9.12% of the total treated cases. If the same percentage of disabilities and deaths is applied to cases that are still under treatment, there will be a further of 308 cases that could end with disabilities and deaths. The total economic burden on the economy in one year from all these accidents will reach US\$ 261.11 Million.

Third Quarter 2018	Occupational Hazards Benefits																							
	Monthly Benefits												lump sum				Marriage grant				Death Grant			
	Partial Disability				Full Disability				FAMILY MEMBERS								Saudi		Non-Saudi		Saudi		Non-Saudi	
Office name	Saudi		Non-Saudi		Saudi		Non-Saudi		Saudi		Non-Saudi		Saudi		Non-Saudi		Saudi		Non-Saudi		Saudi		Non-Saudi	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Riyadh Office	274,498	9,875	324,307	368	94,923	0	174,478	0	483,271	1,159,190	87,506	966,212	173,870	59,729	1,739,601	1,614,113	0	0	0	3,375	10,000	11,667	0	0
Al Qassem Office	11,948	0	1,275	0	23,786	0	0	0	88,591	171,836	1,286	4,814	49,825	0	119,306	0	0	0	0	0	0	0	0	0
Hail Office	19,369	0	0	0	0	0	0	0	86,934	103,789	0	700	0	0	0	0	0	0	0	0	0	0	0	0
Al Kharj Office	7,037	0	0	0	0	0	0	0	37,617	104,084	0	0	0	0	720	0	0	0	0	0	0	0	0	0
Makkah/Jeddah Office	132,949	0	12,769	0	42,242	2,976	10,107	0	307,479	826,711	4,340	45,063	4,839	0	1,144,055	0	0	30,429	0	0	0	0	0	0
Makkah Office	22,156	0	1,200	0	14,231	0	0	0	141,429	356,219	7,479	8,563	50,000	0	385,542	300,000	0	0	0	0	0	0	0	0
Madinah Office	32,320	0	4,058	0	21,994	0	0	0	102,156	230,865	1,258	4,566	0	0	147,723	29,400	0	0	0	0	0	0	0	0
Tabouk Office	10,487	0	2,924	0	7,476	0	0	0	41,241	79,053	0	0	0	0	20,463	0	0	0	0	0	0	0	0	0
Al Taif Office	6,267	0	0	0	2,976	0	0	0	25,542	196,157	0	750	0	0	14,640	0	0	0	0	0	0	0	0	0
Yanbu Office	26,132	0	0	0	11,976	0	0	0	53,897	196,036	0	1,359	83,290	0	27,795	0	0	0	0	0	0	0	0	0
Eastren Region Office	325,209	0	8,594	0	94,819	0	0	0	416,761	1,377,313	3,734	25,679	658,025	0	151,642	0	0	37,969	0	0	0	0	0	0
Ahsa Office	222,521	0	1,425	0	50,702	0	0	0	379,032	1,164,342	1,089	10,355	102,723	0	112,230	0	0	44,571	0	0	0	0	0	0
Al Jouf Office	6,319	0	0	0	15,480	0	0	0	40,955	77,000	0	0	0	0	5,997	0	0	0	0	0	3,333	0	0	0
Jubail Office	107,483	0	3,055	0	49,813	0	0	0	177,848	494,967	2,800	17,781	0	0	52,263	165,000	0	6,210	0	0	0	0	0	0
Hafer Al-Batin Office	5,709	0	0	0	14,607	0	0	0	30,983	91,274	0	1,592	0	0	0	0	0	6,750	0	0	0	0	0	0
Northren Borders Office	5,878	0	0	0	0	0	0	0	41,991	81,489	0	0	0	0	7,588	0	0	0	0	0	0	0	0	0
Assir Office	24,340	0	0	0	17,976	0	0	0	212,016	393,474	1,035	518	0	0	60,870	0	0	0	0	0	0	10,000	0	0
Jazan Office	28,541	0	0	0	4,331	0	0	0	111,207	267,167	0	4,835	0	0	2,415	0	0	0	0	0	0	0	0	0
Al Baha Office	18,281	0	0	0	5,250	0	0	0	28,319	90,020	0	1,150	0	0	0	0	0	0	0	0	0	0	0	0
Najran Office	20,794	0	600	0	13,234	0	0	0	83,757	190,666	0	397	0	0	0	0	0	0	0	0	0	0	0	0
Bisha Office	2,570	0	0	0	0	0	0	0	43,141	101,510	397	1,695	0	0	0	0	0	0	0	0	0	0	0	0
Dawadmi Office	0	0	0	0	0	0	0	0	12,864	51,498	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	131,0809	9875	360207	368	48,5815	2976	184585	0	294,7032	7,804,486	110,925	109,6030	112,2571	59,729	3,992,848	2,108,513	0	125,929	0	3,375	13,333	21,667	0	0
Monthly Benefits	14,313,106												Lump Sum + Marriage + Death Grants:				7447,965							
Total Benefits for One Quarter	42939318.66																							
Grant Total	42,939,318.66 + 7,447,965 = 50,387,283 Saudi Rials = US\$ 13,436,608.80 or US\$ 13.44 Million																							

Table 8: Benefits against Disabilities and Deaths Arising from Accidents (GOSI, 2018)

Since the cost of accidents in the Qatar, Oman and Saudi Arabia presented in the above section was based on the cost of accidents in other countries, semi-structured interviews were conducted with the expert in the construction industry to ascertain their view on the results presented in this paper. the results of the semi-structured interviews are presented in the next section.

4. Semi-Structured Interview:

One of the main limitations of this research was that the direct costs of the accident were assumed to be similar to of UK, USA, SA, or AUS. This assumption was made due to the fact that the authors were not able to get the data to estimate the direct costs of the accident in any of the selected GCC countries. To confirm the finding of this research, a total of 10 interviews with the main stakeholders across the GCC countries were conducted. An approach of semi-structured interviews was considered to be best suited in this situation. Five interviewees have selected from academic and five from the construction industry. Interviews within Oman were conducted face-to-face, while interviews from other GCC countries were conducted telephonically. The interviewees were selected in a way so that more accurate and reliable information could be obtained. Academic interviewees were selected from across the GCC countries representing the top leading universities. The condition for academic interviewees was that the respondents should be at the rank of full-time professor with a research interest in construction management. The interviewee should have their academic qualifications in civil or a closer field of engineering. Likewise, the interviewees from the industry were also selected from all over GCC countries representing the leading construction organizations. The respondents were chosen on the criteria that they must be at a managerial role who have safety-related responsibilities. The minimum experience at managerial roles for interviewees was set as 10 years. Their organizations must be registered as an excellent grade company in any GCC country and should be able to participate in all tenders in that

country. During the interview process, the interviewees were given an insight into the current research with the key areas to improve safety and health in the GCC construction. All the interviewees agreed that the costs of accidents derived from different available data in GCC countries reflect the actual costs of an accident in construction. Most of the interviewees showed their concern regarding the availability of data for research studies. Two of the interviewees from academics mentioned that he assumes that the direct costs of accidents in GCC countries could be more than the direct costs of accidents in the USA or UK. They pointed out that this could be because of the high costs of medical treatment in GCC countries. Both of them, however, confirmed that the estimates made by the authors will attract the attention of the decision-makers both at government and construction organizations as these estimates would be somehow shocking for them. One of the interviewees, while agreeing with the costs of the accident presented in this article pointed out that such results will force the management of construction organizations to invest in safety and health-related factors. An interviewee from the industrial background, show a high interest in the results of the costs of an accident in construction and stated that such results could be helpful to motivate the industry towards improved safety and health performance.

The next section aims to provide a discussion and conclusion of the research presented in this paper.

5. Discussion and Conclusion:

The improved safety performance could not be achieved until there is some investment in it. Owners or management of the construction organizations remains reluctant to spend money on safety as they ignored the consequences even the financial. One of the main factors which could motivate the owner and the management of the construction organizations to spend on the safety and health-related issue, that they know the costs of accidents. When the top

management or the owner will have a clear idea of the costs of accidents, they will be then prepared to spend on the preventive measure. The matter is not only associated with organizations but there is also a need for awareness at government level as how much their country's economy is affected by such costs which can be prevented by a small investment. This article estimates the costs of accidents arising from the workplace in GCC. The GCC construction market is grooming and provides jobs to millions of peoples both locally and internationally. The current status of safety and health of workers in this region has attracted the attention of media due to the number of world renowned projects such as the FIFA world cup stadium in Qatar. Some reports indicate that the worker's deaths have already reached 1,200 and it may hit 4,000 deaths by 2022 when the project will be completed. In such a situation the estimate of the costs of accidents in this region may be helpful to motivate both the government and construction organizations working in this region to improve their safety performance. Three countries among the GCC including Qatar, Oman, and Saudi Arabia were selected to estimate the costs of the accident. Different parameters were used to estimate these costs in this region. The average values of the cost of accidents based on the values of the project in the USA and the UK are calculated as 7.5%. First, the costs of accidents in Qatar, Oman, and Saudi Arabia are calculated based on this value (~7.5%) and the current projects in these countries. The results show that the costs of accidents on this principle are US\$ 8,808 Million in Qatar, US\$ 12,268 Million in Oman and US\$ 3,005.1Million in Saudi Arabia. In the second method, the costs of accidents are calculated on the amount paid against injuries, disabilities, and deaths in Oman and Saudi Arabia. There were 75 deaths and one disability caused by work-related accidents in Qatar. The total expenditures of benefits caused by these deaths (~USD 4.31 Million) and disability (~1.37 Million), was US\$ 5.68 Million which were translated into a total cost of an accident in Qatar as US\$ 205,526. The amount of compensation disbursed by the PASI in 2017 against these cases (~495) is equal to

US\$ 8.16 Million or US\$ 151,135 per injury, which is considered as indirect costs of an accident in Oman (Umar et al., 2018). The total costs of an accident in Qatar and Oman are then calculated considering the relationship between the direct and indirect cost of an accident. Based on this relationship the estimated costs of an accident in Qatar stand at US\$ 205,526; while in Oman it is standing at US\$ 415,620. The costs of accidents in Qatar (~US\$ 205,526) and in Oman (~US\$ 415,620) are nine times and 16 times more than the average costs of an accident in the USA, UK, SA, and AUS (~US\$ 25,450) respectively. This translates into an economic burden of US\$ 205.73 Million per year on the Omani economy. The available statistics related to compensation against injuries, disabilities, and deaths published by the government agency in Saudi Arabia; show that in the third quarter of 2018, a total of US\$ 13.44 Million against the disabilities or deaths caused by accidents at workplace. The total number of disabilities (~386) and deaths (~16) in the same period were 402. Thus the indirect costs per accident which result in disability or death can be therefore estimated at US\$ 33,433. The total costs of an accident in Saudi Arabia are estimated at US\$ 91,940. The economic burden of these accidents on the Saudi economy is calculated using ratio analysis between the amounts disbursed in one quarter and the number of disabilities and death in the same quarter. This method was applied as the data for the remaining quarters was not available. The total number of accidents resulting in disabilities and deaths is therefore estimated at 2,840 per year. The total costs of these accidents ($2,840 \times 91,840 = 261.10$ Million) put an economic burden of US\$ 261.10 Million per year on the Saudi economy. Finally, the results of the costs of the accident are confirmed through a semi-structured interview held with respondents from academic and industry. Construction organizations and insurance companies are required to facilitate such research so that a more reliable estimate of the costs of an accident in GCC's construction could be produced.

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