Sixth International Conference on Construction in the 21st Century (CITC-VI)
"Construction Challenges in the New Decade"
July 5-7 2011, Kuala Lumpur, Malaysia

Comparative Analysis of Construction Safety in Asian Developing Countries

Adeeba A. Raheem, Jimmie W. Hinze
M. E. Rinker, Sr.School of Building Construction, University of Florida, Gainesville, Florida, USA

Salman Azhar
McWhroter School of Building Science, Auburn University, Auburn, Alabama, USA

Rafiq M. Choudhry, Zainab Riaz
National University of Sciences and Technology, Islamabad, Pakistan

Abstract
There is no doubt about the fact that there is a huge performance gap in terms of construction safety management practices between developed and developing nations but this is also true that this situation persists even within the developing nations. It has been acknowledged that there are many socio-economic and political reasons behind this poor construction safety performance that need to be addressed with a proactive approach. Despite of the fact that construction safety has a vital role for the progress of construction Industry and for the nation's economy as well, currently a really weak framework of policies has been instituted for safety implementation in Asian developing countries. The aim of this paper is to conduct a comparative analysis of safety regulations, technology, training and techniques adopted in different Asian developing countries such as Pakistan, India, China, Bhutan, Malaysia, South Korea and Taiwan. This analysis had provided a more clear understanding related to the current issues that are hindering the proper implementation of safety techniques in developing countries. This analysis can be really helpful to develop a common regulatory framework for implementation of construction safety within the Asian developing countries that meets their needs in accordance with their developing economies.

Keywords
Developing countries, Occupational Safety and Health, Regulations, Economic Impact, Asia

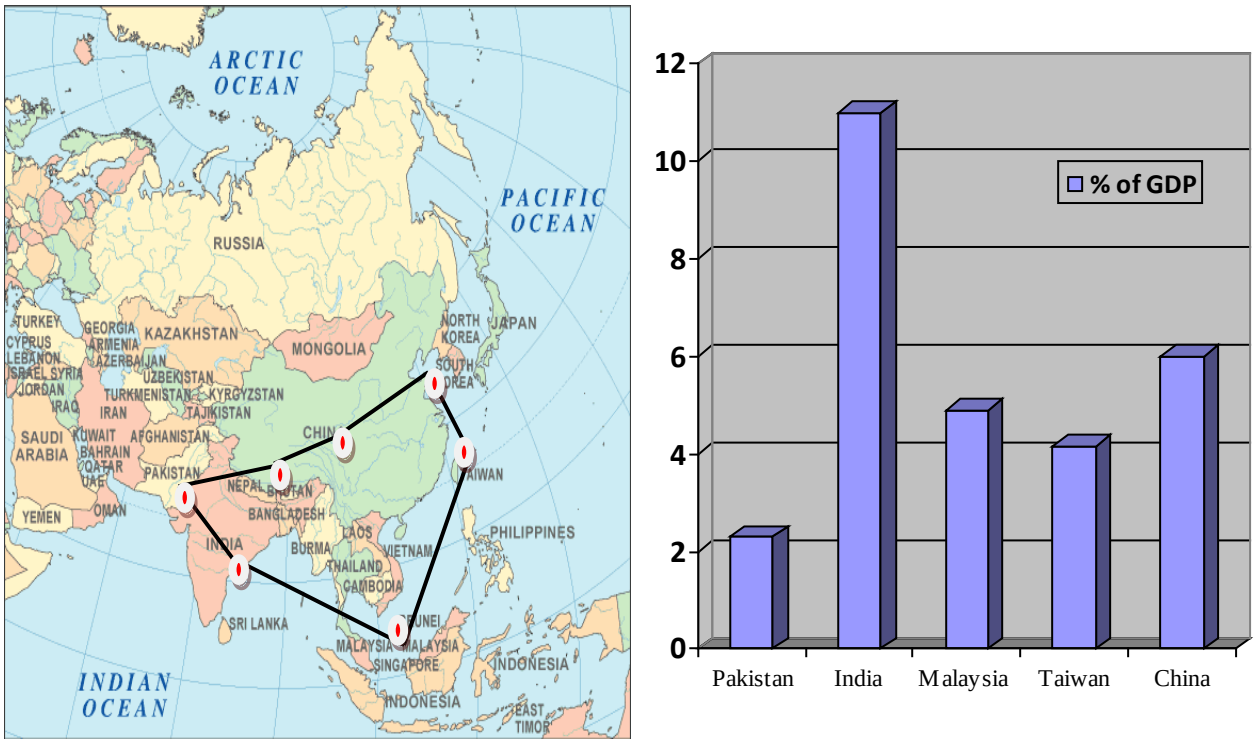
1. Introduction

There are many issues pertaining to the construction industry in developing countries but construction safety can be rated as the most critical one because of its direct linkage to the productivity of workers. The construction industry is perilous by nature and the risk of a fatal accident in construction industry is five times more likely than in other industries (Sorock et al. 1993; Sawacha et al. 1999). The major causes of accidents are related to the unique nature of the industry, human behavior, difficult work-site conditions, and poor safety management (Abdelhamid et al. 2000). Accidents can have serious socio-economic implications to the construction industry such as demotivation of workers; disruption of site activities; delay of project progress; and adversely affecting the overall cost, productivity and reputation of the construction industry (Mohamed 1999). The major expenses due to accidents on any construction site include transportation costs, cost of fixing or replacing damaged equipment or materials, and the cost of hiring new workers (Hinze 1992).

According to the Article 7 of the International Covenant on Economic, Social and Cultural Rights (ICESCR), "The States Parties to the present Covenant recognize the right of everyone to the enjoyment of just and favorable conditions of work which ensure, in particular: safe and healthy working conditions." Improvement in any field starts by improving perceptions. In most developing countries, implementation of construction safety is not given a priority, and employment of safety measures during construction is considered a burden (Mbuya and Lema 2002). Instead of treating construction safety as integral construction process function, it has been considered as a luxury in these countries. Most importantly in most of the developing countries the workers are not aware of any such rights/rules to protect themselves from any fatality during construction. The safety regulations are mostly just on papers and there is lack of proper efforts to devise procedures for implementing basic construction safety practices in developing countries.

2. Geographical Extent of the Study

To have a broad perspective and to assess the major issues related to the implementation of construction safety in a comprehensive manner, seven Asian developing countries have been selected including Pakistan, India, China, South Korea, Taiwan, Bhutan and Malaysia. In almost all these countries construction industry has a considerable economic impact on the overall GDP of the country. Figure 1(a) shows the geographical extent of the research study that covers South and South eastern parts of Asia. The aim was to select countries from the approximately same economic region especially within which construction workers are working across the borders.



a) **b)**

Figure 1.a): Geographical location of Asian countries selected for research b) Construction industry as a %age of total GDP

Data sources: State Bank of Pakistan Annual Report (2006-2007), Bank Negara Malaysia BNM Monthly Statistical Bulletin August 2010, Directorate General of Budget, Accounting and statistics, Taiwan 2008, National Bureau of statistics of China 2010, IHS 2009

3. Comparative Analysis:

In most of the Asian developing countries, construction industry is one of the major stakeholders of the national economy but construction safety has been neglected seriously mainly due to fragmented relationship between laws and enforcing agencies. There are other so many factors that are affecting the enforcement process. Broadly divided all these factors are analyzed under three main categories in this research:

3.1 Political/Legal Factors

In most of the Asian developing countries there is not any specific legislation related to construction safety. The national rules and regulations concerning Occupational safety and health (OSH) are numerous but due to segmented framework, direct enforcement of these laws to construction safety is really difficult. Due to this reason construction industry has been treated under general industry regulations. The workers are not even provided with the basic OSH protection that is available to other industrial workers, because most labor laws do not apply to this sector, and the rate of accidents, diseases and injuries is consequently higher.

Major laws that govern occupational safety and health in construction industry for the selected Asian countries are listed in table 1. The order of implementation is devised as **Excellent-Good-Fair-Moderate-Low-None.** If a country has proper operational OSH department and labor statistics are available including fatality/injury rates then it's rated as Fair-Good. If OSH department is working but it's difficult to get fatality/injury data then the implementation in the country is rated as Moderate-fair. If neither proper OSH department nor fatality/injury data exist then implementation of law is rated as low/none.

Table 1: Laws Governing OSH in Construction Industry

Countries	Laws governing OSH	Implementation of Laws
Bhutan	Chathrim for Wage rate, Recruitment Agencies and worker compensation Law 1994, Labor and Employment Act, 2007, labor administration policy and law, 2003	Low/none
China	Labor Law 1994,	Moderate
India	Factories Act 1948 (amended 1954, 1970, 1976, 1987), Workman's Compensation Act Employees State Insurance (ESI), The Explosives Act, 1884, The Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989	Low/ None
Malaysia	Labor Law 1955, Occupational Safety and Health Act (OSHA) of 1994, The Factories and Machinery Act 1967	Fair- Good
Pakistan	Factories Act 1934, Workmen's Compensation Act 1923, Minimum Wage Ordinance, 1961	Low/None
South Korea	Labor Standards Act (last amended on 20 February 1998), Trade Union and Labor Relations Adjustment Act (last amended on 20 February 1998), Labor Relations Commission Act, Act Concerning the Promotion of Worker Participation and Cooperation, Korea Occupational Safety and Health Agency Law, 1987	Fair- Good
Taiwan	Labor Standards Law 1984, Labor Insurance Act 1958, the Employment Services Act 1992, Labor Safety and Health Law, 1974, The Labor Inspection Law, Occupational Hazard Prevention Program, Construction Industry Act, 2003	Fair-Good

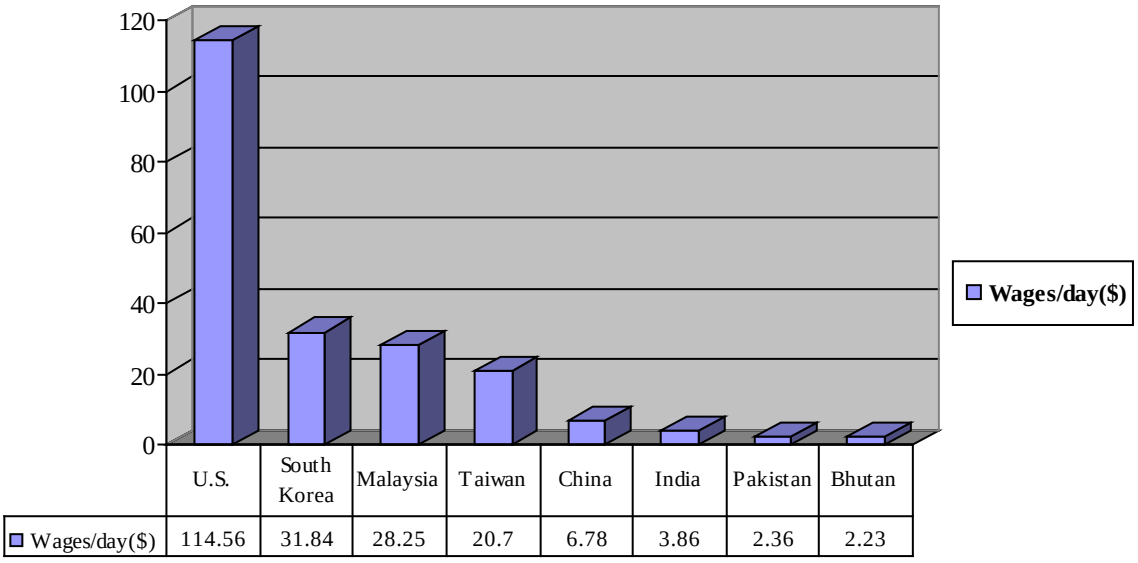
Data sources: Department of Labor (Bhutan,, India, Malaysia, Pakistan, South Korea), Council of Labor Affairs Taiwan, Department of labor and social security China

Child labor is strictly prohibited in all the selected countries and its enforcement is a part of labor law but it's a common practice in Pakistan, India and Bhutan to take work from the children under the age of 18 on construction sites in form of helpers performing different activities about which they have no technical knowledge. These children are working either on very low wage or employers just provide them food to survive. Also except large/international companies, there is no concept for paid leave in case of sickness/injury for construction workers in these countries so workers who are ill or injured temporarily send their young children to work even under hazardous site conditions. The lack of necessary skills or unfamiliarity with the job process exacerbates the situation and results in increasing number of accidents.

3.2 Financial/Economical Factors

3.2.1 Average daily wage of construction workers:

Unlike the developed countries, in most of the Asian developing countries the minimum wage for construction worker is way low than the other competing sectors like manufacturing or service Industry. It has been observed that the workers with the longest working hours are the least paid. In fact, the casual labor working in the sector construction is often viewed as a typical example of a free labor market. Due to low average daily wage in most of Asian developing countries the workers look for overtimes to make their better livelihood. Though within the selected countries, South Korea offers highest daily wage to the construction laborers but still it is more than 3 times less than the workers paid in U.S. On average in U.S. construction worker is paid $14.32/hr. (U.S. Bureau of Labor statistics, 2011) whereas in South Korea as well as other selected countries, the rate is either approx. equal to or slightly greater than the minimum wage rate set by the government (Figure 2).



	U.S.	South Korea	Malaysia	Taiwan	China	India	Pakistan	Bhutan
Wages/day($)	114.56	31.84	28.25	20.7	6.78	3.86	2.36	2.23

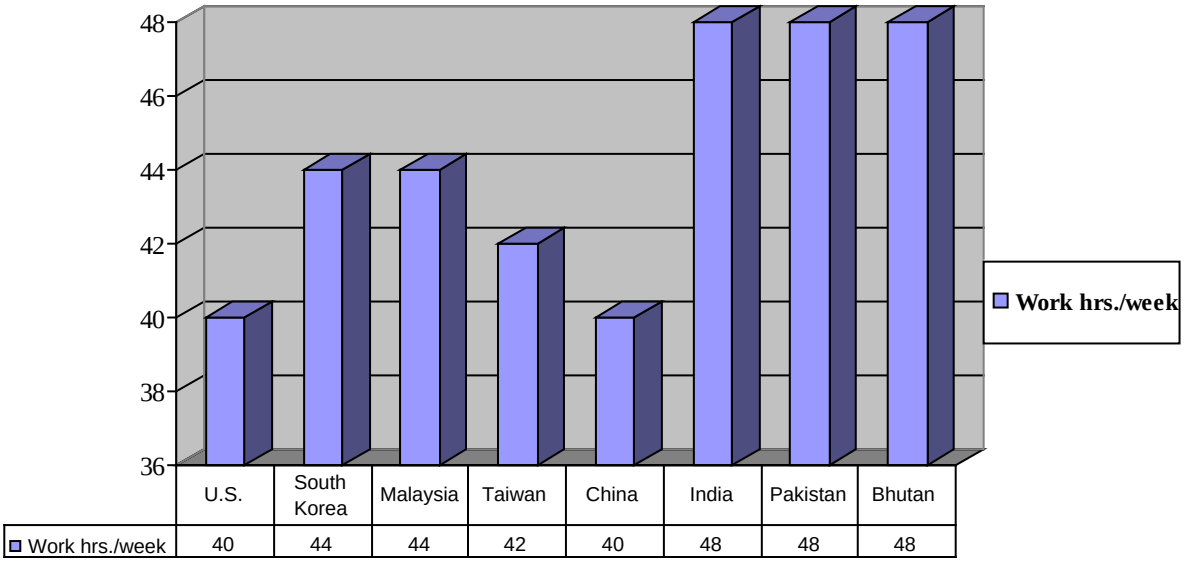
Figure 2: Average daily laborer's wage in construction (2005-2011)
Data source: International Labor organization

3.2.2 Working hrs. per week

The prevalent labor laws and policies on working hours have a limited influence on actual working hours in the Asian developing countries. Due to weak law enforcement, attempts to reduce hours in these countries have been unsuccessful for various reasons including the worker's willingness to work long hours to make better income and the widespread use of overtime by employers in an effort to increase company's output under conditions of low productivity (Karen et al. 2008).

In short, increased working hours seems beneficial both for workers and employers in this scenario because workers have no choice but to endure longer working hours because the minimum wage is not a living wage. This fact paves an easier way for employers to keep workers for longer hours with little overtime rate. Research has shown that in most of the Asian developing counties standard working hrs. per week are greater than 40(Figure 3) . Also greatest number of working hours is observed in India, Pakistan and Bhutan where the least daily wage is offered as compared to the other selected countries. That means clearly there is a connection between minimum wage rates, long working hours and ultimately this leads to higher rate of accidents in construction industry.

Another important factor is the forged implementation of the standard working hours in these countries. Due to illiteracy and poverty most of the construction workers especially in India, China, Bhutan don't have any idea about such a standardize work time devised by their legislature which in most cases is already more than the standard productivity working hours (40hrs/week). They are just told that they will be paid lump-sum amount if they will complete some multiple tasks in a day. So in order to complete that task the workers do overtimes without any additional compensation.



	U.S.	South Korea	Malaysia	Taiwan	China	India	Pakistan	Bhutan
Work hrs./week	40	44	44	42	40	48	48	48

Figure 3: Comparison of number of working hours per week
Data sources: Department of Labor (U.S, Bhutan, China, India, Malaysia, Pakistan, South Korea), Council of Labor Affairs Taiwan

3.2.3 Economical Pressure

Mostly the growth of construction industry in Asian developing countries is based on the demands derived from both the Government and the private sector, including Foreign Direct Investments (FDI).It is evident from the history that whenever there is an economic crisis in most of the Asian developing countries, government tries to compensate through increase in taxes/duties and prices for construction materials and equipment escalate at once. On the other hand employers try to compensate through less workers and prolonged working hours. As compare to other selected countries, Malaysian government and private sector has been supporting construction industry through such slow down periods in economy. For example when the economy slowed down in 2001, the Government pumped into the construction sector stimulus packages of total RM7.3 billion (CIDB Malaysia). The Ninth Malaysia Plan (9MP 2006-2010) (last five year development program under vision 2020 plan) was also a great step recognizing key thrusts and Strategic Initiatives Involving the Construction Sector. The third largest government funding recipient in 9MP was the safety sector with a government allocation of RM21.20 billion and RM4.28 billion for private finance initiative (PFI).

Another important aspect is the lack any legal framework to protect the safety rights of the construction workers and to provide them job security. Now because small scale companies cannot sustain increasing tax/duty pressures under any economic crises, these companies lay off workers and the remaining workers have no option to obey their employees for working long hours and working on multiple activities at the same time. Nobody can deny the fluctuation in economics so unemployment can increase during the dark hours. For example, according to ANZ Taiwan Monthly Chartbook report, in the year 2010 about 8% of the total employed people were working in construction whereas in the same year the unemployment in construction sector was 13% of the total. So employment rate was lower than the unemployment rate (Figure 4). Now due to absence of proper legal enforcement for construction safety in selected countries, employee usually hire the willing unemployed workers paying them less and taking work for longer hours than the standard without any basic training or orientation. Sometimes the workers insist to work for multiple shifts continuously without any break and they are allowed to do so because companies especially small scale companies can save a lot of money.

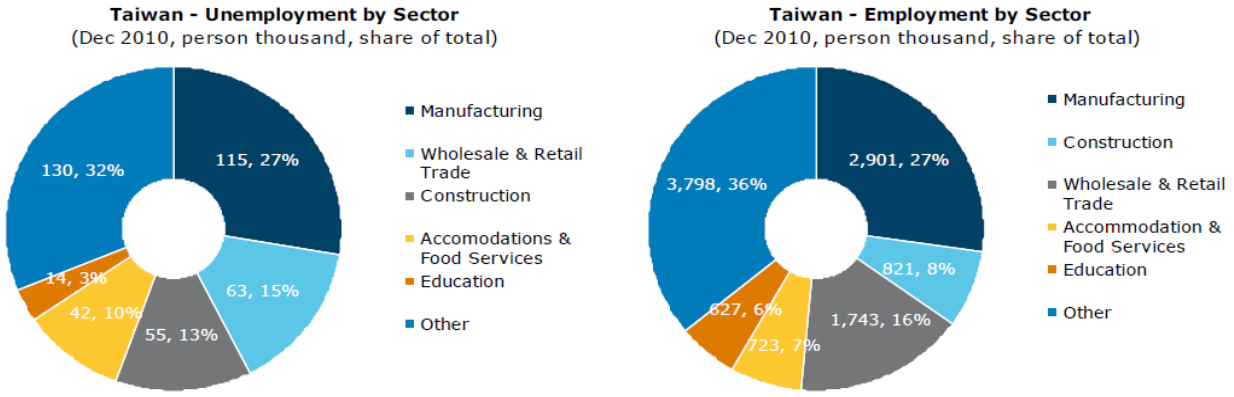


Figure 4: %age employment and unemployment by sector in Taiwan (2010)
Source: ANZ Taiwan Monthly Chartbook report

3.3 Technical Factors

3.3.1 Lack of Government support

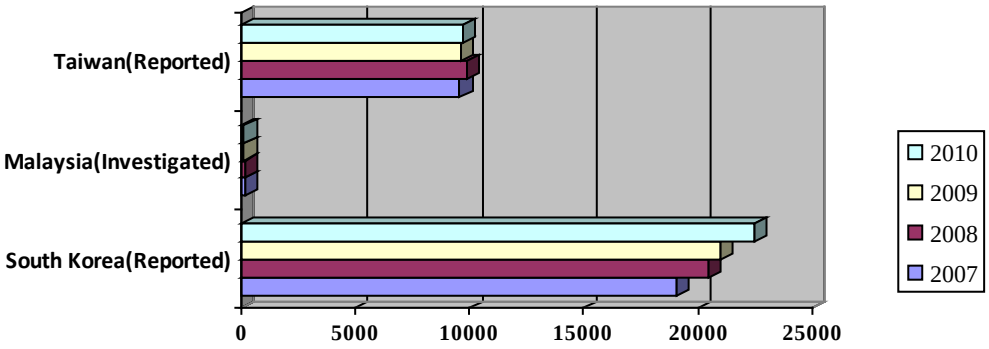
Though construction Industry is considered to be an important stakeholder for improving nation's economy but there are very little efforts that have been done for improving construction safety standards. It is rear that government would allocate a special budgetary amount for the betterment of OSH department/Agency. Government can help by decreasing taxes on safety equipment import and by providing funding for different informatory programs related to construction safety. In most of the selected countries, major part of the overall budget is devoted to enhance country's defense, agriculture and manufacturing whereas negligible efforts are done for improving construction industry. In such an environment of industrialization the worker's right of safety has been completely ignored in the past.

3.3.2 Data collection

The biggest issue is the transparency in data collection related to fatality/injury rate. In most of the selected countries like Pakistan, India, Bhutan, China, there is not any proper reporting system to collect data related to construction or even any other type of Industry. The only information one can get is from newspapers. In other selected countries different methods have been adopted for data collection. In Malaysia department of Occupational safety and health is working under the Ministry of Human resources and the information related to occupational accidents is descriptive as well as statistical (Malaysia OSH department). Only those cases are included which are investigated by the department itself. The collected data are divided into three categories based on non-permanent injuries, permanent

injuries and deaths. Though the department is relatively young and data available from 2007 to-date only for the investigated cases but it's a healthy sign for the future of construction Industry.

Similarly in Taiwan Council of Labor affairs is working with the mission of providing security for health and safety in the work place and has established Department of Labor Safety and Health to collect fatality/injury data by sector. The data consist of the injuries/fatalities reported under labor insurance. In South Korea "Korea Occupational Safety and Health Agency is working since 1987 but after 2001 this agency established itself in true manners. The data provided by the agency consists of Occupational Injuries and Illnesses Statistics and pattern changes by sector from 2005 to-date.



	South Korea(Reported)	Malaysia(Investigated)	Taiwan(Reported)
2010	22504	120	9673
2009	20998	102	9596
2008	20473	129	9860
2007	19050	181	9560

Figure 5: Number of construction injuries/illness/fatalities reported/investigated (2007-2010)
Data sources: KOSHA Korea, DOSH Malaysia, CLA Taiwan

3.4 Human Factors

Construction Industry in all the selected countries employs a very large number of workers. About 18 million people in India and 24 million people in China are working in construction industry. Unfortunately despite of this large labor of employment the workers seldom get any training or orientation while working on any project. Unlike factory workers, people working as construction laborers are not informed about any work related hazards. Workers are exposed of unsafe conditions because there is weak/no enforcement of safety rules. Illiteracy and poverty are other big issues and workers have to tradeoff their safety rights due to the impuissance imposed by the frail policies.

4. Importance of construction safety for Asian developing countries in future

Through this research it is clear that the Asian developing countries such as Malaysia, South Korea and Taiwan has a slightly better construction safety management system as compare to Pakistan, China, India and Bhutan. Construction Industry in Malaysia is forecasted to grow by 4.4% in 2011 and currently the annual output of construction industry in China is about US $ 93 billion and is growing at an average annual rate of nearly 10%. In India Construction sector accounts for about 38% of gross investment and about 45% of India's total infrastructure costs and its growth rate is expected to increase as compare to other Asian countries but the problem lies with the segmented legal and administrative framework within these countries that is main problem for enforcement of OSH laws and if this situation remains the same then these growing industries will see a sharp increase in the accidents rate in future.

Figure 6: Expected infrastructure construction growth rate (%) across Asia 2010
Source: IHS Global Insight

5. Concluding Remarks

It has been deduced through this research that the prevailing laws related to occupational safety and health are too broad to be applied directly for construction safety in Asian developing countries. These are only general guidelines that do not specify the concrete measures needed. So there is a dire need to realize the importance of construction safety by increasing the coordination between all the stakeholders including workers. This can be done by establishing a strong legal and administrative safety infrastructure. Another suggestion is to form an umbrella organization related to construction safety in developing countries that can provide a platform to these countries to address the collective safety issues for improving safety culture in this region. This can be helpful in improving the individual construction industries as well as overall regional economy in the longer run.

Acknowledgements

This project is funded by the United States Department of State and the Higher Education Commission of Pakistan (HEC) under the joint Pakistan-US Science and Technology Cooperation Program (Phase 4).

References

Abdelhamid, T. S., and Everett, J. G. (2000). "Identifying root causes of construction accidents". J. Constr. Eng. Manage., 126(1), pp 52-60.

Hinze, J. (1992). "Indirect costs are a major portion of injury costs." Concrete Construction, 37, pp 229.

Karan K.A. and Selvaraj S. (2008). "Trends in wages and earnings in India: Increasing wage differentials in a segmented labor market". ILO Asia-Pacific Working paper series, International Labor Organization subregional Office New Dehli, India

Mbuya, E. and Lema, N.M. (2002). "Towards development of a framework for integration of safety and quality management techniques in construction project delivery process". Proceeding of the 1st International Conference of CIB W107– Creating a Sustainable Construction Industry in Developing Countries, 11–1.

Mohamed, S. (1999). "Empirical investigation of construction safety management activities and performance in Australia". *Safety Science*, 33, pp 129–142.

Sorock, G.S., Smith, E.O., Goldoft, M. (1993). "Fatal occupational injuries in the New Jersey construction industry: 1983–1989". Journal of Occupational Medicine, vol 35, pp 916–921.

Sawacha, E., Naoum, S., Fong, D. (1999)."Factors affecting safety performance on construction sites". International Journal of Project Management, 17(5), pp 309–315.

U.S. department of Labor. (2011). "Career Guide to industries". Bureau of Labor Statistics, Department of Labor, U.S.