

# The Relationship between National Income and Occupational Injury

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## ABSTRACT

In this paper, we analyze the relationship between national GDP and safety standards by determining if the rate of fatal occupational injury is high or low. We examine countries in two broad categories: the developed markets and the emerging markets. This study is limited for the seven year range of 2011 through 2007. Among the selected countries in the developed economies are the USA, Norway, Germany, and United Kingdom. Among the selected countries in the emerging market countries are Russia, India, Mexico, and Thailand. We determine that countries in the emerging markets have higher rate of fatal occupational injury compared to the countries with developed economies. This analysis also demonstrates that national income and safety standards relate by determining the level of rate of fatal occupational injury low or high.

*Keywords: National income, Gross Domestic Product (GDP), occupational injury, safety standards*

## 1. INTRODUCTION

Is there a significant correlation between the wealth of a nation and its rate of fatal occupational injury? The quest to address that question is the focus of this study. In order to examine this problem it is deemed that the study must be limited to a manageable number of selected nations that represent either developed or emerging economies. This study has narrowed the number of developed and emerging economies to four nations each. The emerging nations are Russia, India, Mexico, and Thailand and the developed ones are the USA, Norway, Germany, and United Kingdom. In order to show the relationship between these two sets of economies, a few assumptions have been made. The first assumption is that the developed economies have more robust regulatory statutes that better prevent occupational injury and that these laws are more rigorously enforced. The second assumption is that regulations in emerging economies are either less demanding and/or less assiduously enforced. Even with this assumed disparity, occupational accidents happen in all nations, even in highly developed economies. The Fukushima nuclear power plant accident in 2011 has killed an estimated 1,600 people from post evacuation conditions in highly developed Japan [1]. The evidence for this study is derived from statistics about the eight selected nations GDP, their number of workers, cases of fatal occupational injury, and their rates of fatal occupational injury. The connection between national income and occupation injury which may be empirically assumed is strongly verified by the data presented.

## 2. LITERATURE REVIEW

The key purpose of this study is to understand the core reasons of man-made accidents. Various researchers have studied similar questions to the one posed here. Khazai, Merz,

Schulz, & Borst have used a framework to describe a regions exposure to indirect disaster losses. This proposed framework enables the combination of sub-systems including industrial and social ones and identifies a regions vulnerability to losses. It further exposes the characteristic fragilities of the region and the coping capacities of the people within affected areas to deal with such damages. An advantage of this indicator-based approach is that it can be widened to include the vulnerably of other sub-systems such as Agricultural or Ecological. One of the key advantages of this technique is that it can identify the most vulnerable regions and even rank different regions as to their susceptibility. This in turn can lead to better planning and implement the most cost effective mitigation measures. The model is implemented through multi-criteria decision analysis software [2].

A study by Park has recognized a set of statistically significant relationships which quantifies the variables that determine the safety performance of a society. The findings largely confirm the inverted *u*-curve or Safety Kuznet curve. This hypothesis identifies the relationship between the safety performance in a society and its level of national income. These findings have some potential implications. The first is for the policy makers in nations that show a higher potential for man-made disasters. Included among these are the rapidly growing economies and newly industrialized countries such as China and India. The repeated mining accidents in China, for example, are likely the result of failure to comprehend the root cause of the disasters. The other major implication is for multinational insurance companies. They need to exhibit extra caution for those countries that are at higher risk, and they can develop a better strategy which may be more culturally sensitive but may have a justifiably higher premium due to greater risk [3].

What may be the worst industrial disaster ever, may have resulted, according to recently released documents, from the attempt to reduce operating costs which led Union Carbide India Limited (UCIL) to cost cutting design flaws according to MacKenzie. The disaster which occurred at the pesticide plant in Bhopal, India on December 2–3, 1984 resulted in about 8,000 people killed and another 150,000 injured [4].

The central thesis of an investigation by Saaroni is that while the risk of disaster may be mitigated, not all disasters can be prevented. The very concept of risk itself is based on human perception and may not account for the infinite and unknown number of possible variables. It is not possible to find all risk factors that may result in industrial disasters. In those instances where crucial risks are identified, they still may not be manageable in an industrial setting which is usually a complex system. A further complication is that industrial complexes are created and run by humans. This alone puts doubt into industrial disaster prevention. Other factors such as environmental factors and conflict may also avert industrial disaster prevention [5].

Passariello reported in the Wall Street Journal that well-known American and Western retailers became part of factory disaster legacy of Bangladesh in 2012 and 2013. Tazreen Fashion Limited violated fire safety rules that resulted in tragedy affecting a great number of employees and their family. Tazreen Fashion Limited was making clothes for Walmart and Sears. Liberty Fashion Wears Ltd had structural failures at their facility, and the Rana Plaza Factory also had a structural fault that led to a collapsed building. With these aforementioned industrial disasters, many famous retailers associate, such as Hennes & Mauritz AB, Zara parent Inditex SA, British retailer Primark, part of Associated British Foods PLC, Tesco PLC, Carrefour SA, Debenhams PLC, PVH Corp., Calvin Klein, N Brown Group PLC, Wal-Mart Stores Inc., and Gap Inc. all demanded that the manufacturers enforce improved safety practices [6].

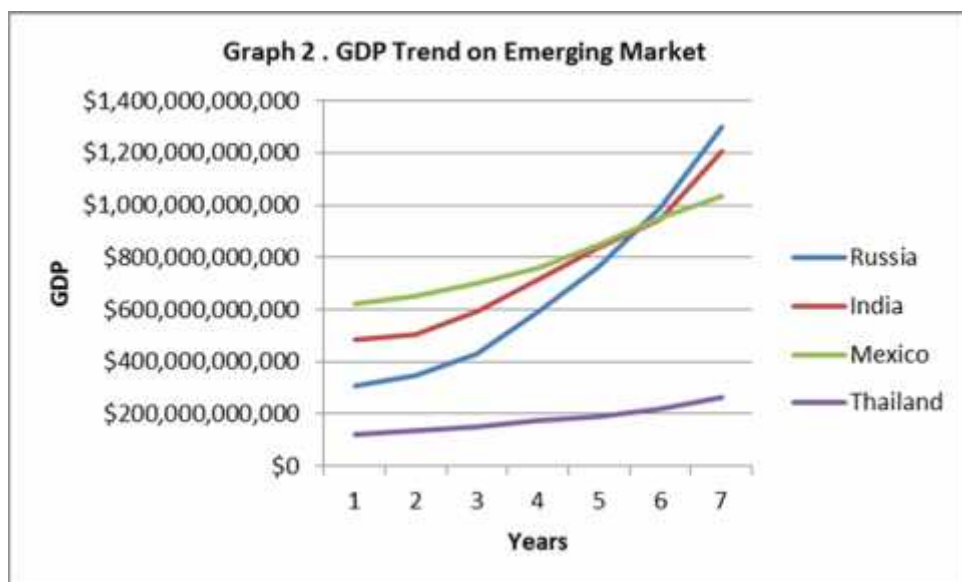
### 3. DATA AND METHODOLOGY

Our hypothesis is that the relationship between safety performance in a society and level of national income determine the occurrence of fatal occupational injuries (See Graph 1). If the country has low criteria for safety standards then the country, the evidence shows, has more cases of fatal occupational injuries. On the other hand, countries with higher safety standards generally have fewer cases of occupational injuries. We compare four countries from the emerging markets and four countries from the developed economies. The four selected countries from the emerging markets are Russia, India, Mexico, and Thailand. The ones from the developed economies are USA, Norway, Germany, and United Kingdom. Our data focus on the country's Gross Domestic Product (GDP), its number of workers, the number of cases of fatal occupational injury, and the rate of fatal occupational injury.

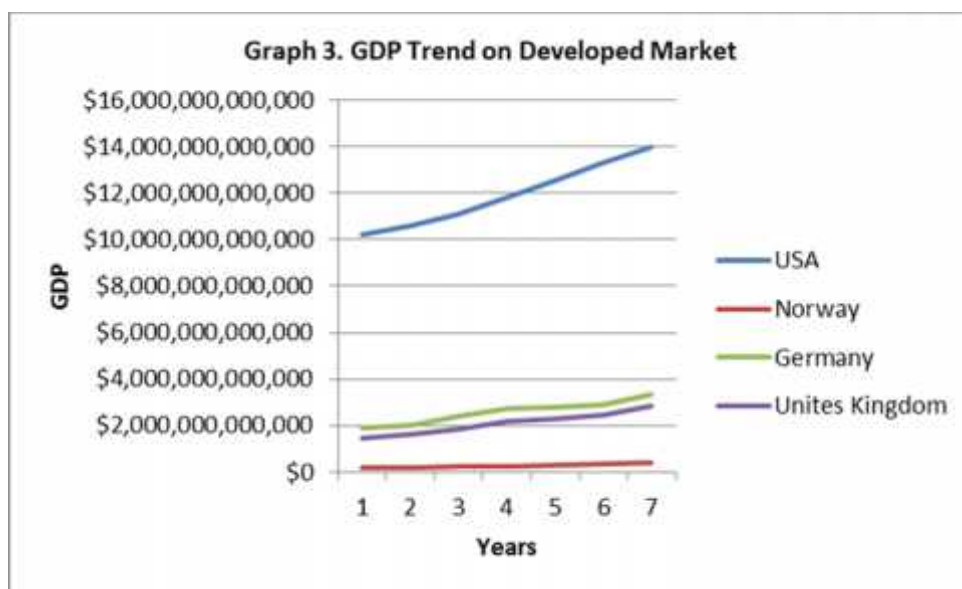
**Graph 1. Factors Influence on Rate of Fatal Occupational Injury**



The trend of emerging and developed markets from 2001 through 2007 demonstrates that GDP is much higher in the developed economies than in emerging markets. Countries with the developed economies have GDP higher than \$2 trillion. On the other hand, countries from the emerging market have GDP lower than \$2 trillion.

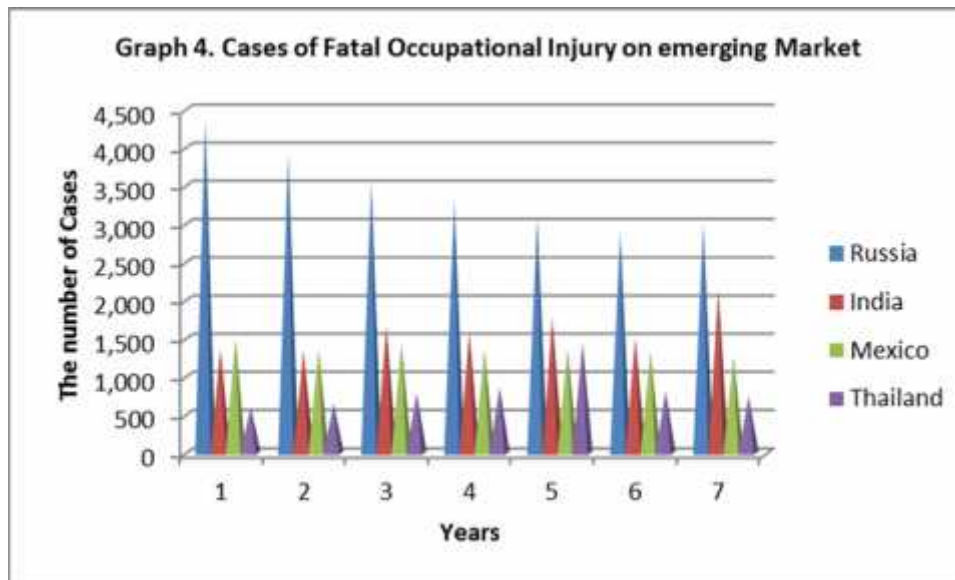


120 This graph shows the strong growth of Mexico, India and Russia and the steady but  
 121 unspectacular growth of Thailand's economy.  
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124 Graph 3 demonstrates the growth of the four selected economies. It should be noted that  
 125 there is a very wide range in the working populations of the four nations with the USA having  
 126 a much greater one than the other developed nations.  
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129 Our next step is to observe and analyze the trend on Cases of Fatal Occupational Injury that  
 130 are shown on graphs 4 and 5.  
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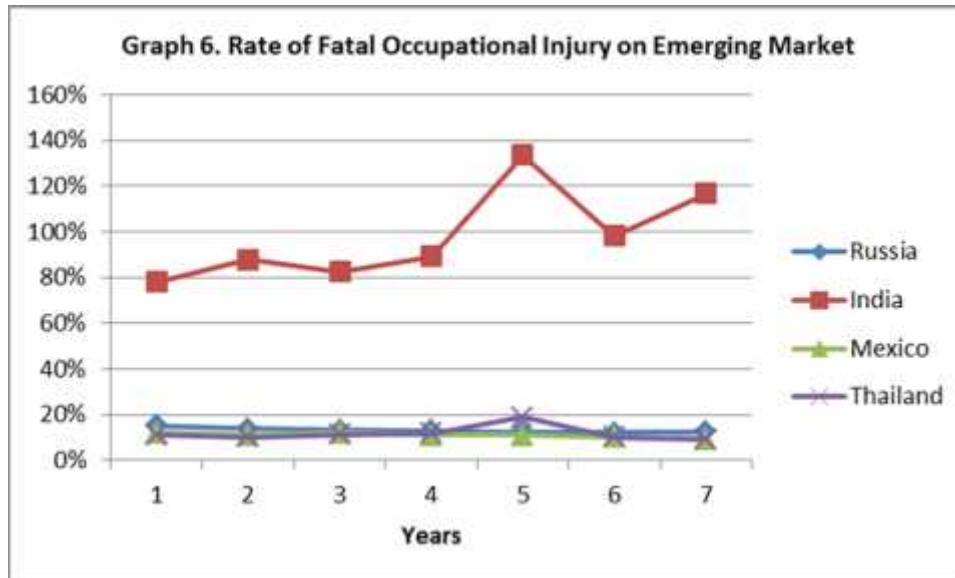


132  
133 Graph 4 identifies that the trends for cases of occupational injury vary among the four  
134 nations. The trend for Russia is a decline, for India an increase and for Mexico and Thailand  
135 the trends are steady.  
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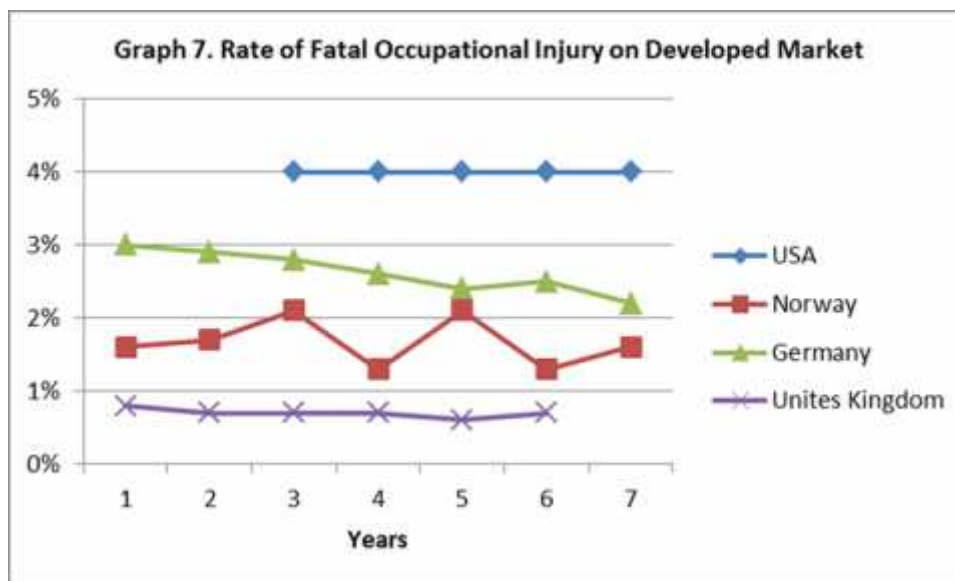


137  
138 The trends identified in Graph 5 show a steadiness in cases of fatal occupational injury for  
139 the four developed economies. Data for the USA for years 1 and 2 could not be obtained.  
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141 AS is evident from graph 6 and 7, the Rate of Fatal Occupational Injury from emerging  
142 market have higher rates in the range from 10% to 117% compared with countries with  
143 developed economies with rates in the range from 0.6% to 4%.



144 The rates for Russia, Mexico and Thailand are similar. The rates for India are significantly  
 145 higher.  
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148 The rates for the four developed economies range from less than 1% to about 4%.  
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### 151 3. RESULTS AND DISCUSSION

152  
 153 The results from gathered data in developed and emerging economies can be summarized  
 154 in the following form:  
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**Table 1. Summary on Occupational Injuries in Developed and Emerging Markets**

<i><b>Economy</b></i>	<i><b>GDP</b></i>	<i><b>Cases of Fatal Occupational Injuries</b></i>	<i><b>Rate of Fatal Injuries</b></i>
Developed	170 – 14, 991 billion	37 - 5,840	0.6% - 4%
Emerging	120 – 1,400 billion	605 – 4,370	9.0% - 117%

*The table details the countries with the developed economies and high national GDP implement have higher safety standards that lead to a lower rate of fatal occupational injuries. On the contrary, countries with the emerging economies and lower national GDP have lower safety standards that lead to higher rate of fatal occupational injuries.*

#### **4. CONCLUSION**

This analysis shows that there is a significant relationship between safety performance in a society and the level of national income. This further explains the markedly greater occurrence of fatal occupational injuries in nations with emerging economies compared to their developed counterparts. This is very apparent when a country's GDP is lower and its safety standards are substandard or poorly implemented. Countries that have developed economies with higher GDPs have fewer occurrences of fatal occupational injuries and their rate of fatal occupational injury is also lower. This relationship between safety performance in a society and the level of national income is an important consideration for management when it considers outsourcing its manufacturing or any other business overseas. The high risk of fatal occupational injuries might lead to major losses or even a business extinction such as the one that affected like Union Carbide Corporation after the Bhopal disaster.

A limitation of this study is that data for many major players (both developed and emerging) on the global market such as Japan, China, Indonesia, and Bangladesh, was insufficient to be included in this study. The recent safety issues in Bangladesh, for example, have yet to yield publically available data which might have the effect of reinforcing the conclusions of this study.

Future investigation might be focused on other factors that impact the fatal occupational injury occurrences, or other factors that may influence the rate of fatal occupational injury. Perhaps the most fruitful follow-up research will be conducted when data becomes available to the research community to examine the true costs of doing business in nations with lower occupational standards compared with developed economies.

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## APPENDIX

### Appendix 1: GDP in Emerging Markets

Emerging Market							
Country	GDP						
	2001	2002	2003	2004	2005	2006	2007
Russia	306,602,673,980	345,110,438,694	430,347,770,733	591,016,690,743	764,000,901,161	989,930,542,279	1,299,705,764,824
India	482,967,940,906	504,946,434,158	591,332,373,599	715,459,354,731	837,499,067,126	947,912,052,610	1,206,110,390,294
Mexico	622,092,637,151	649,075,575,302	700,324,664,927	759,777,472,170	848,947,464,609	951,915,698,648	1,036,000,680,567
Thailand	120,051,854,636	134,064,590,967	151,997,909,265	172,637,545,862	188,620,150,176	220,826,400,537	261,825,647,965

*This table shows GDP in US dollars for seven years in the selected emerging market countries. . Among the selected countries are Russia, India, Mexico, and Thailand. The data were collected from the World Bank Web site [7].*

### Appendix 2: Cases of Fatal Occupational Injury in Emerging Markets

Emerging Market							
Country	Cases of Fatal Occupational Injury						
	2001	2002	2003	2004	2005	2006	2007
Russia	4,370	3,920	3,540	3,290	3,090	2,900	2,990
India	1,366	1,346	1,663	1,581	1,780	1,514	2,140
Mexico	1,502	1,361	1,427	1,364	1,367	1,328	1,279
Thailand	605	650	787	861	1,444	808	741

*This table shows the number of fatal cases for seven years in the selected emerging market countries. Among the selected countries are Russia, India, Mexico, and Thailand. The data were collected from the International Labor Organization (ILO) Web site [8].*

### Appendix 3: Rate of Fatal Occupational Injury in Emerging Markets

Emerging Market							
Country	Rate of Fatal Occupational Injury						
	2001	2002	2003	2004	2005	2006	2007
Russia	15.0%	13.8%	13.1%	12.9%	12.4%	11.9%	12.4%
India	77.9%	87.8%	82.5%	89.3%	133.4%	98.3%	116.8%
Mexico	12.0%	11.0%	12.0%	11.0%	11.0%	10.0%	9.0%
Thailand	10.9%	9.9%	11.2%	11.7%	18.7%	10.1%	9.1%

*This table shows the rate of fatal cases for seven years in the selected emerging market countries. Among the selected countries are Russia, India, Mexico, and Thailand. The data were collected from the International Labor Organization (ILO) Web site.*

### Appendix 4: GDP in Developed Markets

Developed Market							
Country	GDP						
	2001	2002	2003	2004	2005	2006	2007
USA	10,233,900,000,000	10,590,200,000,000	11,089,300,000,000	11,797,800,000,000	12,564,300,000,000	13,314,500,000,000	13,961,800,000,000
Norway	170,922,851,074	191,927,027,230	224,880,794,328	260,029,106,208	304,060,069,849	340,041,912,704	393,479,162,082
Germany	1,880,878,023,463	2,006,678,890,909	2,423,721,432,864	2,726,341,472,500	2,766,253,792,966	2,902,749,305,068	3,323,809,686,746
Unites Kingdom	1,468,121,585,535	1,601,561,196,401	1,855,750,258,175	2,196,860,009,521	2,295,843,320,737	2,452,970,940,716	2,825,528,324,602

*This table shows GDP in US dollar for seven years in the selected developed economies. Among the selected countries are USA, Norway, Germany, and United Kingdom. The data were collected from the World Bank Web site.*

## Appendix 5: Cases of Fatal Occupational Injury in Developed Markets

Developed Market							
Country	Cases of Fatal Occupational Injury						
	2001	2002	2003	2004	2005	2006	2007
USA			5,575	5,764	5,734	5,840	5,657
Norway	37	39	49	38	48	31	38
Germany	1,107	1,071	1,029	949	863	941	812
Unites Kingdom	210	191	174	179	173	220	

*This table shows the number of fatal cases for seven years in the selected developed economies. Among the selected countries are USA, Norway, Germany, and United Kingdom. The data were collected from the International Labor Organization (ILO) Web site. Data is missing from 2001 and 2002 from the U.S. and from 2007 for the United Kingdom due to the absence on provided information to the International Labor Organization.*

## Appendix 6: Rate of Fatal Occupational Injury in Developed Markets

Developed Market							
Country	Rate of Fatal Occupational Injury						
	2001	2002	2003	2004	2005	2006	2007
USA			4%	4%	4%	4%	4%
Norway	1.6%	1.7%	2.1%	1.3%	2.1%	1.3%	1.6%
Germany	3%	2.9%	2.8%	2.6%	2.4%	2.5%	2.2%
Unites Kingdom	0.8%	0.7%	0.7%	0.7%	0.6%	0.7%	

*This table shows the rate of fatal cases for seven years in the selected developed economies. The selected countries are USA, Norway, Germany, and United Kingdom. The data were collected from the international labor organization (ILO) web site. Data is missing from*

268     *2001 and 2002 from the U.S. and from 2007 for the United Kingdom due to the absence on provided information to the international labor*  
269     *organization.*

