

Impact of Globalization on Ergonomics

Lawrence J. H. Schulze, PhD, PE, CPE
Associate Professor
Department of Industrial Engineering
University of Houston – Houston, TX USA

Abstract

Globalization can be defined as the industrialization of the world. However, a more pragmatic definition might be the transfer of manufacturing from Established Economic Markets (USA and European Community as defined by the World Bank) to ‘developing’ economic markets. As such, the transference of manufacturing to areas with little or no infrastructure to ensure the health and safety of their workforces, these economic markets find that their rates of work-related injuries have skyrocketed. Although the globalization of economies has brought economic growth and new prosperity to many regions of the world, it has also brought with it an increasing safety concern. Although there are certainly threats to workplace health and safety, there are also opportunities for the international community. Worldwide cooperation, exchange of information, exchange of stories of success and failure, and international networks of Ergonomists, Industrial Hygienists, Safety Professionals and Public Health Professionals will create a collaboration that will be part of the solution than part of the problem through individual efforts. Approaches such as: (1) grass-roots citizen efforts; (2) consumer efforts; (3) professional collaborations; (4) publication of success stories; (5) and a focus on practical solutions that have an immediate impact on worker health and safety while supporting productivity and competitiveness will have an impact on improving working conditions around the world. The world is truly a small place, where the impact is one regions is truly felt globally.

Introduction

The demands of new technologies and growing economies have led to the globalization of manufacturing, assembly and service industries. The globalization of the workplace and the multi-national configuration of organizations have created an environment for personnel and managers of constant change within the area of occupational and environmental health in which safety, human factors and ergonomics play vital roles. Ergonomists, Safety and Human Factors Specialists and Industrial Hygienists often find it difficult to stay abreast of current information needed to stay in the forefront of important workplace issues. The most critical areas of concern are: communication, understanding, cultural differences and educational level of the workforce.

The international Labor Office (ILO, 2005) indicated that 2.2 million people die of work-related accidents and diseases each year, that’s about 5,000 per day, every day. However, due to poor reporting and surveillance stems in many countries, the number is probably vastly under estimated. Such poor reporting and lack of surveillance is due to rapid development and strong competitive pressures of globalization. Approximately 4% of the world’s GNP is lost due to work related injuries and deaths.

The WHO estimates that only about 10 to 15% of workers worldwide have some kind of access to occupational health services, and extending coverage is a key challenge.

What do such work-related injuries and illness result from?

Work-related malaria

Other communicable diseases

Cancers from exposure to hazardous substances no longer used in ‘developed’ countries

A global workforce that lacks legal or preventative health measures

No accident or illness compensation

Non acceptance of the work-relatedness of injury

Wages paid by maquiladora-type facilities exceeds local wages

Workers need to feed their families

Personal protective equipment has more value in the black market

Accident hazards are more prevalent in ‘developing’ economies

Lack of education implies employment in high-hazard industries

‘Industrialized’ economies are more service economies

Using the United States as an example (Figure 1), the number of native born injuries is declining while the number of foreign-born injuries is increasing. They have only recently declined as a result of globalization and the exportation of jobs to developing economies.

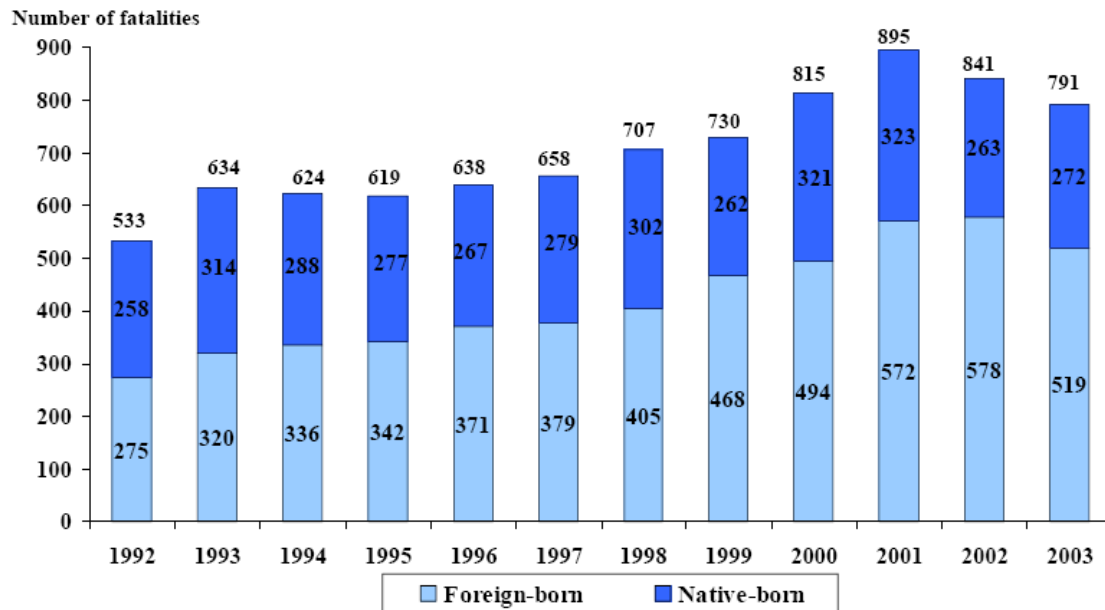
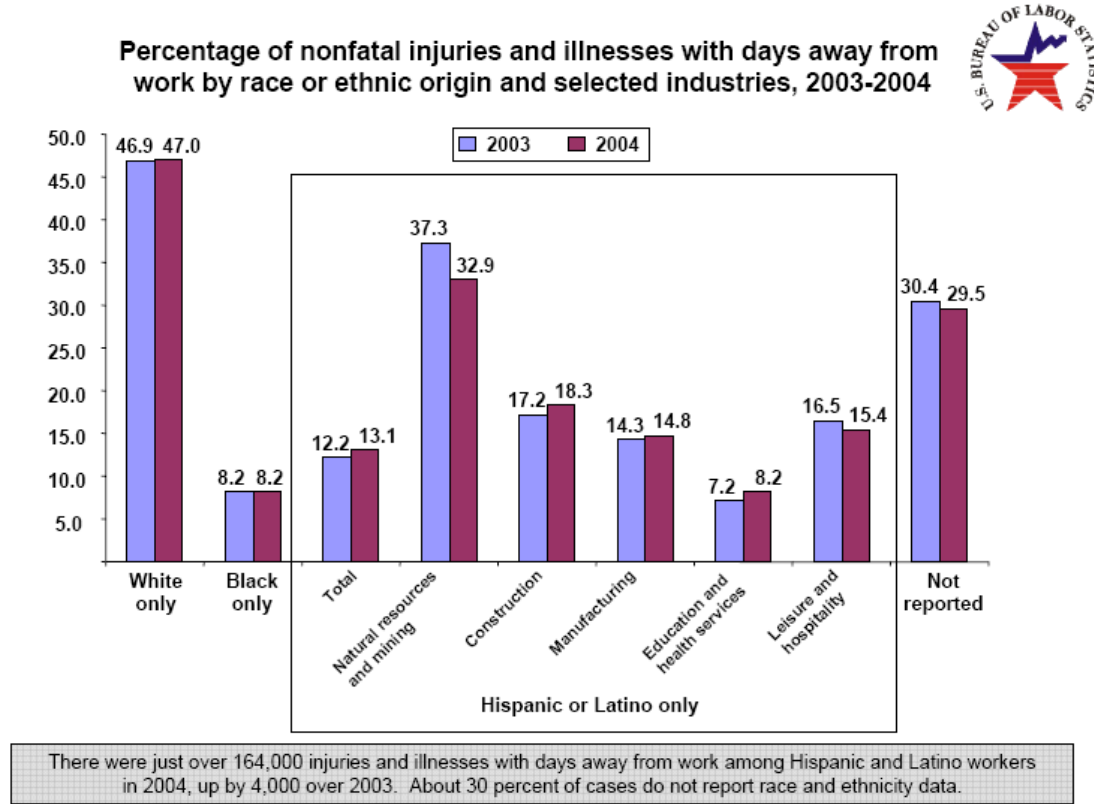


Figure 1. Number of fatalities reported in the U.S. by native-born and foreign-born workers. Source: Bureau of Labor Statistics, U. S Department of Labor (2004).

Further, the injured workforce is transitioning away from the tradition workforce to the largest growing immigrant group in the Unites States (Figure 2). The reason for this transition is that many of these immigrants are working in the highest hazard industries due to lower educational attainment. However, it is important to note that these data may not be representative of the

actual number due to the large number of undocumented workers who are working in the most hazardous of these industries.



SOURCE: Bureau of Labor Statistics, U.S. Department of Labor, Survey of Occupational Injuries and Illnesses.

Figure 2. Transition of non-fatal injuries from traditional worker populations to the Latin-American worker population.

Recently published statistics are provided to establish relation between occupational injuries and Safety in the workplace in relation to the growth of a globalized marketplace. To do so, information from the World Bank are used to evaluate the growth of economies worldwide, and these ratios will be compared to the estimate number of Expected annual cases of Occupational injuries and diseases as established by Leigh, Macaskill, Kuosma and Madryk (1999).

Economic Growth in the Global Market

In order to understand globalization, statistics from the World Bank were used to analyze the economic growth of the different economic regions around the world. For this purpose, eight distinct economic regions were identified following the guidelines of the World Bank¹ (these regions were also used by Leigh, Macaskill, Kuosma and Madryk (1999)). These regions are described in Table 1.

Table 1. Economic region and their abbreviation

Region	Abbreviation
Latin America and Caribbean	LAC
Middle East Crescent	MEC
Sub Saharan Africa	SSA
India	IND
China	CHI
East Asia and Pacific	EAP
Established Economic Markets (USA and EC)	EME
Other European and Central Asia	OTH

For each of these regions, three key statistics were analyzed over the last 5 years. These were Exports of Goods and Services as a percentage of the Gross Domestic Product, the Annual GDP growth and the Net Inflow in US dollars of Foreign Direct Investment, and their change in the last Five Years². The results are summarized in the following tables.

Table 2. Foreign direct investment by region

LAC			
Exports of Goods and Services	21.00%	27.00%	28.57%
Foreign Direct Investment	\$78,916,796,416.00	\$42,399,997,952.00	46.27%
GDP	\$1,983,911,297,024.00	\$2,018,714,845,184.00	1.75%
MEC			
Exports of Goods and Services	28.00%	29.00%	3.57%
Foreign Direct Investment	\$4,264,300,032.00	\$4,100,000,000.00	-3.85%
GDP	\$470,766,387,200.00	\$600,256,282,624.00	27.51%
SSA			
Exports of Goods and Services	33.00%	33.00%	0.00%
Foreign Direct Investment	\$6,339,500,032.00	\$11,299,999,744.00	78.25%
GDP	\$331,426,168,832.00	\$543,990,382,592.00	64.14%
India			
Exports of Goods and Services	14.00%	15.00%	7.14%
Foreign Direct Investment	\$2,496,041,984.00	\$4,268,999,936.00	71.03%
GDP	\$457,376,923,648.00	\$691,876,265,984.00	51.27%
China			
Exports of Goods and Services	26.00%	40.00%	53.85%
Foreign Direct Investment	\$38,399,299,584.00	\$53,504,999,424.00	39.34%
GDP	\$1,080,741,396,480.00	\$1,649,329,438,720.00	52.61%
EAP			
Exports of Goods and Services	38.00%	45.00%	18.42%

Services			
Foreign Direct Investment	\$44,245,299,200.00	\$63,600,001,024.00	43.74%
GDP	\$1,599,600,721,920.00	\$2,367,508,185,088.00	48.01%
EME			
Exports of Goods and Services	24.00%	21.50%	10.42%
Foreign Direct Investment	\$953,076,547,584.00	\$396,355,690,496.00	58.41%
GDP	\$15,822,159,872,000.00	\$21,038,439,074,444.00	32.97%
OTH			
Exports of Goods and Services	41.00%	32.00%	21.95%
Foreign Direct Investment	\$29,153,699,840.00	\$37,600,002,048.00	28.97%
GDP	\$952,684,380,160.00	\$1,768,088,010,752.00	85.59%

As is clear from these statistics, regions like India, Africa and China have seen an explosion in their economic indicators over the last 5 years in exports and investment, as was expected from the globalization of corporations. As a result regions like the Established Economic Markets and, to a lesser extent, Latin America, have experienced negative growth in their Foreign Direct Investment and Exports of goods and services.

Occupational Injuries in the Global Market

This globalization of markets brings along injuries, and although accurate numbers over the last years are hard to obtain, Leigh, Macaskill Kuosma and Mandryk (1999) came out with estimates and predictions based on their findings of the expected number of Occupational injuries and diseases based on the different regions established above. Based on their findings, the following table (Table 3) summarizes the total population, the injuries (fatal and nonfatal) and their respective percentages.

Table 3. Summary of total populations by region and their fatal and non-fatal injury rates.

Region	Population	Working Pop	% of WP of Total Pop	Non-Fatal Injuries/YR	% of Total Pop	% of WP	Fatal Injuries/YR	% of Total Pop	% of WP
LAC	541,322,304	173,000,000	32%	2,077,000	0.38%	1.20%	8,900	0.0016%	0.0051%
MEC	293,994,208	143,000,000	49%	1,134,000	0.39%	0.79%	8,440	0.0029%	0.0059%
SSA	719,022,208	155,000,000	22%	770,000	0.11%	0.50%	9,900	0.0014%	0.0064%
India	1,079,721,216	324,000,000	30%	17,000,000	1.57%	5.25%	45,000	0.0042%	0.0139%
China	1,296,499,968	432,000,000	33%	9,832,000	0.76%	2.28%	33,800	0.0026%	0.0078%
EAP	1,870,228,352	260,000,000	14%	2,384,000	0.13%	0.92%	11,400	0.0006%	0.0044%
EME	600,952,600	384,000,000	64%	9,481,000	1.58%	2.47%	14,100	0.0023%	0.0037%
OTH	472,073,248	188,000,000	40%	3,000,000	0.64%	1.60%	10,300	0.0022%	0.0055%

The result that stands out is India's. In a country that has seen an economic explosion over the last decade, where the work population is nearly 30% of the total, 5.25% of the working population suffered from non fatal injuries and 0.0139% from Fatal. This number is alarming high compared to other regions, and just goes to demonstrate how globalization impacts the work place.

However, as can be seen from a review of Figure 3, China the worker population of China suffers from a larger number of malignant neoplasms and respiratory system diseases than does India, based in part on the significant difference in manufacturing versus service sector work opportunities

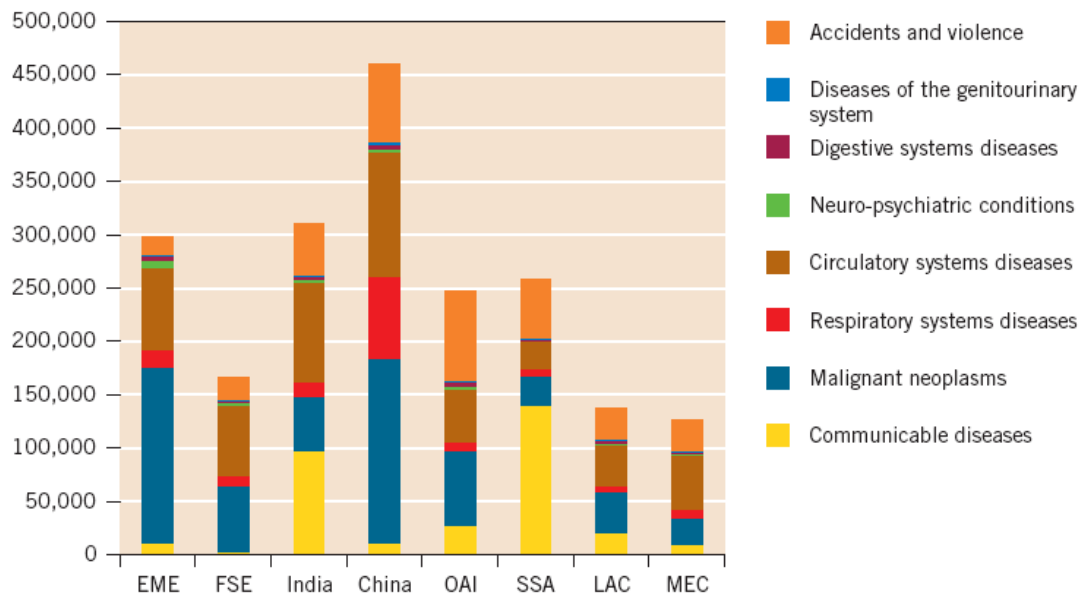


Figure 3. Global estimated work-related injuries. Source: Takala, ILO, 2005. Where: EME = Established Economic Markets (USA and EC); FSE = Formers Socialist Economies; OAI = Other Asian and Islands; SSA – Sub-Saharan Africa; LAC = Latin American and Caribbean; and MEC – Middle East Crescent.

Finally, the following table summarizes the expected number of new cases of Occupational Injuries and Diseases per year, and the Economic Ratios. This tables shows how the largest expanding economies in the global market, are also the most critical in terms of safety in the workplace.

Table 4. Predicted number of new cases of occupational injuries per year

Region	Exp. Occu. Injuries (mil)	Exp. Occu. Disease (mil)	Exports Change	Foreign Direct Investment
LAC	9.89	1.02	28.57%	-46.27%
MEC	9.15	1.04	3.57%	-3.85%
SSA	9.02	1.06	0.00%	78.25%
India	18.3	1.85	7.14%	71.03%
China	24.42	2.53	53.85%	39.34%
EAP	14.71	1.49	18.42%	43.74%
			-	
EME	10.35	1.18	10.81%	-55.55%
OTH	4.85	0.5	-9.09%	-64.04%

The globalization of commerce, services, and industry necessitates international collaboration to ensure the health and safety world-wide. The inherent right of workers to leave work in as good as health as when they arrived is threatened around the world as the economic force of globalization pressures the enforcement of health and safety regulations to be ignored for both developed and developing economies (Brown, 2002). As developing economics compete for their spot in international trade, developed economies struggle to compete against lower wages, larger available workforces, and lower rates of regulatory enforcement. As a result, the rate of work-related injuries increase in these developing economies, while the decrease in developed economies.

So what is being done today?

We are gathered here during these few days at the Occupational Risk Prevention Conference exchanging ideas and developing collaborations. I have had the incredible opportunity to be associated with a number of collaborating universities that include the Polytechnic University of Catalunya, The University of Texas School of Public Health, the Javeriana University in Bogotá, Colombia (S.A.) and the Costa Rican Institute of Technology in Cartago, Costa Rica as an adjunct faculty member in their programs. This is but one vehicle of demonstrable collaboration and the exchange of ideas. In addition, the following conference and network can be accessed to continue dialogue and development of collaborative efforts. The 16th World Congress on Ergonomics, Maastricht, Netherlands, 10-14 July 2006, and participation in the Global Occupational Health Network (http://www.who.int/occupational_health/publications/newsletter/en/).

How does this work?

Example 1

Erika Arias Paz, PhD. Biomedical Engineer, from the Polytechnic University of Catalunya, visited the University of Houston during June & July of 2005. During this period, Ms. Arias

worked with Carmen Madriz-Quiros and me to develop the dissertation research topic of Ms. Madriz and the research procedures to be used. Ms. Madriz will be going to Javeriana University in Bogotá, Colombia to collect the Phase I data of her research and then will be going to Costa Rica to collect her Phase II research in the banana plantations of Costa Rica. Ms Madriz will be developing an ergonomics risk determination tool for dynamic work in the agricultural industries.

Example 2

The National Institutes of Health, a sub organization of the Centers for Disease Control and Prevention has responded through the International Training and Research Program in Environmental and Occupational Health (ITROEH). The ITROEH is a collaboration among the John E. Fogarty International Center, National Institute of Environmental Health Sciences, the National Institute for Occupational and Environmental Health (NIOSH), the Agency for Toxic Substances and Disease Registry and the Centers for Disease Control and Prevention. During the first 5 years (1995 – 2000) the ITROEH focused on epidemiology, risk assessment, and surveillance. During the second cycle (2001 – 2006) the focus was expanded to include prevention and intervention research to reduce risks in collaborating countries (Claudio, 2003). Four areas of collaboration have been established:

The four (4) areas of current collaboration are presented in Table 5

Table 5. Current areas of ITREOH collaboration

The Americas	Europe	Africa	Asia
Mexico	Russia	Zambia	China
Nicaragua	Belarus	Zimbabwe	Pakistan
Costa Rica	Poland	Botswana	India
Venezuela	Czech Republic	Lesotho	Bangladesh
Colombia	Slovakia	South Africa	Vietnam
Brazil	Slovenia		Thailand
Peru	Hungary		Phillipines
Chile	Ukraine		
Uruguay	Romania		
	Yugoslavia		
	Bulgaria		

Conclusions

Lima (2005) presented ten (10) safety and health challenges for the twenty-first century. These are presented here as challenges for Ergonomists in the environment of globalization. Additional areas of challenge concentration will be provided .

Challenge 1

Integrate the concepts of working conditions and working environment into occupational safety and health, not just see these conditions as separate concerns (e.g., IH vs. safety).

Challenge 2

Build ergonomics into occupational safety and health, into occupational safety and health instead of treating them as separate programs

Challenge 3

Promote more active cooperation between workers and employers (e.g., unions vs. management)

Challenge 4

Encourage the extension of safety culture in education, in the family and at work (e.g., safety, ergonomics, etc. is 24/7).

Challenge 5

Better reporting and surveillance. Encourage the reporting of accidents and injuries as a method of controlling risk.

Challenge 6

Improve the quality and scope of inspection. Look at inspection is a method of continuous improvement.

Challenge 7

Expand ergonomics and safety from large companies to small and micro companies and to the informal sector.

Challenge 8

Communicate the vision and model of a national workplace safety and health system as modeled in Figure 5 (below).

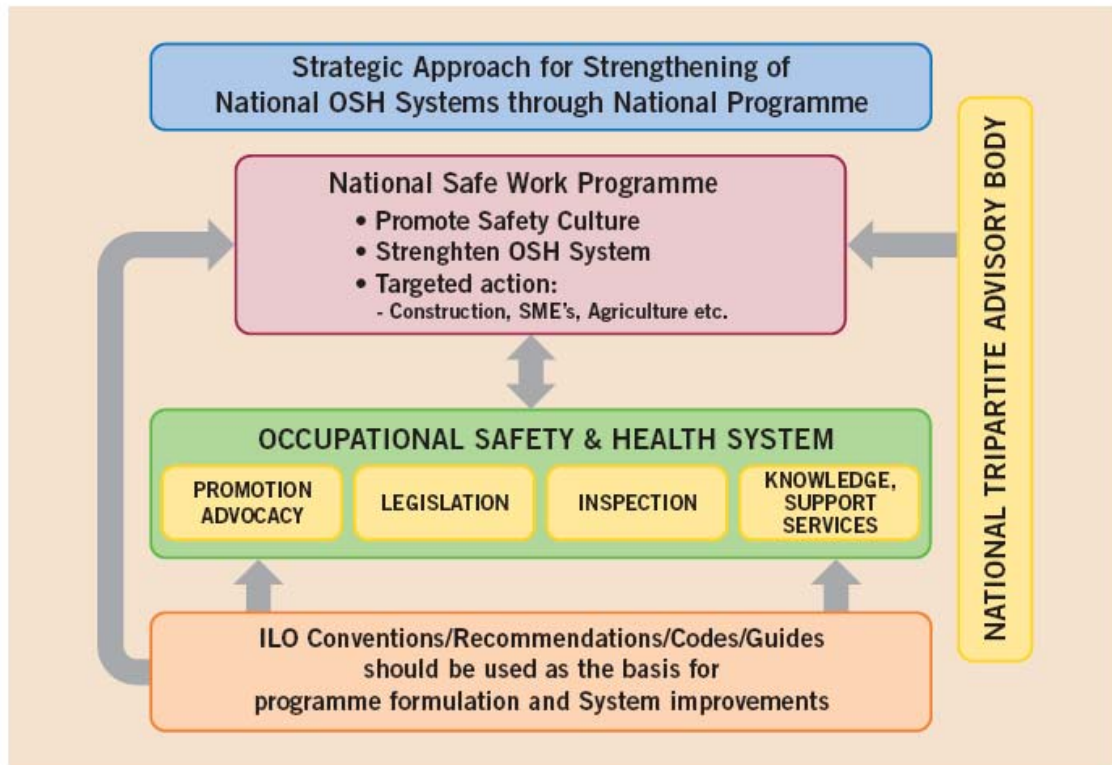


Figure 5. International Labor Office strategic approach to addressing work-related injuries due to globalization. Source: Takala , ILO, 2005.

Challenge 9

Build occupational safety and health values into national education, such as being conducted by the International Ergonomics Association Committee, Ergonomics for Children in Educational Environments (ECEE).

Challenge 10

Converge occupational health, safety and environmental standards, instead of having separate standards for different regions.

Additional challenges

Challenge 11

Communicate hazard recognition and hazard control in a manner that the local workforce is accustomed to. Understand that globalization and the transfer of technology have created the diffusion of risk communication to populations not used to such communication.

Challenge 12

Accommodate tools, workstations, etc. to the local workforce. Ensure that the appropriate (local) anthropometric data is used to specify tools, equipment etc.

Challenge 13

Educate the workforce to a level of comprehension of task requirements, task risks, and risk control

Challenge 14

Integrate ergonomics, human factors, safety, health, and environmental protection into a culture of continuous quality improvement.

Challenge 15

Disseminate successes and failures to the widest range of professionals in the shortest time possible so that the impact of ergonomics can keep pace with the rapid changes induced by globalization.

Acknowledgements

The author would like to thank the following individuals for their assistance in gather data regarding the impact of globalization on ergonomics: Juan Chiquillo, Nurettin Gorkem Gebes, Maria Laura Perez, Jonathan Rocha, Jane Russell, and Jeremy Shaun Simmons

References

Brown, G. D. (2002). The global threats to workers' health and safety on the job. Social Justice. 2(29).

Claudio, L. (2003). Building self-reliance in environmental science: The ITREOH Experience. Environmental Health Perspectives. 111(9), A460-A463.

Hiba, J. C. (2005). Ten Safety and Health Challenges for the Twenty-First Century. www.ilo.org/public/english/dialogue/actrav/publ/126/hiba.pdf

Leigh, J., Macaskill, P., Kuosma, E., and Mandryk, J (1999). Global burden of disease and injury due to occupational factors. Epidemiology. 10(5). 626-631.

Takala, J. (2005). Introductory Report: Decent Work – Safe Work. International Labour Office, Geneva.

World Development Bank. (2004). World Development Indicators.

¹ The World Bank Group, 2004 “World Development Indicators”

² The World Bank Group, 2004 “World Development Indicators”

Leigh, Macaskill, Kuosma, and Mandryk (1999). Global burden of disease and injury due to occupational factors.

